বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

ISO 9001:2015, ISO 14001:2015 &
ISO 45001:2018 CERTIFIED

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT
FOR THE

SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 33/11 KV (1X10/14 MVA) SUB-STATION (KUSHTIA-5) IN KUSHTIA PBS ON TURN-KEY BASIS
AND
SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 33/11 KV (1X10/14 MVA) SUB-STATION (MIRPUR-3) IN KUSHTIA PBS ON TURN-KEY BASIS

UNDER
Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)", BREB.

TENDER PACKAGE NO: DNE(W)-SSN-15

Sub-Package No. : (1) DNE(W)-SSN-15-01
: (2) DNE(W)-SSN-15-02

ISSUED TO: M/S……

Tender Ref. No: 27.12.0000.162.27.002.20.974 ; Date: 23.01.2020

ON BEHALF OF THE OFFICE OF
Project Director, 100% DNE (RRKB)
Training Academy Building, 7th Floor
Bangladesh Rural Electrification Board

SEAL & SIGNATURE

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

1	Ministry/Division	Power Division, Ministry of Power, Energy and Mineral Resources.
2	Agency	Bangladesh Rural Electrification Board.
3	Procuring Entity Name & District	"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)" Project
4	Invitation for Tender Name	SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 33/11 KV SUB-STATIONS (10/14MVA EACH, Turn-Key)
5	Invitation Ref No. & date	27.12.0000.162.27.002.20.974 ; Date: 23.01.2020
KEY INFORMATION		
6	Procurement Method	Open Tendering Method (Single Stage Two Envelope) NCT.
FUNDING INFORMATION		
7	Budget and Source of Funds	GOB
8	Development Partners (if applicable)	N/A
PARTICULAR INFORMATION		
9	Project/ Programme Name	"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)" Project
10	Tender Package No.	DNE(W)-SSN-07, DNE(W)-SSN-08, DNE(W)-SSN-09, DNE(W)-SSN-10, DNE(W)-SSN-13, DNE(W)-SSN-15, DNE(W)-SSN-18, DNE(W)-SSN-20
11	Tender Publication Date	Within 27-01-2020
12	a) Tender Last Selling Date	25-02-2020 up to office time for Package No. DNE(W)-SSN-07, DNE(W)-SSN-08, DNE(W)-SSN-09
	b) Tender Last Selling Date	26-02-2020 up to office time for Package No. DNE(W)-SSN-10, DNE(W)-SSN-13
	c) Tender Last Selling Date	27-02-2020 up to office time for Package No. DNE(W)-SSN-15, DNE(W)-SSN-18, DNE(W)-SSN-20

TENDER CLOSING AND OPENING		Date	Time
13	a) Tender Closing Date and Time	26-02-2020 for Package No. DNE(W)-SSN-07, DNE(W)-SSN-08, DNE(W)-SSN-09	12.00 Noon (BST)
	b) Tender Closing Date and Time	27-02-2020 for Package No. DNE(W)-SSN-10, DNE(W)-SSN-13	
	c) Tender Closing Date and Time	01-03-2020 for Package No. DNE(W)-SSN-15, DNE(W)-SSN-18, DNE(W)-SSN-20	
14	a) Tender Opening Date and Time	26-02-2020 for Package No. DNE(W)-SSN-07, DNE(W)-SSN-08, DNE(W)-SSN-09	12.30 PM (BST)
	b) Tender Opening Date and Time	27-02-2020 for Package No. DNE(W)-SSN-10, DNE(W)-SSN-13	
	c) Tender Opening Date and Time	01-03-2020 for Package No. DNE(W)-SSN-15, DNE(W)-SSN-18, DNE(W)-SSN-20	
15	Pre-Tender Meeting	13 -02-2020	11.00 A.M (BST)
16	**Name & Address of the office**	**Address**	
	- For Selling Tender Document	Office of the Project Director, DNE 100% (RRKB), Training Academy Building, 7th Floor, BREB, Nikunja-2, Khilkhet, Dhaka-1229, Bangladesh.	
	- For Receiving Tender Document	Office of the Project Director, DNE 100% (RRKB), Training Accademy Building, 7th Floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.	
	- For Opening Tender Document	Office of the Project Director, DNE 100% (RRKB), Training Accademy Building, 7th Floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.	
	-For Pre-Tender Meeting	Office of the Project Director, DNE 100% (RRKB), Training Academy Building, 7th Floor, BREB, Nikunja-2, Khilkhet, Dhaka-1229, Bangladesh.	

INFORMATION FOR TENDERER		
17	Eligibility of Tender	Bangladeshi Manufacturers/Tenderers.
18	Price of Tender Document (Tk.)	Tk. 8,000.00 (Per Document)
19	**Brief Description of Works and amount of Tender Security :**	

Tender Package No.	Sub-Package No.	Description	Quantity	Tender Security Amount in Tk.	Completion Period
DNE (W)-SSN-07	DNE (W)-SSN-07-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Stations (Kazipur-2 & Belkuchi-3) in Sirajgonj PBS-2 (1X10/14 MVA Each, Turn-Key)	02 (Two) Nos.	37,60,000.00	12 (Twelve) Months
DNE (W)-SSN-08	DNE (W)-SSN-08-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Tojumuddin) in Bhola PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,50,000.00	
DNE (W)-SSN-09	DNE (W)-SSN-09-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Taltoli) in Patuakhali PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,60,000.00	
DNE (W)-SSN-10	DNE (W)-SSN-10-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Ishwardi-4) in Pabna PBS-1 (1X10/14 MVA, Turn-Key)	01 (One) No.	18,40,000.00	
	DNE (W)-SSN-10-02	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Atghoria-2) in Pabna PBS-1 (1X10/14 MVA, Turn-Key)	01 (One) No.	18,65,000.00	
DNE (W)-SSN-13	DNE (W)-SSN-13-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Rampal-2) in Bagerhat PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,60,000.00	
	DNE (W)-SSN-13-02	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Kachua) in Bagerhat PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,50,000.00	
DNE (W)-SSN-15	DNE (W)-SSN-15-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Kushtia-5) in Kushtia PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,40,000.00	
	DNE (W)-SSN-15-02	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Mirpur-3) in Kushtia PBS (1X10/14 MVA, Turn-Key)	01 (One) No.	18,35,000.00	
DNE (W)-SSN-18	DNE (W)-SSN-18-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Sharsha-4) in Jessore PBS-1 (1X10/14 MVA, Turn-Key)	01 (One) No.	18,30,000.00	
DNE (W)-SSN-20	DNE (W)-SSN-20-01	Supply, Installation, Testing & Commissioning of 33/11 KV Sub-Station (Kamarkhond-2) in Sirajgonj PBS-2 (1X10/14 MVA, Turn-Key)	01 (One) No.	19,15,000.00	

20	Regarding Tender Document	Tender Document can be purchased by the interested tenderer on submission of a written application to the address below upon the payment of non-refundable Tk. 8000.00 (Taka Eight Thousand) in the form of Pay Order / Bank Draft in favor of PD, 100% DNE (RRKB) BREB, Dhaka, Bangladesh. No tender document will be sent by courier or by mail. One tender document cannot be used for submission of tender proposal(s) by more than one tenderer. One tenderer, however, may submit tenders against any number of sub-packages included in the tender document by purchasing only one copy of the tender document.
21	Mode of payment	Payment will be made directly to the Tenderers in Local Currency (BDT).
22	Completion Period	Completion Periods shall begin with effect from the date of signing of contract or 28th day from the date of notification of award which to be earlier.
23	Special Instruction	Tender document can be viewed in the BREB website www.reb.gov.bd.

PROCURING ENTITY DETAILS		
24	Name of official Inviting Tender	Hindol Das
25	Designation of official Inviting Tender	Project Director, "Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)" Project
26	Address of official Inviting Tender	Bangladesh Rural Electrification Board, Training Academy Building (7th floor), Nikunja-2, Khilkhet, Dhaka-1229.
27	Contract details of official Inviting Tender	Tel. # 8900591
28	The procuring entity reserves the right to accept or reject all tenders	

(হিন্দোল দাস)
প্রকল্প পরিচালক
১০০% ডিএনই (অরআরইবি) প্রকল্প
বাপবিবো, ঢাকা।

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড
BANGLADESH RURAL ELCTRIFICATION BOARD
বাপবিবোর্ড/জন-( )/২০১৯-২০২০

ISO 9001, ISO 14001 & OHSAS 18001 Certified.

Project Director
"Distribution Network Expansion for 100% Rural (Rajshahi, Rangpur, Khulna & Barisal Divisions)" Project
Bangladesh Rural Electrification Board
Training Academy Building (7th Floor) Nikunja-2
Khilkhet, Dhaka-1229, Bangladesh, Phone : 8900591
e-mail: dne100rrkb.reb@gmail.com

TENDER DOCUMENT FOR THE

Table of Contents

Section 1.	Instructions to Tenderers	1
	A. General	1
	1. Scope of Tender	1
	2. Interpretation	1
	3. Source of Funds	1
	4. Corrupt, Fraudulent, Collusive, Coercive (or Obstructive in case of Development Partner) Practices	2
	5. Eligible Tenderers	4
	6. Eligible Plant and Services	5
	7. Site Visit	5
	B.Tender Document	5
	8. Tender Document: General	6
	9. Clarification of Tender Document	6
	10. Pre-Tender Meeting	7
	11. Addendum to Tender Document	7
	C. Qualification Criteria	8
	12. General Criteria	8
	13. Litigation History	8
	14. Experience Criteria	8
	15. Financial Criteria	8
	16. Personnel Capacity	9
	17. Equipment Capacity	9
	18. Joint Venture, Consortium or Association	9
	19. Subcontractor(s)	9
	D. Tender Preparation	10
	20. Only one Tender	10
	21. Cost of Tendering	10
	22. Issuance and Sale of Tender Document	10
	23. Language of Tender	10
	24. Contents of Tender (Document establishing the tender's qualification)	11
	25. Alternatives	13
	26. Tender Prices, Discounts & Price adjustment	13
	27. Tender Currency	16
	28. Documents Establishing the Conformity of Plant, and Services	16
	29. Documents Establishing Eligibility of the Tenderer	17
	30. Validity Period of Tender	17
	31. Extension of Tender Validity and Tender Security	17
	32. Tender Security	18
	33. Form of Tender security	18
	34. Authenticity of Tender Security	18
	35. Return of Tender Security	19
	36. Forfeiture of Tender Security	19
	37. Format and Signing of Tender	19
	E. Tender Submission	20

38. Sealing, Marking and Submission of Tender 20
39. Deadline for Submission of tenders 21
40. Late tender 22
41. Modification, Substitution or Withdrawal of Tenders 22
42. Tender Modification 22
43. Tender Substitution 22
44. Withdrawal of Tender 23
F. Tender Opening and Evaluation 23
45. Tender Opening 23
46. Evaluation of Tenders 25
47. Evaluation Process 25
48. Preliminary Examination 25
49. Technical Evaluation and Responsiveness 26
50. Clarification on Technical Offer 27
51. Restrictions on Disclosure of Information 28
52. Approval of Technical Offer 28
53. Financial Offer Opening 28
54. Clarification on Financial Offer 29
55. Correction of Arithmetical Errors 30
56. Conversion to Single Currency 30
57. Financial Evaluation 30
58. Price Comparison 31
59. Post-qualification 32
60. Negotiation 33
61. Rejection of All Tenders 33
62. Informing Reasons for Rejection 33
G. Contract Award 34
63. Award Criteria 34
64. Notification of Award 34
65. Performance Security 34
66. Form and Time Limit for furnishing of Performance security 35
67. Validity of Performance Security 35
68. Authenticity of performance Security 35
69. Contract Signing 35
70. Publication of Notification of Award of Contract 36
71. Debriefing of Tenderers 36
72. Right to Complains 36
38

Section 2. Tender Data Sheet
A.General 38
B.Tender Document 38

C.Qualification Criteria 39
D.Tender Preparation 41
E.Submission of Tender 42
F.Opening and Evaluation of Tenders 43
G.Award of Contract 44
Section 3. General Conditions of Contract 46
A.General 46
1. Definitions 46
2. Interpretation 50
3. Communications & Notices 51
4. Governing Law 51
5. Governing Language 51
6. Documents Forming the Contract and Priority of Documents 51
7. Contract Agreement 52
8. Assignment 52
9. Eligibility 52
10. Gratuities / Agency fees 52
11. Confidential Details 52
12. Joint Venture (JV) 53
13. Possession of the Site 54
14. Access to the Site 54
15. Safety, Security and Protection of the Environment 54
16. Working Hours 54
17. Welfare of Laborers 54
18. Child Labor 55
19. Fossils& antiquities 55
20. Corrupt, Fraudulent, Collusive or Coercive Practices 55
21. License/ Use of Technical Information 56
B. Subject Matter of Contract 57
22. Scope of Facilities 57
23. Time for Commencement 58
24. Time for Completion 58
25. Employer's Responsibilities 58
26. Contractor's Responsibilities 59
27. Employer's and Contractor's Risks 59
28. Employer's Risks 59
29. Contractor's Risks 60
C. Execution of the Facilities 60
30. Representatives 60
31. Work Program 62
32. Subcontractor 63

33. Nominated Subcontractor 63
34. Other Contractors 63
35. Design and Engineering 64
36. Procurement 65
37. Installation 66
38. Test & Inspection 70
39. Completion of the Facilities 71
40. Commissioning and Operational Acceptance 73
D. Guarantees and Liabilities 75
41. Completion Time Guarantee 75
42. Defect Liability 76
43. Functional Guarantees 78
44. Patent Indemnity 79
45. Limitation of Liability 80
E. Risk Distribution 80
46. Transfer of Ownership 80
47. Care of Facilities 80
48. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification 81
49. Insurance 82
50. Unforeseen Conditions 84
51. Change in Laws and Regulation 85
52. Force Majeure 86
53. Notice of Force Majeure 86
54. Duty to Minimize Delay 86
55. Consequences of Force Majeure 87
F. Payment 87
56. Contract Price 87
57. Terms of Payment 88
58. Advance Payment Security 88
59. Performance Security 88
60. Taxes and Duties 89
61. Payments to Nominated Subcontractor(s) 89
62. Price Adjustment 89
63. Liquidated Damages 90
G. Change in Contract Elements 90
64. Change in the Facilities 90
65. Extension of Time for Completion 93
66. Suspension 94
H. Termination and Settlement of Disputes 95
67. Termination 95
68. Payment upon Termination 97

	69. Property	98
	70. Frustration	98
	I. Claims, Disputes and Arbitration	98
	71. Contractor's Claims	98
	72. Settlement of Disputes	99
Section 4.	**Particular Conditions of Contract**	100
	Appendix 1. Terms and Procedures of Payment	107
	Appendix 2. Price Adjustment	108
	Appendix 3. Insurance Requirements	109
	Appendix 4. Time Schedule	112
	Appendix 5. List of Major Items of Plant and Services and List of Approved Subcontractors	113
	Appendix 6. Scope of Works and Supply by the Employer	114
	Appendix 7. List of Documents for Approval or Review	115
	Appendix 8. Functional Guarantees	116
Section 5.	**Tender and Contract Forms**	118
	Tender Submission Letter for Technical offer	119
	(Form PG5A-1a)	119
	Tender Submission Letter for Financial offer (Form PG5A-1b)	122
	Tenderer Information (Form PG5A-2a)	125
	JVCA Partner Information Form(PG5A-2b)	128
	Subcontractor Information (Form PG5A-2c)	131
	Price Schedule for Rates and Prices (Form PG5A-3)	134 138
	Technical Proposal (Form PG5A-4)	143
	Manufacturer's Authorisation Letter (Form PG5A - 5)	150
	Bank Guarantee for Tender Security (Form PG5A– 6)	151
	Letter of Commitment for Bank's undertaking for Line of Credit (Form PG5A-6a)	152
	Notification of Award (Form PG5A - 7)	153
	Contract Agreement (Form PG5A - 8)	154
	Bank Guarantee for Performance Security (Form PG5A – 9)	155
	Bank Guarantee for Advance Payment (Form PG5A – 10)	156
	Bank Guarantee for Retention Money Security (Form PG5A-11)	157
Section 6.	**Employer's Requirements**	158
	6.2 Specification	171
	6.3 Form of Completion Certificate	461
	6.4 Form of Operational Acceptance Certificate	462
	6.5 Form of Change Order Procedure and Forms	463
	Annex 1. Request for Change Proposal	465

Annex 2. Estimate for Change Proposal 466
Annex 3. Acceptance of Estimate 467
Annex 4. Change Proposal 468
Annex 5. Change Order 470
Annex 6. Pending Agreement Change Order 471
Section 7. Drawings 473

Section 1. Instructions to Tenderers

A. General

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

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

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

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

	5.12 These above requirements for eligibility will extend, as applicable, to each JV partner and Subcontractor proposed by the Tenderers. 5.13 Tenderers shall have the up-to-date valid license(s), issued by the corresponding competent authority, as specified in the **TDS.**
6. Eligible Plant and Services	6.1 The plant and services to be supplied under the contract are eligible, unless their origin is from a country specified in the **TDS** and all expenditures under the contract will be limited to such plant, and services.
	6.2 For purposes of this Clause, the term "plant" means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided in the facilities; and "installation services" means all those services ancillary to the supply of the Plant for the Facilities, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation, installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training etc
	6.3 For purposes of this clause, "origin" means the place where the plant, or component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components or country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.
	6.4 The origin of plant & equipment is distinct from the nationality of the Tenderer. The nationality of the firm that produces, assembles, distributes, or sells the goods shall not determine their origin.
7. Site Visit	7.1 The Tenderer is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the tender and entering into a contract for the provision of Plant and Installation Services.
	7.2 The Tenderer and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Tenderer, its personnel, and agents will release and indemnify the

		Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
	7.3	The Tenderer should ensure that the Purchaser is informed of the visit in adequate time to allow it to make appropriate arrangements.
	7.4	The costs of visiting the Site shall be at the Tenderer's own expense.
B. Tender Document		
8. Tender Document: General	8.1	The Sections comprising the Tender Document are listed below, and should be read in conjunction with any Addendum issued under ITT Clause 11. • Section 1 Instructions to Tenderers (ITT) • Section 2 Tender Data Sheet (**TDS**) • Section 3 General Conditions of Contract (GCC) • Section 4 Particular Conditions of Contract (**PCC**) • Section 5 Tender and Contract Forms • Section 6 Employer's Requirements • Section 7 Drawings
	8.2	The Purchaser shall reject any Tender if the Tender Document was not purchased directly from the Purchaser, or through its agent as stated in the **TDS.**
	8.3	The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document as well as addendum to Tender Documents.
9. Clarification of Tender Document	9.1	A prospective Tenderer requiring any clarification of the Tender Document shall contact the Purchaser in writing at the Purchasers address indicated in the **TDS** before **two-third** of time allowed for preparation and submission of Tender elapses.
	9.2	The Procuring Entity is not obliged to answer any clarification request received after that date as stated under ITT Sub Clause 9.1.
	9.3	The Procuring Entity shall respond in writing within five (5) working days of receipt of any such request for clarification received under ITT Sub Clause 9.1.
	9.4	The Procuring Entity shall forward copies of its response to all those who have purchased the Tender Document, including a description of the enquiry but without identifying its source.
	9.5	Should the Procuring Entity deem it necessary to revise the Tender Document as a result of a clarification, it will do so following the procedure under ITT Clause 11.

10. Pre-Tender Meeting	10.1 To clarify issues and to answer questions on any matter arising in the Tender Document, the Purchaser may, if stated in the **TDS**, hold a Pre-Tender Meeting at the place, date and time as specified in the TDS. All Potential Tenderers are encouraged to attend the meeting, if it is held. 10.2 Minutes of the pre-Tender meeting, including the text of the questions raised and the responses given, together with any responses prepared after the meeting, will be transmitted within one week (7 days) after holding the meeting to all those who purchased the Tender Document and even those who did not attend the meeting. 10.3 Any amendment to the Tender Documents listed in ITT Sub-Clause 8.1 that may become necessary as a result of the pre-Tender meeting shall be made by the Purchaser exclusively through the issue of an Addendum as stated under ITT Sub-Clause 11 and not through the minutes of the pre-Tender meeting. 10.4 Non-attendance at the Pre-Tender meeting will not be a cause for disqualification of a Tenderer.
11. Addendum to Tender Document	11.1 At any time prior to the deadline for submission of Tenders, the Purchaser on its own initiative or in response to a clarification request in writing from a Tenderer, having purchased the Tender Document or as a result of a Pre-Tender meeting, may revise the Tender Document by issuing an addendum pursuant to Rule 95 of the Public Procurement Rules, 2008.
	11.2 The addendum issued under ITT Sub-Clause 11.1 shall become an integral part of the Tender Document and shall have a date and an issue number and shall be circulated by fax, mail or e-mail, to Tenderers who have purchased the Tender Documents within five (5) working days of issuance of such addendum, to enable Tenderers to take appropriate action.
	11.3 The Tenderer shall acknowledge receipt of an addendum.
	11.4 Tenderers who have purchased the Tender Documents but have not received any addendum issued under ITT Sub-clause 11.1 shall inform the Purchaser of the fact by fax, mail or e-mail before **two-third** of the time allowed for the submission of Tenders has elapsed.
	11.5 Procuring Entities shall also ensure posting of relevant addenda with the reference number and date on their website.
	11.6 To give a prospective Tenderer reasonable time in which to take an amendment into account in preparing its Tender, the Purchaser may, at its discretion, extend the deadline for the submission of Tenders, pursuant to Rule 95(6) of the Public Procurement Rule, 2008 and under ITT Clause 36.

	11.7 If an addendum is issued when time remaining is less than one-third of the time allowed for the preparation of Tenders, a Purchaser shall extend the deadline by an appropriate number of days for the submission of Tenders, depending upon the nature of the Procurement requirement and the addendum. The minimum time for such extension shall not be less than seven (7) days.
C. Qualification Criteria	
12. General Criteria	12.1 The Tenderer shall possess the necessary professional and technical qualifications and competence, financial resources, equipment and other physical facilities, managerial capability, specific experience, reputation, and the personnel, to perform the contract.
	12.2 In addition to meeting the eligibility criteria, as stated in ITT Clause 5, the Tenderer must satisfy the other criteria stated in ITT Clauses 13 to 15 inclusive.
	12.3 To qualify for multiple number of contracts/lots in a package made up of this and other individual contracts/lots for which tenders are invited in the Invitation for Tenders, the Tenderer shall demonstrate having resources and experience sufficient to meet the aggregate of the qualifying criteria for the individual contracts.
13. Litigation History	13.1 The maximum number of arbitration awards against the Tenderer over a period shall be as specified in the **TDS.**
14. Experience Criteria	14.1 Tenderers shall have the following minimum level of supply experience to qualify for supplying the Plant and Services under the contract: (a) a minimum number of years of general experience in the role of Contractor or Subcontractor or Management Contractor as specified in the **TDS**; and (b) Specific experience as a Contractor or Subcontractor or Management Contractor that are similar to the proposed plant and services in at least a number of contract(s) and of a minimum value over the period, as specified in the **TDS**.
15. Financial Criteria	15.1 Tenderers shall have the following minimum level of financial capacity of qualify for the supply, execution and performance of plant and services under the contract. (a) the average annual turnover as specified in the **TDS** calculated as total certified payments received for contracts in progress or completed, during the period specified in the **TDS;** (b) availability of minimum liquid assets or working capital or credit facilities, as specified in the **TDS**;

		and; (c) satisfactory resolution of all claims, arbitrations or other litigation cases and shall not have serious negative impact on the financial capacity of the Tenderer.
16. Personnel Capacity	16.1	The Tenderer shall have the following minimum level of personnel capacity to qualify for the performance of the plant and services under the Contract. A Project Manager, Engineers, and other key staff with qualifications and experience as specified in the **TDS;**
17. Equipment Capacity	17.1	The Tenderer shall own suitable equipment and other physical facilities or have proven access through contractual arrangement to hire or lease such equipment or facilities for the desired period, where necessary or have assured access through lease, hire, or other such method, of the essential equipment, in full working order, as specified in the **TDS.**
18. Joint Venture, Consortium or Association	18.1	The Tenderer may participate in the procurement proceedings forming a Joint Venture, Consortium or Associations (JVCA) by an agreement, executed case by case on a non judicial stamp of value as stated in **TDS** or alternately with the intent to enter into such an agreement supported by a Letter of Intent along with the proposed agreement duly signed by all partners of the intended JVCA and authenticated by a Notary Public.
	18.2	The figures for each of the partners of a JVCA shall be added together to determine the Tenderer's compliance with the minimum qualifying criteria; however, for a JVCA to qualify, lead partner and its other partners must meet the criteria stated in the **TDS.** Failure to comply with these requirements will result in rejection of the JVCA Tender. Subcontractors' experience and resources will not be taken into account in determining the Tenderer's compliance with the qualifying criteria.
	18.3	Each partner of the JVCA shall be jointly and severally liable for the execution of the Contract, all liabilities and ethical and legal obligations in accordance with the Contract terms.
	18.4	The JVCA shall nominate a Representative (partner-in-charge/Lead Firm) who shall have the authority to conduct all business for and on behalf of any and all the partners of the JVCA during the tendering process and, in the event the JVCA is awarded the Contract, during contract execution including the receipt of payments for and on behalf of the JVCA.
	18.5	Each partner of the JVCA shall complete the JVCA Partner Information (**Form PG5A-2b)**for submission with the Tender
19. Subcontractor(s)	19.1	Tenderer, pursuant to Rule 53 of the PPR2008, is allowed to sub-contract a portion of the Supply.

	19.2	The Tenderer shall specify in its Tender all portion of the Plant and Services that will be subcontracted, if any, including the entity(ies) to whom each portion will be subcontracted to, subject to the maximum allowable limit for subcontracting of Plant and Services specified in the **TDS**.
	19.3	The Purchaser may require Tenderers to provide more information about their subcontracting arrangements. If any Subcontractor is found ineligible or unsuitable to carry out the subcontracted tasks, the Procuring Entity may request the Tenderer to propose an acceptable substitute.
	19.4	The Purchaser may also select nominated Subcontractor(s) to execute certain specific components of the Works and if so, those will be specified in the **TDS**.
	19.5	The successful Tenderer shall under no circumstances assign the goods/works/services or any part of it to a Subcontractor
	19.6	Subcontractors must comply with the provision of ITT Clause 5. For this purpose contractor shall complete the Subcontractor's information in Form **PG5A-2c** for submission with tender
	19.7	If the Purchaser determines that a subcontractor is ineligible, the subcontracting of such portion of the Plants and Services assigned to the ineligible subcontractor shall be disallowed

D. Tender Preparation

20. Only one Tender	20.1	If a Tender for Plant and Services is invited on 'lot-by-lot' basis, each lot shall constitute a tender. A Tenderer shall submit only one (1) Tender for each lot, either individually or as a JVCA. The Tenderer who submits or participates in more than one (1) Tender for each lot will cause all the Tenders with that Tenderer's participation to be rejected.
21. Cost of Tendering	21.1	Tenderers shall bear all costs associated with the preparation and submission of its Tender, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Tendering process.
22. Issuance and Sale of Tender Document	22.1	A Purchaser, pursuant to Rule 94 of the Public Procurement Rules, 2008 shall make Tender Documents available immediately to the potential Tenderers, requesting and willing to purchase at the corresponding price if the advertisement has been published in the newspaper pursuant to Rule 90 of the Public Procurement Rules, 2008.
	22.2	Full contact details with mailing address, telephone and facsimile numbers and electronic mail address, as applicable, of those to whom Tender Documents have been issued shall be recorded with a reference number by the Purchaser or its agent.

	22.3	There shall not be any pre-conditions whatsoever, for sale of Tender Document and the sale of such Document shall be permitted up to the day prior to the day of deadline for the submission of Tender.
23. Language of Tender	23.1	Tenders shall be written in the English language. Correspondences and documents relating to the Tender may be written in English or *Bangla.* Supporting documents and printed literature furnished by the Tenderers that are part of the Tender may be in another language, provided they are accompanied by an accurate translation of the relevant passages in the English or *Bangla* language, in which case, for purposes of interpretation of the Tender, such translation shall govern.
	23.2	Tenderers shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.
24. Contents of Tender (Document establishing the tender's qualification)	24.1	The Tender prepared by the Tenderers shall comprise Two Envelope submitted simultaneously, one called the **Technical Offer** (**Envelope-01**) containing the documents listed in ITT 24.2 and other called the **Financial Offer** containing the documents listed in 24.3, both envelopes enclosed together in an outer Single envelope.
	24.2	The **Technical Offer** (**Envelope-01**) prepared by the Tenderers will comprise the following: (a) Technical Submission Letter (**Form PG5A-1a**) as furnished in Section 5: Tender and Contract Forms. This form must be completed without any alterations to its format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested (b) Tenderer Information Sheet (**Form PG5A-2**)as furnished in Section 5: Tender and Contract Forms; (c) Tender Security as stated under ITT Clause 32,33 and 34; (d) Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and Contract Forms. (e) Alternatives, if permitted, as stated under with ITT Clause 25; (f) Written confirmation authorising the signatory of the Tender to commit the Tenderer, as stated under ITT Sub-Clause 37.3; (g) The completed eligibility declarations, to establish its eligibility as stated under ITT Clause 5, in the Tender Submission Sheet (Form PG5A-1a & 1b), as furnished in section 5: Tender and Contract Forms; (h) An affidavit confirming the legal capacity stating that

	there are no existing orders of any judicial court that prevents either the Tenderer or employees of a Tenderer entering into or signing a Contract with the Purchaser as stated under ITT clause 5; (i) An affidavit confirming that the Tenderer is not insolvent, in receivership or not bankrupt or not in the process of bankruptcy, not temporarily barred from undertaking their business for financial reasons and shall not be the subject of legal proceedings for any of the foregoing as stated under ITT Clause 5; (j) A certificate issued by the competent authority stating that the Tenderer is a Tax payer having valid Tax Identification Number (TIN) and VAT registration number or in lieu any other document acceptable to the Purchaser demonstrating that the Tenderer is a genuine Tax payer and has a VAT registration number as a proof of fulfillment of taxation obligations as stated under ITT Clause 5. In the case of foreign Tenderers, a certificate of competent authority in that country of which the Tenderer is citizen shall be provided ; (k) Documentary evidence demonstrating that they are enrolled in the relevant professional or trade organizations registered in Bangladesh or in case of foreign tenderer in their country of origin or a certificate concerning their competency issued by a professional institution in accordance with the law of the country of their origin, as stated under ITT Clause 5; (l) The country of origin declarations, to establish the eligibility of the Plant and Services as stated under ITT Clause 6, in the Price Schedule for Plant and Services (**Form PG5A-3**) as, applicable, furnished in Section 5: Tender and Contract Forms; (m) Documentary evidence as stated under ITT Clauses 28, that the Goods and Related Services conform to the Tender Documents; (n) Documentary evidence as stated under ITT Clause 29 that the Tenderer's qualifications conform to the Tender Documents; (o) Documents establishing legal and financial autonomy and compliance with commercial law, as stated under ITT Sub-clause 5.3 in case of government owned entity; and (p) In addition to the requirements stated under ITT Sub Clause 18.1, Tenders submitted by a JVCA or proposing a Subcontractor shall include. i. a Joint Venture Agreement entered into by all

	partners, executed on a non-judicial stamp of value or equivalent as stated under ITT Sub Clause 18.1; or ii. a Letter of Intent along with the proposed agreement duly signed by all partners of the intended JVCA with the declaration that it will execute the Joint Venture agreement in the event the Tenderer is successful; iii. the JVCA Partner Information (**Form PG5A-2b**); iv. the Subcontractor Information (**Form PG5A-2c**). (q) the completed Specifications Submission and Compliance Sheet **(Form PG5A-4a)**as stated under ITT clause 28.1; (r) Any other document as specified in the **TDS.** 24.3 The Financial Offer (**Financial Envelope -02**) prepared by the Tenderers shall comprise the following: (a) The Financial offer Submission Letter (**Form PG5A-1b**) as furnished in Section 5: (b) The Tenderer shall submit the completed Price Schedule for Plant and Services (**Form PG5A-3**), according to their origin as appropriate as furnished in section 5: Tender and Contract Forms. (c) the written confirmation authorizing the signatory of the Tender to commit the Tenderer, as stated under ITT Sub Clause 37.3; (d) any other document as specified in the **TDS**.
25. Alternatives	25.1 Unless otherwise stated in the **TDS**, alternatives shall not be considered.
26. Tender Prices, Discounts & Price adjustment	26.1 Unless otherwise **specified in the TDS,** tenderers shall quote for the entire Plant and Installation Services on a "single responsibility" basis such that the total tender price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the tender document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the tender document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Tender Document, all in accordance with the requirements of the General Conditions of Contract. Items against which no price is entered by the Tenderer will not be paid for by the Purchaser when executed and shall be deemed to be covered by the prices for other items.

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

26.3 Tenderers shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 5, Tender and Contract Forms.

26.4 Depending on the scope of the Contract, the Price Schedules may comprise up to the six (6) schedules listed below. Separate numbered Schedules included in Section IV, Tender Forms, from those numbered 1-4 below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 5), giving the total tender price(s) to be entered in the Letter of Tender.

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

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

Schedule No. 3 Design Services

Schedule No. 4 Civil works part

Schedule No. 5 Installation Services

Schedule No. 6 Grand Summary (Schedule Nos. 1 to 4)

Schedule No. 7 Recommended Spare Parts

Tenderers shall note that the plant and equipment included in Schedule Nos. 1 and 2 above **exclude** materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation Services.

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

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

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

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

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

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

(iii) The total price for the item.

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

(d) Installation Services shall be quoted separately

	(Schedule No. 4) and shall include rates or prices for local transportation to named place of final destination as **specified in the TDS,** insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Tender Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's country as of twenty-eight (28) days prior to the deadline for submission of tenders. (e) Recommended spare parts shall be quoted separately (Schedule 6) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts 26.6 The current edition of INCOTERMS, published by the International Chamber of Commerce shall govern. 26.7 The prices shall be either fixed or adjustable as specified in the **TDS**. 26.8 In the case of **Fixed Price**, prices quoted by the Tenderer shall be fixed during the Tenderer's performance of the contract and not subject to variation on any account. A tender submitted with an adjustable price quotation will be treated as non-responsive and rejected. 26.9 In the case of **Adjustable Price**, prices quoted by the Tenderer shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A tender submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Tenderers are required to indicate the source of labor and material indices in the corresponding Form in Section 5, Tender and Contract Forms 26.10 If so indicated in ITT 1.2, tenders are to be invited for individual lots or for any combination of lots (packages). Tenderers wishing to offer any price reduction (discount) for the award of more than one lot shall specify in their Tender Submission Letter the price reductions applicable to each package, or alternatively, to individual Contracts within the package, and the manner in which the price reductions will apply. 26.11 Tenderers wishing to offer any unconditional discount shall specify in their Letter of Tender the offered discounts and the manner in which price discounts will

	apply. 26.12 If so indicated under ITT Sub Clause 26.9, Tenders are being invited with a provision for price adjustments. The unit rates or prices quoted by the Tenderer are subject to adjustment during the performance of the Contract in accordance with the provisions of the relevant GCC Clause and, in such case the Employer shall provide the indexes and weightings or coefficients in **Appendix to the Tender** for the price adjustment formulae specified in the **PCC.** 26.13 The Employer may require the Tenderer to justify its proposed indexes, if any of those as stated under ITT Sub Clause 26.12, are instructed to be quoted by the Tenderer in **Appendix to the Tender**. 26.14 The price adjustment stated under ITT Sub Clause 26.9and 26.12 shall be dealt with in accordance with the provisions in Section 12 and 22 of the Public Procurement Act, 2006 and Rule 5 and 38 of the Public Procurement Rules, 2008.
27. Tender Currency	27.1 For expenditures that will be incurred in Bangladesh, the Tenderer shall quote the prices in Bangladesh Taka
	27.2 Suppliers offering Goods manufactured or assembled in Bangladesh are permitted to submit their Tender in a combination of local and foreign currencies. 27.3 In case of National Tender, all quoted price shall be in local currency. 27.4 In case of international competitive tender, for expenditures that will be incurred outside Bangladesh, the Tenderer may quote the prices as specified in **TDS**.
28. Documents Establishing the Conformity of Plant, and Services	28.1 To establish the conformity of the plant and services to the Tender Documents, the Tenderer shall furnish as part of its Tender the documentary evidence that the Goods and Related services conform to the technical specifications and standards in Section 6, Employer's Requirement. a. a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification b. a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing functioning of the plant for the period named in the **TDS**, following completion of plant and services in accordance with provisions of contract; and c. a commentary on the Employer's Specification and adequate evidence demonstrating the substantial responsiveness of the plant and services to those specifications. Tenderers shall note that standards for workmanship, materials

		and equipment designated by the Employer in the Tender Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Tenderer may substitute alternative standards, brand names and/or catalog numbers in its tender, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Specification.
29.Documents Establishing Eligibility of the Tenderer	29.1	Tenderers, if applying as a sole Tenderer, shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, it shall: (a) complete the eligibility declarations in the Tender Submission Letter (**Form PG5A-1a**); (b) complete the Tenderer Information (**Form PG5A-2a**); (c) complete Subcontractor Information (**Form PG5A-2c**), if it intends to engage any Subcontractor(s).
	29.2	Tenderers, if applying as a partner of an existing or intended JV shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, in addition to as stated underITT Sub Clause 29.1, it shall: (a) provide for each JV partner, completed JV Partner Information (**Form PG5A-2b**); (b) provide the JV agreement or Letter of Intent along with the proposed agreement of the intended JV as stated under ITT Sub Clause 18.1
30. Validity Period of Tender	30.1	Tender validities shall be determined on the basis of the complexity of the Tender and the time needed for its examination, evaluation, approval of the Tender and issuance of the Notification of Award (NOA).
	30.2	Tenders shall remain valid for the period specified in the **TDS** after the date of Tender submission deadline prescribed by the Purchaser, as stated under ITT Clause 39. A Tender valid for a period shorter than that specified will be rejected by the Purchaser as non- responsive.
31. Extension of Tender Validity and Tender Security	31.1	In justified exceptional circumstances, prior to the expiration of the Tender validity period, the Purchaser following Rule 21 of the Public Procurement Rules, 2008 may solicit, **not later than ten (10) days** before the expiry date of the Tender validity, compulsorily all the Tenderers' consent to an extension of the period of validity of their Tenders.
	31.2	The request for extension of Tender validity period shall state the new date of the validity of the Tender.

	31.3	The request from the Purchaser and the responses from the Tenderers will be made in writing.
	31.4	Tenderers consenting in writing to the request made by the Purchaser under ITT Sub-Clause 30.1 shall also correspondingly extend the validity of its Tender Security for twenty-eight (28) days beyond the new date for the expiry of Tender validity.
	31.5	Tenderers consenting in writing to the request under ITT Sub-Clause 31.1 shall not be required or permitted to modify its Tender in any circumstances.
	31.6	If the Tenderers are not consenting in writing to the request made by the Purchaser under ITT Sub-Clause 31.1, its Tender will not be considered for subsequent evaluation.
32. Tender Security	32.1	The Tender Security and its amount shall be determined sufficient to discourage the submission of frivolous and irresponsible tenders pursuant to Rule 22 of the Public Procurement Rule2008 and shall be expressed as a rounded fixed amount and, shall not be stated as a precise percentage of the estimated total Contract value. 32.2 The Tenderer shall furnish as part of its Technical offer (**envelope-1**) Tender, in favour of the Purchaser or as otherwise directed on account of the Tenderer, a ender security in original form (not copy) and in the amount as specified in **TDS.** 32.3 If the Tender is a Joint Venture, the Tenderer shall furnish as part of its Tender, in favour of the Procuring Entity or as otherwise directed on account of the title of the existing or intended JVCA or any of the partners of that JVCA or in the names of all future partners as named in the Letter of Intent of the JVCA, a Tender Security in original form and in the amount as stated under ITT Sub Clause 32.1.
33. Form of Tender security	33.1	The Tender Security shall: (a) In case of NCT, at the Tendere's option, be either; (i) In the form of a Bank Draft, Pay order or (ii) in the form of an irrevocable bank guarantee issued by any scheduled Bank of Bangladesh, in the format **(Form PG5A-6)** furnished in Section 5: Tender and Contract Forms. (b) In case of ICT, in the form of an irrevocable bank guarantee issued by an internationally reputable bank and shall require to be endorsed by its any correspondent bank located in Bangladesh, to make it enforceable, in the format **(Form PG5A-6)** furnished in Section 5: Tender and Contract Forms; 33.2 Tender security shall be payable promptly upon written demand by the Purchaser in the case of the conditions listed in ITT Clause 36 being invoked; and

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

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

	sealed envelopes for the original and copies of the technical Tender shall then be enclosed and sealed in one single envelope and clearly mark it "**Envelope-01: TECHNICAL OFFER".** 38.2 The inner and outer envelopes of Technical Offer shall: (a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1; (b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1; (c) bear the name and address of the Tenderer; (d) bear a statement "DO NOT OPEN BEFORE ---------- ----------" the time and date for Tender opening as stated under ITT Sub Clause 45.2 (e) bear any additional identification marks as specified in the **TDS.**
	38.3 Tenderers shall enclose the original of **Financial Offer** in one (1) envelope and all the copies of the **Financial Offer** in another envelope, duly marking the envelopes as "**ORIGINAL OF FINANCIAL OFFER**" & "**COPY OF FINANCIAL OFFER".** These sealed envelopes for the original and copies of the Financial Tender shall then be enclosed and sealed in one single envelope and clearly mark it "**ENVELOPE-02: FINANCIAL OFFER.**
	38.4 The inner and outer envelopes of Financial Offer shall: (a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1; (b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1; (c) bear the name and address of the Tenderer; **(d)** bear a statement "**DO NOT OPEN BEFORE THE TECHNICAL OFFER EVALUATION AND APPROVAL".** (e) bear any additional identification marks as specified in the **TDS.**
	38.5 **The Envelope-01** as stated in ITT Clause 38.1 and **Envelope-02** as in ITT Clause 38.3 shall then be enclosed and sealed in one single outer envelope which shall contain the information as stated under ITT Clause 38.2 (a) to (e) & ITT Clause 38.4 (a) to (e)
	38.6 Tenderers are solely and entirely responsible for pre-disclosure of Tender information if the envelope(s) are not properly sealed and marked.
	38.7 Tenders shall be delivered by hand or by mail, including courier services at the address(s) as stated under ITT Sub Clause 39.1.
	38.8 The Procuring Entity will, on request, provide the Tenderer

		with acknowledgement of receipt showing the date and time when it's Tender was received.
39. Deadline for Submission of tenders	39.1	Tenders shall be delivered to the Purchaser at the address specified in the **TDS** and no later than the date and time specified in the **TDS**.
	39.2	The Purchaser may, at its discretion on justifiably acceptable grounds duly recorded, extend the deadline for submission of Tender as stated under ITT Sub Clause 39.1, in which case all rights and obligations of the Purchaser and Tenderers previously subject to the deadline will thereafter be subject to the new deadline as extended.
	39.3	If submission of 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.**
	39.4	The Procuring Entity shall ensure that the Tenders received at the secondary place(s) are hand-delivered at the primary place as stated under ITT Sub Clause 39.1, within THREE (3) HOURS after the deadline for submission of Tenders at the secondary place (s), in case of MULTIPLE DROPPING as stated under ITT Sub Clause 39.3, as specified in the **TDS**.
40. Late tender	37.6	Any Tender received by the Purchaser after the deadline for submission of Tenders as stated under ITT Clause 39, shall be declared LATE, rejected, returned unopened to the Tenderer.
41.Modification, Substitution or Withdrawal of Tenders	41.1	Tenderers may modify, substitute or withdraw its Tender after it has been submitted by sending a written notice duly signed by the authorized signatory and properly sealed, and shall include a copy of the authorization; provided that such written notice including the **affidavit** is received by the Procuring Entity prior to the deadline for submission of Tenders as stated under ITT Clause 39
42. Tender Modification	42.1	Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit corresponding modification either to its original **Technical Offer** or **Financial Offer** or both, marked as **"MODIFICATION FOR TECHNICAL OFFER(MTO)" or "MODIFICATION FOR FINANCIAL OFFER (MFO)"**with two separate envelopes. The envelope/envelopes marked as MTO and/or MFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as **"MODIFICATION (M)".**
43. Tender Substitution	43.1	Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit another

		Technical Offer or **Financial Offer** or both, marked as **"SUBSTITUTION FOR TECHNICAL OFFER (STO)" or "SUBSTITUTION FOR FINANCIAL OFFER (SFO)"**with two separate envelopes. The envelope/envelopes marked as STO and/or SFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as **"SUBSTITUTION (S)".**
44. Withdrawal of Tender	44.1	The Tenderer shall be allowed to withdraw its Tender by a Letter of Withdrawal marked as "WITHDRAWAL" prior to the deadline for submission of Tenders as stated under ITT Clause 39.
F. Tender Opening and Evaluation		
45. Tender Opening	45.1	Only the **Technical Offer (Envelope-01**) shall be opened immediately after the deadline for submission of Tenders at the primary place as specified in the **TDS** but not later than **ONE HOUR,** after expiry of the submission deadline at the same primary place unless otherwise stated under ITT Sub Clause 39.2. But with in **THREE HOURS** after the dateline of submission of tender at primary place in case of multiple dropping. Tender opening shall not be delayed on the plea of absences of Tenderers or his or her representatives. Financial offer **(Envelope-02)** shall not open with Technical offer (**Envelope-01)** and shall be kept unopened at the Custody of the Head of the Procuring Entity or his Authorised Officer (AO).
	45.2	Persons not associated with the Tender may not be allowed to attend the public opening of Technical Offers.
	45.3	Tenderers' representatives shall be duly authorised by the Tenderer. Tenderers or their authorised representatives will be allowed to attend and witness the opening of **Technical Offers**, and will sign a register evidencing their attendance. Technical Offers Opening shall not be delayed on the plea of absence of Tenderers or his or her representatives.
	45.4	The authenticity of withdrawal or substitution of, or modifications to original Tender, if any made by a Tenderer in specified manner, shall be examined and verified by the Tender Opening Committee (TOC) based on documents submitted as stated under ITT Sub Clause 41.1. Any envelope related to financial modification, substitute shall be recorded but not open with technical offer.
	45.5	Verify (**M), (S), (W), (A), (O) by following step by steps** (a) **Step 1:** envelopes marked "**Withdrawal (W)"** shall be opened and "Withdrawal" notice read aloud & recorded in the opening sheet. After verify the withdrawal letter is genuine, corresponding tender shall not be opened, but returned unopened to the

	Tenderer by Procuring Entity (**PE**) at a late time. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice shall be as stated in 41.1& 44.1 and in such case the Tender shall be opened and recorded. (b) **Step 2:** the remaining Tenders will be sorted out and those marked **"SUBSTITUTION (S)"** or "**MODIFICATION (M)"** of Tender will be linked with their corresponding Original Tender. (c) **Step 3:** outer envelopes marked "**SUBSTITUTION (S)**" shall be opened. The inner envelopes containing the "Substitution of Technical Offer (**STO**)" and/or "Substitution of Financial Offer (**SFO**)" shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Tenderer unopened by the Procuring Entity at a later time immediately after opening of Technical Offers. Only the Substitution of Technical Offer, if any, shall be opened, read out, and recorded. Substitution of Financial Offer will remain unopened in accordance with ITT Sub Clause 45.1. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at Technical Offer opening. (d) **Step 4:** outer envelopes marked "**MODIFICATION (M)**" shall be opened. No Technical Offer and/or Financial Offer shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Offers. Only the Technical Offers, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Financial Offers, both Original as well as Modification, will remain unopened in accordance with ITT Sub Clause 45.1 (e) **Step5:** if so specified in this Tender Document, the envelopes marked "Alternative of Technical Offer (ATO)" shall be opened and read aloud with the corresponding Technical Offer and recorded. 45.6 Ensuring that only the correct (**MTO), (STO), (ATO), (OTO)** envelopes are opened, details of each Technical Offer will be dealt with as follows: (a) the Chairperson of the **TOC** will read aloud each Technical Offer and record in the Technical Offer Opening Sheet (**TOOS):** (i) the name and address of the Tenderer; (ii) state if it is a withdrawn, modified, substituted or original Technical Offer; (iii) any alternatives; (iv) record the rejection of the Tender which

	submitted Technical Offer and Financial Offer together in one envelope. (v) the presence or absence of any requisite Tender Security; and (vi) such other details as the Procuring Entity, at its discretion, may consider appropriate. (b) Only Technical Offer and alternatives read aloud at the Technical Offer Opening will be considered in evaluation. (c) all pages of the original version of the Technical Offer, except for un-amended printed literature, will be initialled by members of the TOC**. Remember, No financial Offer shall be open with Technical Offer** 45.7 Upon completion of Technical Offer opening, all members of the **TOC** and the Tenderers or Tenderer's duly authorised representatives attending the Technical Offer opening shall sign by name, address, designation, the TOS, copies of which shall be issued to the Head of the Procuring Entity or an officer authorised by him or her and also to the members of the TOC and any authorised Consultants and, to the Tenderers immediately. 45.8 The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record under ITT Sub Clause 45.7 45.9 No Tender i.e., Technical or Financial Offer shall be rejected at the Tender opening stage except the **LATE** Tenders as stated in the ITT Clause 40.
46. Evaluation of Tenders	46.1 Technical Offers shall be examined and evaluated only on the basis of the criteria specified in the Tender Document. 46.2 **Tender Evaluation Committee** (**TEC**) shall examine, evaluate and compare Tenders that are responsive to the requirements of Tender Documents in order to identify the successful Tenderer.
47. Evaluation Process	47.1 TEC may consider a Tender Offer as responsive in the Evaluation, only if it is submitted in compliance with the mandatory requirements set out in the Tender Document. The evaluation process should begin immediately after Technical Offer opening following Two steps: (a) Preliminary examination (b) Technical examination and responsiveness
48.Preliminary Examination	48.1 Compliance, adequacy and authenticity of the documentary evidences for meeting the qualification criterion specified in the corresponding section of the Tender document shall have to be preliminarily examined and verified. 48.2 The TEC shall firstly examine the Tenders to confirm that all documentation requested in ITT Clause 24 has been provided. Examination of the compliance, adequacy and authenticity of the documentary evidence may follow the

	order below: (a) verification of the completeness of the eligibility declaration in the Tender Submission Letter (Form PG5A-1), to determine the eligibility of the tenderer as stated under ITT Sub-Clause 24(h). Any alterations to its format, filling in all blank spaces with the information requested, failing which the tender may lead to rejection of the Tender; (b) verification of that the Tenderer is enrolled in the relevant professional or trade organisations as stated under ITT Clause 24(l); (c) verification of the eligibility in terms of legal capacity and fulfilment of taxation obligation by the tenderer in accordance as stated under ITT Sub-Clause 24(i) and 24(k); (d) verification of eligibility that the tenderer is not insolvent, in receivership, bankrupt, not in the process of bankruptcy, not temporarily barred as stated under ITT Sub-Clause 24(j); (e) verification of eligibility of Tenderer's country of origin as stated under ITT Sub-Clause 24(b); (f) verification of the written authorization confirming the signatory of the Tenderer to commit the Tender has been attached with Tender Submission Letter (Form PG5A-1) as stated under ITT Sub-Clause 24(g); in order to check the authenticity of Tender and Tenderer itself ; (g) verification of the Tender Security as stated under ITT Sub-Clause 24(d); and 48.3 The TEC shall confirm that the above documents and information have been provided in the Tender and the completeness of the documents and compliance of instructions given in corresponding ITT Clauses shall be verified, failing which the tender shall be considered rejection of that tender.
49. Technical Evaluation and Responsiveness	49.1 Only those Tenders surviving preliminary examination need to be examined in this phase. 49.2 Secondly, the TEC will examine the adequacy and authenticity of the documentary evidence which may follow the order below: (a) verification of the completeness of the country of origin declaration in the Price Schedule for Plant and Services (Form PG5A-3) as furnished in Section 5: Tender and Contract Forms to determine the eligibility of the Goods and Related Services as stated under ITT Sub Clause 24(m). (b) verification and examination of the documentary evidence and completed Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and

	Contract Forms to establish the conformity of the Goods and Related Services to the Tender Documents as stated under ITT Sub Clause 24(e) and 24(n). (c) verification and examination of the documentary evidence that the Tenderer's qualifications conform to the Tender Documents and the Tenderer meets each of the qualification criterion specified in Sub-Section C, Qualification Criteria as stated under ITT Sub Clause 24(o). (d) verification and examination of the documentary evidence that Tenderer has met all the requirements in regards under Section 6, Employer's Requirements, without any material deviation or reservation. (e) verification and examination of the documentary evidence and completed Specification Submission Sheet **(Form PG5A-4a**) to determine the conformity of the Goods and related services .
	49.3 TEC may consider a Tender as responsive in the evaluation, only if comply with the mandatory requirements as stated under Clause 49.2.
	49.4 The TEC's determination of a Tender's responsiveness is to be based on the documentary evidence as requested in Clause 49.2 without recourse to extrinsic evidence.
	49.5 Information contained in a Tender, that was not requested in the Tender Document shall not be considered in evaluation of the Tender.
	49.6 If a Tender is not responsive to the mandatory requirements set out in the Tender Document it shall be rejected by the TEC and shall not subsequently be made responsive by the Tenderer by correction of the material deviation, reservation.
	49.7 A material deviation or reservation is one- (a) which affects in any substantial way the scope, quality, or performance of the Goods and Related Services and Tenderer's qualifications mentioned in the Tender Document (b) which limits in any substantial way, inconsistent with the Tender Documents, the Purchaser's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would anyway affect unfairly the competitive position of other Tenderers presenting responsive Tenders.
	49.8 During the evaluation of Tender, the following definitions apply: (a) Deviation" is a departure from the requirements specified in the Tender Document;

		(d) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Tender Document;
	49.9	A TEC may regard a Tender as responsive, even if it contains-minor or insignificant deviations, which do not meaningfully alter or depart from the technical specifications, characteristics and commercial terms and conditions or other requirements set out in the Tender Document; errors or oversights, which if corrected, would not alter the key aspects of the Tender.
50. Clarification on Technical Offer	50.1	TEC may ask Tenderers for clarification of their Technical Offers in order to facilitate the examination and evaluation of Technical Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing, and Technical Offers clarifications which may lead to a change in the substance of the Technical Offers or in any of the key elements of the Technical Offers as stated under ITT Sub Clause 49.2, will neither be sought nor be permitted.
	50.2	Any request for clarifications by the TEC shall not be directed towards making an apparently non-responsive Tender responsive and reciprocally the response from the concerned Tenderer shall not be articulated towards any addition, alteration or modification to its Technical Offer.
	50.3	If a Tenderer does not provide clarifications of its Technical Offer by the date and time, its Tender shall not be considered in the evaluation
51. Restrictions on Disclosure of Information	51.1	Following the opening of Technical Offers until issuance of Notification of Award no Tenderer shall, unless requested to provide clarification to its Tender or unless necessary for submission of a complaint, communicate with the concerned Procuring Entity
	51.2	Tenderers shall not seek to influence in anyway, the examination and evaluation of the Tenders
	51.3	Any effort by a Tenderer to influence the Procuring Entity in its decision concerning the evaluation of Tenders, Contract awards may result in the non-responsiveness of its Tender as well as further action in accordance with Section 64 (5) of the Public Procurement Act, 2006.
	51.4	All clarification requests shall remind Tenderers of the need for confidentiality and that any breach of confidentiality on the part of the Tenderer may result in their Tender being non-responsive.
52. Approval of Technical Offer	52.1	TEC shall prepare the Technical Offer Evaluation Report and shall directly submit the Evaluation Report to the Head of the Procuring Entity **(HOPE) or Authorized Officer for approval.**

53. Financial Offer Opening	53.1 After receiving approval of the Technical Offer Evaluation Report, Financial Offer **(Envelope-2)** of only the Responsive Tenderers who have been determined as qualified to the requirements of the Technical Offer, shall be opened publicly, The Date, time and place of Financial Offer Opening shall be communicated to the Responsive Tenderers in writing by issuing a Financial Offer Opening notice not less than **SEVEN DAYS** before the opening.
	53.2 Ensuring that only the correct **MFO, SFO, OFO** envelopes of the Responsive Tenderers shall be opened, in the presence of the Responsive Tenderer's representatives who choose to attend, on the date, time and at the place as notified by the Procuring Entity in accordance with ITT Clause 53.1. Details of each Financial Offer will be dealt with as follows: (a) the Chairperson of the Tender Evaluation Committee will read aloud each Financial Offer and record in the Financial Offer Opening Sheet (**FOOS**): (i) the name and address of the Tenderer; (ii) state if it is a modified, substituted or original Financial Offer; (iii) the Tender Price; (iv) the number of initialled corrections; (v) any discounts; and (vi) any other details as the Procuring Entity, at its discretion, may consider appropriate (b) only the discounts and alternatives read aloud and recorded at the Financial Offer Opening will be considered in Financial Offer Evaluation. No Tenders shall be rejected at the opening of the Financial Offer. (c) all pages of the original version of the Financial Offer, except for un-amended printed literature, will be initialled by members of the Tender Evaluation Committee. (d) The Procuring Entity shall, in writing, notify the Non-responsive Tenderers who have not been determined as qualified to the requirements of the Technical Offer and shall return their Financial Offers (Envelope-02) unopened after signing of the contract.
54. Clarification on Financial Offer	54.1 TEC may ask Tenderers for clarification of their Financial Offers, about the breakdowns of unit rates, in order to facilitate the examination and evaluation of Financial Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing.
	54.2 Changes in the Tender price shall not be sought or permitted, except to confirm the correction of arithmetical errors discovered by the TEC in the evaluation of the

	Tenders, as stated under ITT Sub Clause 55.1.
	54.3 If a Tenderer does not provide clarifications of its Financial Offer by the date and time, its Tender shall not be considered in the evaluation.
	54.4 Requests for clarifications on Financial Offers shall be duly signed only by the TEC Chairperson.
55. Correction of Arithmetical Errors	55.1 The TEC shall correct any arithmetic errors that are discovered during the examination of Tenders, and shall promptly notify the concerned Tenderer(s) of any such correction(s) pursuant to Rule 98(11) of the Public Procurement Rule, 2008. 55.2 Provided that the Tender is responsive, TEC shall correct arithmetical errors on the following basis: (a) If there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected, unless in the opinion of the TEC there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted will govern and the unit price will be corrected; (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the sub-totals shall prevail and the total shall be corrected. 55.3 Any Tenderer that does not accept the correction of the Tender amount following correction of arithmetic errors as determined by the application of ITT Sub-Clause 55.2 shall be considered as non-responsive.
56. Conversion to Single Currency	56.1 For evaluation and comparison purpose, TEC shall convert all Tender prices expressed in the amounts in various currencies into an amount in Bangladeshi Taka currency, using the **selling exchange rates** established by the Bangladesh Bank, on the date of **Tender opening**.
57. Financial Evaluation	57.1 Thirdly the TEC, pursuant to Rule 98 of the Public Procurement Rules, 2008 shall evaluate each Tender that has been determined, up to this stage of the evaluation, to be responsive to the mandatory requirements in the Tender Document..
	57.2 To evaluate a Tender in this stage , the Purchaser shall consider the following (a) Verification and examination of the Price Schedule for Plant and Services (Form PG5-3) as furnished by the Tenderer and checking the compliance with the instructions provided under ITT Clause 26; (b) Evaluation will be done for Items or lot by lot as stated under ITT Clause 26 and the Total Tender

	Price as quoted in accordance with Clause 26; (c) Adjustment for correction of arithmetical errors as stated under ITT Sub-Clause 55.2; (d) Adjustment for price modification offered as stated under ITT Clause 41; (e) Adjustment due to discount as stated under ITT Sub-Clauses 26.11 and 57.3; (f) Adjustment due to the application of economic factors of evaluation as stated under ITT Sub-Clause 57.5 if any; (g) Adjustment due to the assessment of the price of unpriced items as stated under ITT Clause 58 if any;
	57.3 If Tenders are invited for a single lot or for a number of lots as stated under ITT Sub-clauses 26.10, TEC shall evaluate only lots that have included at least the percentage of items per lot. The TEC shall evaluate and compare the Tenders taking into account: (a) Lowest evaluated tender for each lot ; (b) The price discount/reduction per lot; (c) Least cost combination for the Purchaser, considering discounts and the methodology for its application as stated under ITT Sub-clauses 26.10 and 26.11 offered by the Tenderer in its Tender. 57.4 Only those spare parts and tools which are specified as a item in the List of Goods and Related Services in Section 6, Employer's Requirement or adjustment as stated under ITT Sub-clause 54.5, shall be taken into account in the Tender evaluation. Supplier-recommended spare parts for a specified operating requirement as stated under ITT Sub-clause 28.2(b) shall not be considered in Tender evaluation.
	57.5 The Purchaser's evaluation of a tender may require the consideration of other factors, in addition to the Tender Price quoted as stated under ITT Clause 26. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of tenders. The factors, methodologies and criteria to be used shall be as specified in **TDS**. The applicable economic factors, for the purposes of evaluation of Tenders shall be: (a) djustment for Deviations in the Delivery and Completion Schedule. (b) ost of major replacement components, mandatory spare parts, and service.

	57.6	Variations, deviations, and alternatives and other factors which are in excess of the requirements of the Tender Document or otherwise result in unsolicited benefits for the Purchaser will not be taken into account in Tender evaluation.
58. Price Comparison	58.1	The TEC shall compare all responsive Tenders to determine the lowest-evaluated Tender, as stated in ITT 57.2.
	58.2	In the extremely unlikely event that there is a tie for the lowest evaluated price, the Tenderer with the superior past performance with the Purchaser shall be selected, whereby factors such as delivery period, quality of Goods delivered, complaints history and performance indicators could be taken into consideration.
	58.3	In the event that there is a tie for the lowest price and none of the Tenderers has the record of past performance with the Purchaser, then the Tenderer shall be selected, subject to firm confirmation through the Post-qualification process described in ITT Clause 61, after consideration as to whether the quality of Goods that is considered more advantageous by the end-users.
	58.4	The successful Tenderer as stated under ITT Sub Clauses 58.1, 60.2 and 60.3 shall not be selected through lottery under any circumstances.
59. Post-qualification	59.1	After determining the lowest-evaluated responsive tender as sated under ITT Sub-Clause 58.1, the Purchaser's TEC pursuant to Rule 100 of the Public Procurement Rules, 2008, shall carry out the Post-Qualification of the Tenderer, using only the requirements specified in Sub-Section C, Qualification Criteria.
	59.2	The TEC shall contact the references given by Tenderers about their previous Supply experiences to verify, if necessary, statements made by them in their Tender and to obtain the most up-to-date information concerning the Tenderers.
	59.3	The TEC may visit the premises of the Tenderer as a part of the post-qualification process, if practical and appropriate, to verify information contained in its Tender.
	59.4	The TEC shall determine to its satisfaction whether the Tenderer that is selected as having submitted the lowest evaluated responsive Tender is qualified to perform the Contract satisfactorily.
	59.5	The objective of any visit under ITT Sub-Clause 59.3 shall be limited to a general and visual inspection of the Tenderer's facilities and its plant and equipment, and there shall be no discussion concerning the Tender or its evaluation with the Tenderer during such visit(s).

	59.6 In the event that the Tenderer with lowest evaluated cost fails the post-qualification, the TEC shall make a similar determination for the Tenderer offering the next lowest evaluated cost and so on from the remaining responsive Tenders, provided that, (a) such action shall only be taken if the evaluated costs of the Tenders under consideration are acceptable to the Purchaser; (b) when the point is reached whereby the evaluated costs of the remaining responsive Tenders are significantly higher than that of the official estimate, or the market price, the Purchaser may take action pursuant to Rule 33 of the PPR 2008 and may proceed for re-Tendering, using a revised Tender Document designed to achieve a more successful result.
60. Negotiation	60.1 No negotiations shall be held during the financial offer evaluation or award, with the lowest or any other Tenderer. 60.2 The Procuring Entity through the TEC may, however, negotiate with the lowest evaluated Tenderer with the objective to reduce the Contract Price by reducing the scope of works or a reallocation of risks and responsibilities, only when it is found that the lowest evaluated Tender is significantly higher than the official estimated cost; the reasons for such higher price being duly investigated. 60.3 If the Procuring Entity decides to negotiate for reducing the scope of the requirements under ITT Sub Clause 60.2, it will be required to guarantee that the lowest Tenderer remains the lowest Tenderer even after the scope of work has been revised and shall further be ensured that the objective of the Procurement will not be seriously affected through this reduction. 60.4 In the event that the Procuring Entity decides because of a high Tender 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.
61. Rejection of All Tenders	61.1 The Purchaser may, in the circumstances as stated under ITT Sub-Clause 61.2 and pursuant to Rule 33 of the Public Procurement Rules 2008, reject all Tenders following recommendations from the Tender Evaluation Committee only after the approval of such recommendations by the Head of the Purchaser.rejected, if – 61.2 All Tenders can be rejected, if - (a) the price of the lowest evaluated Tender exceeds the official estimate, provided the estimate is realistic; or (b) there is evidence of lack of effective competition; such as non-participation by a number of potential

	Tenderers; or (c) the Tenderers are unable to propose completion of the delivery within the stipulated time in its offer, though the stipulated time is reasonable and realistic; or (d) all Tenders are non-responsive; or (e) evidence of professional misconduct, affecting seriously the Procurement process, is established pursuant to Rule 127 of the Public Procurement Rules, 2008. 61.3 Notwithstanding anything contained in ITT Sub-Clause 61.2 Tenders may not be rejected if the lowest evaluated price is in conformity with the market price. 61.4 A Purchaser may pursuant to Rule 35 of the Public Procurement Rules, 2008, on justifiable grounds, annul the Procurement proceedings prior to the deadline for the submission of Tenders. 61.5 All Tenders received by the Purchaser shall be returned unopened to the Tenderers in the event Procurement proceedings are annulled under ITT Sub-Clause 61.4.
62. Informing Reasons for Rejection	62.1 Notice of the rejection, pursuant to Rule 35 of the Public Procurement Rules, 2008, will be given promptly within **seven (7) days** of decision taken by the Purchaser to all Tenderers and, the Purchaser will, upon receipt of a written request, communicate to any Tenderer the reason(s) for its rejection but is not required to justify those reason(s).
G. Contract Award	
63. Award Criteria	63.1 The Purchaser shall award the Contract to the Tenderer whose offer is responsive to the Tender Document and that has been determined to be the lowest evaluated Tender, provided further that the Tenderer is determined to be Post-Qualified as stated under ITT Clause 59. 63.2 A Tenderer shall not be required, as a condition for award of contract, to undertake obligations not stipulated in the Tender Document, to change its price, or otherwise to modify its Tender.
64. Notification of Award	64.1 Prior to the expiry of the Tender validity period and within **seven (7)** working days of receipt of the approval of the award by the Approving Authority, the Purchaser pursuant to Rule 102 of the Public procurement Rules, 2008, shall issue the Notification of Award (NOA) to the successful Tenderer.
	64.2 The Notification of Award, attaching the contract as per the sample (**Form PG5A-7)** to be signed, shall state: (a) the acceptance of the Tender by the Purchaser; (b) the price at which the contract is awarded; (c) the amount of the Performance Security and its

		format; (d) the date and time within which the Performance Security shall be submitted; and (e) the date and time within which the contract shall be signed.
	64.3	The Notification of Award shall be accepted in writing by the successful Tenderer within **seven (7)** working days from the date of issuance of **NOA.**
	64.4	Until a formal contract is signed, the Notification of Award shall constitute a Contract, which shall become binding upon the furnishing of a Performance Security and the signing of the Contract by both parties.
	64.5	The Notification of Award establishes a Contract between the Purchaser and the successful Tenderer and the existence of a Contract is confirmed through the signature of the Contract Document that includes all agreements between the Purchaser and the successful Tenderer.
65. Performance Security	65.1	The Performance Security shall be determined sufficient to protect the performance of the Contract pursuant to Rule 27 of the Public Procurement Rules, 2008.
	65.2	Performance Security shall be furnished by the successful Tenderer in the amount specified in the **TDS** and **denominated in the currencies** in which the Contract Price is payable pursuant to Rule 102 (8) of the Public Procurement Rules, 2008.
	65.3	The proceeds of the Performance Security shall be payable to the Purchaser unconditionally upon first written demand as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.
66. Form and Time Limit for furnishing of Performance security	66.1	The Performance Security shall be in the form of irrevocable Bank Guarantee in the format (Form PG5A-9) as stated under ITT Clause 65, shall be issued by an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable pursuant to Rule 27(4) of the Public Procurement Rules, 2008..
	66.2	Within twenty-eight (28) days from issue of the Notification of Award, the successful Tenderer shall furnish the Performance Security for the due performance of the Contract in the amount specified under ITT Sub Clause 65.2.
67. Validity of Performance Security	67.1	The Performance Security shall be required to be valid until a date twenty-eight (28) days beyond the date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations.

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

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

Section 2. Tender Data Sheet

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

ITT Clause	Amendments of, and Supplements to, Clauses in the Instruction to Tenderers
A. General	
ITT 1.1	The Purchaser is : **Project Director** **"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)", BREB.** **Office of the Project Director** **Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.** Telephone: **02-8900591** Electronic mail address: **dne100rrkb.reb@gmail.com**
ITT 1.2	The number, identification and name of lots comprising the Tender are: Tender Ref: **27.12.0000.162.27.002.20.974 Date: 23.01.2020**

1	"**Supply, Installation, Testing & Commissioning of 33/11KV (1x10/14 MVA) Sub-Station (Kushtia-5) in Kushtia PBS on Turn-Key Basis."**	
	Package No.	Sub-Package No.
	DNE(W)-SSN-15	**DNE(W)-SSN-15-01**
2	"**Supply, Installation, Testing & Commissioning of 33/11KV (1x10/14 MVA) Sub-Station (Mirpur-3) in Kushtia PBS on Turn-Key Basis."**	
	Package No.	Sub-Package No.
	DNE(W)-SSN-15	**DNE(W)-SSN-15-02**

ITT3.1	The source of public funds is : **GOB**.
ITT3.3	The name of the Development Partner is : **Not Applicable.**
ITT5.1	Tenderers from the following countries are not eligible : **All Countries other than Bangladesh.**
ITT 5.13	Tenderers shall have the following up to date valid License: **None**
ITT6.1	Materials,Equipment and associated services from the following countries are not eligible: **Israel.**
B. Tender Document	
ITT8.2	The following are authorised agents/offices of the Procuring Entity for the purpose of issuing the Tender Document: The Client is : **Project Director** "**Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)",** **Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.** Telephone: : **02-8900591** Electronic mail address: **dne100rrkb.reb@gmail.com**

<table>
<tr><td>ITT9.1</td><td>For <u>clarification of Tender Document purposes</u> only, the Procuring Entity's address is:
Attention: Project Director, "Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)", BREB."
Training Academy Building (7th floor), Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900591
Electronic mail address: dne100rrkb.reb@gmail.com
and contact the Procuring Entity within 13.02.2020, Time: 11:00 A.M (BST)</td></tr>
<tr><td>ITT10.1</td><td>A Pre-Tender meeting shall be held at Address: Office of the Project Director,
DNE 100% (RRKB),Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900904
Time & Date: 11.00 AM (BST) & 13.02.2020,
A site visit conducted by the Employer will not be organized.
Tenderers are advised to conduct site visit at their own responsibility. The Employer may arrange necessary permissions if requested by the Tenderers.
The costs and expenses associated with attending the pre-Tender meeting and/or site visit shall be borne by the Potential Tenderers.</td></tr>
<tr><td colspan="2"><h2>C. Qualification Criteria</h2></td></tr>
<tr><td>ITT 13.1</td><td>The maximum three (03) number of arbitration against the Tenderer over a period of the last Five (05) years.</td></tr>
<tr><td>ITT14.1 (a)</td><td>The minimum number of years of general experience of the Tenderer in the construction works supply of goods and related service as Prime Contractor or Sub-contractor or Management Contractor shall be 5 (five) years.
[years counting backward from the date of publication of IFT in the newspaper]</td></tr>
<tr><td>ITT 14.1(b)</td><td>i) <u>Specific experience</u>:- 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 Indoor Type 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station successfully completed within the last 05 (five) years, each with a value of at least as following:
<table><tr><th>Package No.</th><th>Sub-Package No.</th><th>Amount in Taka</th></tr><tr><td rowspan="2">DNE(W)-SSN-15</td><td>DNE(W)-SSN-15-01</td><td>2,93,00,000.00</td></tr><tr><td>DNE(W)-SSN-15-02</td><td>2,93,00,000.00</td></tr></table>
ii) Joint venture, Consortium or Association (JVCA) may be made by 1(one) supply contractor and 01(one) construction contractor. In that case, the leading partner must have successfully completed at least 01 (one) contract of Indoor Type 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station within the last 5 (five) years each with a value of at least as following:
<table><tr><th>Package No.</th><th>Sub-Package No.</th><th>Amount in Taka</th></tr><tr><td rowspan="2">DNE(W)-SSN-15</td><td>DNE(W)-SSN-15-01</td><td>2,93,00,000.00</td></tr><tr><td>DNE(W)-SSN-15-02</td><td>2,93,00,000.00</td></tr></table></td></tr>
</table>

ITT 15.1(a)

The required average annual turnover shall be greater than Tk. mentioned below over the last **3 (three)** years .

Package No.	Sub-Package No.	Amount in Taka
DNE(W)-SSN-15	DNE(W)-SSN-15-01	9,90,00,000.00
	DNE(W)-SSN-15-02	9,87,00,000.00

ITT 15.1(b)

The minimum amount of liquid assets or working capital or credit facilities of the Tenderer shall be as following:

Package No.	Sub-Package No.	Amount in Taka
DNE(W)-SSN-15	DNE(W)-SSN-15-01	2,82,00,000.00
	DNE(W)-SSN-15-02	2,80,00,000.00

ITT 16.1(a)

A 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.	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 staff mentioned above may required to increase according to the site condition.

ITT 17.1

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

The tendered 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** only.

ITT 18.2

Maximum number of partners in the JV shall be *3(three)*

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

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

D. Tender Preparation	
ITT 19.2	The maximum of percentage of Goods allowed to be subcontracted: **Not Applicable**
ITT 19.4	The Nominated Subcontractor(s) named [insert name(s)] shall execute the following specific components of the proposed Works: **None.**
ITT 20.1	Tenders are being invited for Tender Ref: **27.12.0000.162.27.002.20.974 Date: 23.01.2020.** Package No: **DNE(W)-SSN-15** Sub-Package No. **(1) DNE(W)-SSN-15-01** **(2) DNE(W)-SSN-15-02**
ITT 24.2(r)	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. The required Technical Proposal shall include also 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 Equipment's 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 Equipment's described in BOQ. X. Electrical and Mechanical type test certificates shall be from an independent reputed Testing Laboratory for the Equipment's described in BOQ. XI. ISO 9001/9002 -2008 or equivalent certificates of proposed manufactures for individual Equipment's described in BOQ XII. Design documents as per **Schedule -I** of the Tender Document. XIII. Personnel required for the work. XIV. Equipment's required for the work.
24.3(d)	The Tenderer shall submit with its financial offer the following additional documents: The required reports on the financial standing, such as profit and loss statements and audited balance sheet shall be for the past 5 years.
ITT 25.1	Alternatives will not be permitted.
ITT 26.1	Tenderers shall quote for the entire Plant and Installation Services on a single responsibility basis **or** Tenderers shall quote for the following components or services on a single responsibility basis: (Not applicable). **and/or** The following components or services will be provided under the responsibility of the Employer: (Not applicable).
26.5(a)	Place of Destination: **(1) The place for 33/11 KV sub-station (1X10/14MVA, Turn-Key) at location of Kushtia-5 substation in Kushtia PBS.** **(2) The place for 33/11 KV sub-station (1X10/14MVA, Turn-Key) at location of Mirpur-3 substation in Kushtia PBS.**
26.5(d)	Local transportation to named place of final destination is: **(1) The site for 33/11 KV (1X10/14 MVA, Turn-Key) Kushtia-5 sub-station in Kushtia PBS.**

<table>
<tr><td></td><td>(2) The site for 33/11 KV (1X10/14 MVA, Turn-Key) Mirpur-3 sub-station in Kushtia PBS.</td></tr>
<tr><td>ITT 26.7</td><td>The prices quoted by the Tenderer shall be fixed for the duration of the Contract.</td></tr>
<tr><td>ITT 27.4</td><td>Name of the foreign currency: Not applicable.</td></tr>
<tr><td>ITT 28.1 (b)</td><td>Spare parts are: Required which list is given in Schedule No. 2. of Price Schedule for Plant and Service (Form PG5A-3).</td></tr>
<tr><td>ITT 28.1(b)</td><td>A Manufacturer’s Authorisation Letter is required for the Equipment and Materials which list is given in schedule no. 1 & 2 of Price Schedule for Plant and Service (Form PG5A-3).</td></tr>
<tr><td>ITT 30.2</td><td>The Tender validity period shall be 120 days.</td></tr>
<tr><td>ITT 32.2</td><td>The Amount of the Tender Security Shall be:
<table>
<tr><th>Package No.</th><th>Sub-Package No.</th><th>Amount in Taka</th></tr>
<tr><td rowspan="2">DNE(W)-SSN-15</td><td>DNE(W)-SSN-15-01</td><td>18,40,000.00</td></tr>
<tr><td>DNE(W)-SSN-15-02</td><td>18,35,000.00</td></tr>
</table>
In favour of
Project Director
“Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB.
Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900591.</td></tr>
<tr><td>ITT 37.1</td><td>In addition to the original of the Tender, 2 copies shall be submitted.</td></tr>
<tr><td colspan="2"><h2>E. Submission of Tender</h2></td></tr>
<tr><td>ITT 38.2(e)</td><td>The inner and outer envelopes shall bear the following additional identification marks : “Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB.
Address:
Bangladesh Rural Electrification Board
Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900591

Do not open before 12:30 PM (BST) on 01.03.2020</td></tr>
<tr><td>ITT 38.4(e)</td><td>(a) The inner and outer envelopes shall bear the following additional identification marks : Be addressed to the Employer at the following address:

Attention: Project Director
“Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB

Address: Office of the Project Director
“Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB.
Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900591
Electronic mail address: dne100rrkb.reb@gmail.com</td></tr>
</table>

<table>
<tr><td></td><td>(b) bear the following identification:

Tender Ref: 27.12.0000.162.27.002.20.974, Date: 23.01.2020

<table>
<tr><td rowspan="3">1</td><td colspan="2">Tender for “Supply, Installation, Testing & Commissioning of 33/11KV (1x10/14 MVA) Sub-Station (Kushtia-5) in Kushtia PBS on Turn-Key Basis.”</td></tr>
<tr><td>Package No.</td><td>Sub-Package No.</td></tr>
<tr><td>DNE(W)-SSN-15</td><td>DNE(W)-SSN-15-01</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">Tender for “Supply, Installation, Testing & Commissioning of 33/11KV (1x10/14 MVA) Sub-Station (Mirpur-3) in Kushtia PBS on Turn-Key Basis.”</td></tr>
<tr><td>Package No.</td><td>Sub-Package No.</td></tr>
<tr><td>DNE(W)-SSN-15</td><td>DNE(W)-SSN-15-02</td></tr>
</table>

“DO NOT OPEN BEFORE THE TECHNICAL OFFER EVALUATION AND APPROVAL”.</td></tr>
<tr><td>ITT 39.1</td><td>For <u>Tender submission purposes</u> only, the Procuring Entity’s address is:

Attention: Project Director
“Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB.
Address:
Bangladesh Rural Electrification Board
Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.
Telephone: 02-8900591
Electronic mail address: dne100rrkb.reb@gmail.com

The deadline for submission of Tenders is :

Time & Date:. 01.03.2020 up to 12.00 Noon (BST)</td></tr>
<tr><td>ITT 39.3</td><td>For <u>Tender submission purposes</u> only, the Procuring Entity’s address is:
Attention: Project Director
“Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)”, BREB.
Address (PRIMARY PLACE): Office of the Project Director, DNE 100% (RRKB), Training Academy Building, 7th Floor, BREB, Nikunja-2, Khilkhet, Dhaka-1229, Bangladesh.

The deadline for the submission of Tenders is:

Time & Date: 01.03.2020 up to 12.00 Noon (BST)</td></tr>
<tr><td>ITT 39.4</td><td>The deadline for hand-delivering of the Tenders at the PRIMARY PLACE is: Not Applicable.</td></tr>
<tr><td colspan="2"><h2>F. Opening and Evaluation of Tenders</h2></td></tr>
<tr><td>ITT 45.1</td><td>The technical offer opening shall take place at: Office of the Project Director, DNE 100% (RRKB), Training Academy Building, 7th Floor, BREB, Nikunja-2, Khilkhet, Dhaka-1229, Bangladesh.

Time & Date: 01.03.2020 on 12:30 PM (BST)

The Technical envelope will be opened first. The Financial Proposal will be kept in safe custody of purchaser. Financial Proposal of only technically responsive tender will be opened at date to be notified later to the respective tenderer. The Financial Proposal of the technically non-responsive tenderer will be returned unopened to the respective tenderer.</td></tr>
</table>

ITT 57.5	The applicable economic factors, for the purposes of evaluation of Tenders shall be: (a) **Adjustment for Deviations in the Delivery and Completion Schedule** **"**The Plant and Service covered by this Tendering process are required to be delivered in accordance with, and completed within, the Delivery and Completion Schedule specified in Section 6, Employer's Requirements. No credit will be given for earlier completion. Tender offering late contract performance schedules within acceptable period will be accepted but the tenders shall be Adjusted in the evaluation by adding to the Tender Price at the rate of [**specify percentage**] ofthe Tender Price for each day ofdelay. Tender offering delivery schedules beyond **[specify time Limit]** of the date specified in Section 6, Employer's Requirement, shall be rejected." **[not applicable]** (b) **Cost of major replacement components, mandatory spare parts, and service** *The Procuring Entity will draw up a list of high-usage and high-value items of components and spare parts **[specify (spare parts, tools, major assemblies, estimated quantities]**of usage in the initial period **[specify period]** of operation. The total cost of these items and quantities will be computed from spare parts unit prices submitted by the Tenderer and added to the tender price, for evaluation purposes only.* **[not applicable]** (c) **Other factors affecting the true economic value** *The Procuring Entity will draw up other factors affecting the true economic value of the Tender price may be life span costs, such as cost of fuel, performance or productivity of the equipment, etc.The total cost of these items and quantities will be computed from submitted Tender and added to the tender price, for evaluation purposes only.* **[not applicable]**
G. Award of Contract	
ITT 65.2	The amount of Performance Security shall be 10% percent of the Contract Price.
ITT 72.5	The name and address of the office where complaints to the Purchaser are to be submitted is: Attention: **Project Director** **"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)", BREB.** Address: **Office of the Project Director** **"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)",** **Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2,Khilkhet, Dhaka-1229**. Telephone: **02-8900591** E-mail address: dne100rrkb.reb@gmail.com

Section 3. General Conditions of Contract

A. General

1. Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

	(w) **Force Majeure** means an event or situation beyond the control of the Contractor that is not foreseeable, is unavoidable, and its origins not due to negligence or lack of care on the part of the Contractor; such events may include, but not be limited to, acts of the Government in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes or more as included in GCC Clause 52. (x) **Goods** mean the Contractor's Plant, Equipment, Materials or any of them as appropriate. (y) **GCC** means the General Conditions of Contract. (z) **Government** means the Government of the People's Republic of Bangladesh. (aa) **Guarantee Test(s)**means the test(s) specified in the Employer's Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof. (bb) **Head of the Procuring Entity** means the Secretary of a Ministry or a Division, the Head of a Government Department or Directorate; or the Chief Executive, by whatever designation called, of a local Government agency, an autonomous or semi-autonomous body or a corporation, or a corporate body established under the Companies Act; (cc) **Installation Services** means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require. (dd) **Intended Completion Date** is the date calculated from the Commencement Date as specified in the PC**C**, on which it is intended that the Contractor shall complete the Works and Physical services as specified in the Contract and may be revised only by the Project Manager by issuing an extension of time or an acceleration order. (ee) **Materials** means things of all kinds other than Plant intended to form or forming part of the Permanent Works, including the supply-only materials, if any, to be supplied by the Contractor under the Contract. (ff) **Month** means calendar month. (gg) **Original Contract Price** is the Contract Price stated in the Procuring Entity's Notification of Award (Form PG5A-7) and

	further clearly determined in the **PCC**. (hh) **Operational Acceptance** means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of contract (ii) **PCC** means the Particular Conditions of Contract. (jj) **Plant** means permanent plant, equipment, machinery, apparatus, materials, articles, ancillary buildings/structure and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor), but does not include Contractor's Equipment. (kk) **Pre Commissioning** means the testing, checking and other requirements specified in the Employer's Requirements that are to be carried out by the Contractor in preparation for Commissioning. (ll) **Procuring Entity/Employer/Purchaser** means, as the context so applies, an Entity having administrative and financial powers to undertake procurement of Plant and Physical services using public funds and is as named in the **PCC** who employs the Contractor to carry out the contractual obligations. (mm) **Project Manager** is the person named in the **PCC** or any other competent person appointed by the Procuring Entity and notified to the Contractor who is responsible for supervising the execution and completion of the plant and services and administering the Contract. (nn) **Schedules** means the document(s) entitled schedules, completed by the Contractor and submitted with the Tender Submission Letter, as included in the Contract. Such document may include the data, lists and schedules of rates and/or prices. (oo) **Site** means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the PC**C** as forming part of the Site (pp) **Site Investigation Reports** are those that were included in the Tender Document and are factual and interpretative reports about the surface and subsurface conditions at the Site. (qq) **Specification** means the Specification of the goods/works/related services included in the Contract and any modifications or additions to the specifications made or approved by the Project Manager in accordance with the Contract. (rr) **Start Date** is the date defined in the **PCC** and it is the last date when the Contractor shall commence execution of the

	goods/works/services under the Contract. (ss) **Subcontractor** means a person or corporate body, who has a contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site. (tt) **Time for Completion** means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, in accordance with the relevant provisions of the Contract. (uu) **Variation** means any change to the plant and services directly procured from the original Contractor to cover increases or decreases in quantities, including the introduction of new work items that are either due to change of plans, design or alignment to suit actual field conditions, within the general scope and physical boundaries of the contract. (vv) **Works** means all works associated with the construction, reconstruction, site preparation, demolition, repair, maintenance or renovation of railways, roads, highways, or a building, an infrastructure or structure or an installation or any construction work relating to excavation, installation of equipment and materials, decoration, as well as physical services ancillary to works as detailed in the **PCC**, if the value of those services does not exceed that of the Works themselves. (ww) Writing means communication written by hand or machine duly signed and includes properly authenticated messages by facsimile or electronic mail.
2. Interpretation	2.1 In interpreting the GCC, singular also means plural, male also means female or neuter, and the other way around. Headings in the GCC shall not be deemed part thereof or be taken into consideration in the interpretation or construance of the Contract. Words have their normal meaning under the language of the Contract unless specifically defined.
	2.2 Entire Agreement. The Contract constitutes the entire agreement between the Employer and the Contractor and supersedes all communications, negotiations and agreements (whether written or verbal) of parties with respect thereto made prior to the date of Contract Agreement; except those stated under GCC Sub Clause 6.1(j).
	2.3 Non waiver. (a) Subject to GCC Sub Clause 2.3(b), no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

	(b) Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.
	2.4. Severability If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.
	2.5. Sectional completion If sectional completion is specified in the **PCC**, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).
3. Communications & Notices	3.1 Communications between Parties such as notice, request or consent required or permitted to be given or made by one party to the other pursuant to the Contract shall be in writing to the addresses specified in the **PCC.**
	3.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.
	3.3 A Party may change its address for notice hereunder by giving the other Party notice of such change to the address.
4. Governing Law	4.1 The Contract shall be governed by and interpreted in accordance with the laws of the People's Republic of Bangladesh.
5. Governing Language	5.1 The Contract shall be written in English. All correspondences and documents relating to the Contract may be written in English. Supporting documents and printed literature that are part of the Contract may be in another language, provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the Contract, such translation shall govern.
	5.2 The Contractor shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.
6. Documents Forming the Contract and Priority of Documents	6.1 The following documents forming the Contract shall be interpreted in the following order of priority: (a) the signed Contract Agreement (**Form PG5A-8**); (b) the Notification of Award (**PG5A-7**); (c) the completed Tender and the **Appendix to the Tender**; (d) the Price Schedule for Plant and Services **(PG5A-3);**

	(e) the Particular Conditions of Contract; (f) the General Conditions of Contract; (g) the Technical Specifications; (h) Personnel Information; (i) Equipment Information; (j) the Drawings; and (k) Any other document listed in the PCC forming part of the Contract.
7. Contract Agreement	7.1 The parties shall enter into a Contract Agreement within twenty eight (28) days from the date of issuance of the Notification of Award (NOA). The costs of stamp duties and similar charges, if any, designated by the applicable law in connection with entry into the Contract Agreement, shall be borne by the Employer.
8. Assignment	8.1 Neither the Contractor nor the Employer shall assign, in whole or in part, its obligations under the Contract; except with the Employer's prior written approval.
9. Eligibility	9.1 The Contractor and its Subcontractor(s) shall have the nationality of a country other than that specified in the PCC.
	9.2 All materials, equipment, plant, and supplies used by the Contractor in both permanent and temporary works and services supplied under the Contract shall have their origin in the countries except any specified in the PCC.
10. Gratuities / Agency fees	10.1 No fees, gratuities, rebates, gifts, commissions or other payments, other than those included in the Contract, shall be given or received in connection with the procurement process or in the Contract execution.
11. Confidential Details	11.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor such documents, data, and other information it receives from the Employer to the extent required for the Subcontractor to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Contractor under GCC Clause 11.

	11.2 The Employer shall not use such documents, data, and other information received from the Contractor for any purposes unrelated to the Contract. Similarly, the Contractor shall not use such documents, data, and other information received from the Employer for any purpose other than the design, construction, or other work and services required for the performance of the Contract.
	11.3 The obligations of a party under GCC Sub Clauses 11.1 and 11.2 above, however, shall not apply to information that: the Employer or Contractor needs to share with institutions participating in the financing of the Contract; now or hereafter enters the public domain through no fault of that party; can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party; or otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
	11.4 The above provisions of GCC Clause 11 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Works or any part thereof.
	11.5 The provisions of GCC Clause 11 shall survive completion or termination, for whatever reason.
12. Joint Venture (JV)	12.1 If the Contractor is a Joint Venture, Consortium, or Association (JVCA), (a) each partner of the JV shall be jointly and severally liable for all liabilities and ethical or legal obligations to the Employer for the performance of the Contract; (b) the JV partners shall nominate a representative who shall have the authority to conduct all business including the receipt of payments for and on behalf of all partners of the JV; (c) in the event of a dispute that results in legal action against all partners of the JV, if they are available and if only one partner is available, then that partner alone shall answer on behalf of all partners and, if the complaint lodged is proven, the penalty shall be applicable on that lone partner as whatever penalty all the partners would have received. (d) the JV shall notify the Employer of its composition and legal status which shall not be altered without the prior approval of the Employer. (e) alteration of partners shall only be allowed if any of the partners is found to be incompetent or has any serious difficulties which may impact the overall implementation of the goods/works/service, whereby the incoming partner shall require to possess qualifications equal to or higher than that of the outgoing partner. (f) if any of the partners of JV has been debarred from participating in any procurement activity due to corrupt,

	fraudulent, collusive or coercive practices, that JV partner shall be altered following provisions under GCC Sub Clause 12.1 (d) and (e), while in case the Leading Partner has been debarred due to the same reasons stated herein the Contract shall be terminated as stated under GCC Sub Clause 67.1(b).
13. Possession of the Site	13.1 The Employer shall give possession of the Site or part(s) of the Site, to the Contractor on the date(s) stated in the PCC. If possession of a part of the Site is not given by the date stated in the PCC, the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.
14. Access to the Site	14.1 The Contractor shall allow the Engineer and any person authorised by the Engineer access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.
15. Safety, Security and Protection of the Environment	15.1 The Contractor shall throughout the execution and completion of the Works and the remedying of any defects therein:
	(a) take all reasonable steps to safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state; (b) provide and maintain at the Contractor's own cost all lights, guards, fencing, warning signs and watching for the protection of the Works or for the safety on-site; and (c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.
16. Working Hours	16.1 The Contractor shall not perform any work on the Site on the weekly holidays, or during the night or outside the normal working hours, or on any religious or public holiday, without the prior written approval of the Project Manager.
17. Welfare of Laborers	17.1 The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's personnel relating to their employment, health, safety, welfare, immigration and shall allow them all their legal rights.
	17.2 The Contractor, in particular, shall provide proper accommodation to his or her labourers and arrange proper water supply, conservancy and sanitation arrangements at the site for all necessary hygienic requirements and for the prevention of epidemics in accordance with relevant regulations, rules and orders of the government.
	17.3 The Contractor, further in particular, shall pay reasonable wages to his or her labourers, and pay them in time. In the event of delay in payment the Employer may effect payments to the labourers and recover the cost from the Contractor.
	17.4 The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against

	accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take appropriate protective measures to prevent accidents that could result in injury. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.
18. Child Labor	18.1 The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development in compliance with the applicable laws and other relevant treaties ratified by the government.
19. Fossils& antiquities	19.1 All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.
	19.2 The Contractor shall, upon discovery of any such finding, promptly give notice to the Project Manager, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs cost from complying with the instructions, the Contractor shall give a further notice to the Project Manager and shall be entitled subject to Claims under GCC Clause 71
20.Corrupt, Fraudulent, Collusive or Coercive Practices	20.1 The Government requires that Employer, as well as the Contractor shall observe the highest standard of ethics during the implementation of procurement proceedings and the execution of the Contract.
	20.2 The Government requires that Employer, as well as the Contractor shall, during the Procurement proceedings and the execution of the Contract under public funds, ensure- (a) strict compliance with the provisions of Section 64 of the Public Procurement Act, 2006 (b) abiding by the code of ethics as mentioned in the Rule127 of the Public Procurement Rules, 2008; (c) that neither it, nor any other member of its staff, or any other agents or intermediaries working on its behalf engages in any such practice as detailed in GCC Sub Clause 20.2. 20.3 For the purposes of GCC Sub Clause 20.2, the terms set forth below as follows (a) "**corrupt practice**" means offering, giving or promising to give, receiving, or soliciting either directly or indirectly, to any officer or employee of a Employer or other public or private authority or individual, a gratuity in any form; employment or any other thing or service of value as an inducement with respect to an act or decision or method followed by a Employer in connection with a Procurement proceeding or Contract execution;

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

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

23.Time for Commencement	23.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC** or within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.
24.Time for Completion	24.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC**or within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.
25.Employer's Responsibilities	25.1 All information and/or data to be supplied by the Employer as described in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, shall be deemed to be accurate, except when the Employer expressly states otherwise 25.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix. 25.3 The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer). 25.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain 25.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Pre Commissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, at or before the time specified in the program furnished by the Contractor under the provisions of contract specified or as

	otherwise agreed upon by the Employer and the Contractor. 25.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 39.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 40.2. 25.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 25 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 40.2. 25.8 In the event that the Employer shall be in breach of any of his obligations under this Clause, the additional cost incurred by the Contractor in consequence thereof shall be determined by the Project Manager and added to the Contract Price
26.Contractor's Responsibilities	26.1 The Contractor shall design, manufacture including associated purchases and/or subcontracting, install and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.
	26.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date twenty-eight (28) days prior to tender submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.
	26.3 The Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 25.3 hereof and that are necessary for the performance of the Contract.
27. Employer's and Contractor's Risks	27.1 The Employer carries the risks that the Contract states are Employer's risks and the Contractor carries the risks that the Contract states are Contractor's risks.
28. Employer's Risks	28.1 From the Start Date until the Defects Correction Certificate has been issued, the following are Employer's risks: (a) the risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to i. use or occupation of the Site by the Works or for the

	purpose of the Works, which is the unavoidable result of the Works or ii. negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or Contracted to him except the Contractor. iii. the risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.
	28.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is Employer's risk, except loss or damage due to: (a) a Defect which existed on the Completion Date; (b) an event occurring before the Completion Date, which was not itself Employer's risk; or (c) the activities of the Contractor on the Site after the Completion Date.
29. Contractor's Risks	29.1 From the Start Date until the Defects Correction Certificate has been issued the risks of personal injury, death, and loss of or damage to property including without limitation, the Works, Plant, Materials, and Equipment, which are not Employer's risks are Contractor's risks.
C. Execution of the Facilities	
30. Representatives	31.1 Project Manager If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided. All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided. 30.2 Contractor's Representative & Construction Manager
	30.2.1 If the Contractor's Representative is not named in the

		Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 30.2.1 shall apply thereto.
		30.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract. The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 30.2.1.
		30.2.3 . The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager. Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 30.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.
		30.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as the Construction Manager's deputy.
		30.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 37.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

	30.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 30.2.5, the Contractor shall, where required, promptly appoint a replacement.
31. Work Program	31.1 Contractor's Organization The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.
	31.2 Program of Performance Within twenty-eight (28) days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and Pre Commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix to the Contract Agreement titled Time Schedule, and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion specified in the PCC pursuant to Sub-Clause 24.1 and any extension granted in accordance with GCC Clause 65.1, and shall submit all such revisions to the Project Manager.
	31.3 **Progress Report** The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 31.2 above, and supply a progress report to the Project Manager every month. The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.
	31.4 **Progress of Performance** If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 31.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into

	account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 24.1, any extension thereof entitled under GCC Sub-Clause 65.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor. 31.5 **Procedures** The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements. The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.
32. Subcontractor	32.1 Subcontracting the whole of the Plant and Service by the Contractor shall not be permissible. The Contractor shall be responsible for the acts or defaults of any Subcontractor, his or her agents or employees, as if they were the acts or defaults of the Contractor.
	32.2 The Contractor shall not be required to obtain consent from the Project Manager or his representative, for suppliers solely of Materials or to a subcontract for which the Specialist Subcontractor(s) is already named in the Contract.
	32.3 The prior consent, in writing, of the Engineer shall however be obtained for other proposed Subcontractor(s).
33. Nominated Subcontractor	33.1 Nominated Subcontractor named in the Contract shall be entitled to execute the specific components of the Works stated in the **PCC.** 33.2 The Contractor shall not be under obligations to employ a Nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars while there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength, or does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, or does not accept to enter into a subcontract which specifies that, for the subcontracted work including design, if any, the Nominated Subcontractor shall undertake to the Contractor such obligations and liabilities as will enable the contractor to discharge his or her liabilities under the Contract.
34. Other Contractors	34.1 The Contractor shall cooperate and share the Site with other Contractors, public authorities, utilities, the Engineer and the Employer between the dates given in the Schedule of other Contractors. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of other Contractors, and shall notify the Contractor of any such modification.

35. Design and Engineering	35.1 **Specifications and Drawings** 35.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice. The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer. 35.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager. 35.2 **Codes and Standards** Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of tender submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 64. 35.3. **Approval/Review of Technical Documents by Project Manager**
	35.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix to the Contract Agreement titled List of Documents for Approval or Review, for its approval or review as specified and in accordance with the requirements of GCC Sub-Clause 31.2 (Program of Performance). Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof. GCC Sub-Clauses 35.3.2 through 35.3.6 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only
	35.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 35.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes. If the Project Manager fails to take such

	action within the said fourteen (14) days, then the said document shall be deemed to have been approved by the Project Manager.
	35.3.3. The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice.
	35.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 35.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.
	35.3.5 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.
	35.3.6 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manageran amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 35.3. If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 64 shall apply to such request.
36. Procurement	36.1 **Plant** Subject to GCC Sub-Clause 60.2, the Contractor shall procure and transport all Plant in an expeditious and orderly manner to the Site.
	36.2 **Employer-Supplied Plant** If the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply: **36.2.1** The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the Parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 31.2, unless otherwise mutually agreed. **36.2.2** Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care,

	custody and control of the Contractor. The provision of this GCC Sub-Clause 36.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired. **36.2.3** The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 42 or under any other provision of Contract.
	36.3 **Transportation** **36.3.1** The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances. **36.3.2** Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment. **36.3.3** Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the Parties. **36.3.4** The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.
	36.4 **Customs Clearance** The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub-Clause 60.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 65.
37. Installation	37.1 **Setting Out/Supervision** 37.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench

	marks, reference marks and lines provided to it in writing by or on behalf of the Employer. If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer. 37.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.
	37.2 Labor: 37.2.1 Engagement of Staff and Labor (a) Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding and transport. (b) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills. (c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel. (d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so

	from the Contractor. 37.2.2 Persons in the Service of Employer The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel. 37.2.3 Facilities for Staff and Labor Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works 37.3 **Contractor's Equipment** 37.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract. 37.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon. 37.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract. 37.4 **Site Regulations and Safety** The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld. Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention. reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

37.5 **Site Clearance**

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

37.6 **Opportunities for Other Contractors**

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

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

37.7 **Emergency Work**

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

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

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

37.8 **Watching and Lighting**

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

38. Test & Inspection	38.1	The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.
	38.2	The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
	38.3	38.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third Party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.
	38.4	The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection. If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.
	38.5	38.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impede the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.
	38.6	If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 38.3.
	38.7	If any dispute or difference of opinion shall arise between the Parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the Parties within a reasonable period of time, it may be referred to an 72.2.

	38.8	The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.
	38.9	The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 38.4, shall release the Contractor from any other responsibilities under the Contract.
	38.10	39.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.
	38.11	The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.
	38.12	If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 38.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.
39. Completion of the Facilities	39.1	As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.
	39.2	Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 39.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer for Pre Commissioning of the Facilities or any part thereof. Pursuant to the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Pre Commissioning of the Facilities or any part thereof.

	39.3	As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters have been provided by the Employer in accordance with GCC Sub-Clause 39.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Sub-Clause 40.5.
	39.4	As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or
	39.5	The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Sub-Clause 39.4, or notify the Contractor in writing of any defects and/or deficiencies. If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 39.4.
	39.6	If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's repeated notice.
	39.7	If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.
	39.8	If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 39.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.
	39.9	As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.
	39.10	Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.

40. Commissioning and Operational Acceptance	40.1 **Commissioning** 40.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Sub-Clause 39.5, or immediately after the date of the deemed Completion, under GCC Sub-Clause 39.6. 40.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning. 40.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.
	40.2 **Guarantee Test** 40.2.1 Subject to GCC Sub-Clause 40.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test and any repeats thereof. 40.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion **specified in the PCC** or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 43.2 and 43.3 shall not apply. 40.3 **Operational Acceptance** 40.3.2 At any time after any of the events set out in GCC Sub-Clause 40.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures)in respect of the Facilities or the part thereof specified in such notice as of the date of such notice. 40.3.3 The Project Manager shall, after consultation with the Employer, and within seven (7) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

	40.3.4 If within seven (7) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.
	40.4 **Partial Acceptance** 40.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities. 40.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate 40.5 **Delayed Pre-commissioning and/or Guarantee Test** 40.5.1 In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Sub-Clause 39.3, or with the Guarantee Test pursuant to Sub-Clause 40.2, for reasons attributable to the Employer either on account of non-availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Contractor's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Sub-Clause 39.6, and Operational Acceptance, pursuant to GCC Sub-Clause 40.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Sub-Clause 42.2, Functional Guarantee, pursuant to GCC Clause 43, and Care of Facilities, pursuant to GCC Clause 48, and GCC Clause 66.1, Suspension, shall not apply. In this case, the following provisions shall apply. 40.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to clauses 58 & 59, the Contractor shall be entitled to the following:

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

		pursuant to GCC Sub-Clause 67.2.2. Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 65. The Contractor shall have no further liability whatsoever to the Employer in respect thereof. However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract. Save for liquidated damages payable under this GCC Sub-Clause 41.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix to the Contract Agreement titled Time Schedule, and/or other program of work prepared pursuant to GCC Sub-Clause 31.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer..
	41.3	If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 65, the Employer shall pay to the Contractor a bonus in the amount **specified in the PCC.** The aggregate amount of such bonus shall in no event exceed the amount **specified as "Maximum" in the PCC.**
42. Defect Liability	42.1	The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant supplied and of the work executed.
	42.2	The Defect Liability Period shall be five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof) or one year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the PCC pursuant to GCC Sub-Clause 42.10. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes: (a) improper operation or maintenance of the Facilities by the Employer; (b) operation of the Facilities outside specifications provided in the Contract; or (c) Normal wear and tear.

	42.3 The Contractor's obligations under this GCC Clause 42 shall not apply to: (a) any materials that are supplied by the Employer under GCC Sub-Clause 36.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein; (b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or (c) Any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub-Clause 42.7.
	42.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.
	42.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 42. The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.
	42.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests. If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.
	42.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.
	42.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of

		any of the aforesaid reasons.
	42.9	Except as provided in GCC Clauses 42 and 49, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, or criminal or willful action of the Contractor.
	42.10	In addition, any such component of the Facilities, and during the period of time as may be **specified in the PCC,** shall be subject to an extended defect liability period. Such obligation of the Contractor shall be in addition to the defect liability period specified under GCC Sub-Clause 42.2.
43. Functional Guarantees	43.1	The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, subject to and upon the conditions therein specified.
	43.2	If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 64.2.2.
	43.3	If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either (a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or (b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix to the Contract Agreement titled Functional Guarantees.
	43.4	The payment of liquidated damages under GCC Sub-Clause 43.3, up to the limitation of liability specified in the Appendix to the Contract Agreement titled Functional Guarantees, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 43.3,

	and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.
44. Patent Indemnity	44.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 44.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country. Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement. 44.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing. 44.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design,

	data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.
45. Limitation of Liability	45.1 Except in cases of criminal negligence or willful misconduct, (a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract, and (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the amount resulting from the application of the multiplier specified in the PCC, to the Contract Price or, if a multiplier is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.
E. Risk Distribution	
46. Transfer of Ownership	46.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant from the country of origin to that country.
	46.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.
	46.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
	46.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.
	46.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.
47. Care of Facilities	47.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 39 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 42. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or

		that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 48.2.
	47.2	If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of
		(a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or (b) any use or occupation by the Employer or any third Party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or (c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed responsibility herein,
	47.3	the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 64. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 64, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 66.1 hereof.
	47.4	The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Sub-Clause 42.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 47.2 (b) and (c).
48. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification	48.1	Subject to GCC Sub-Clause 48.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether

	accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.
	48.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 48.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.
	48.3 If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.
	48.4 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 49, provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.
	48.5 The Party entitled to the benefit of an indemnity under this GCC Clause 48 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.
49. Insurance	49.1 To the extent specified in the Appendix to the Contract Agreement titled Insurance Requirements, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval. (a) Cargo Insurance During Transport Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the

	Contractor's Equipment. (b) Installation All Risks Insurance Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period. (c) Third Party Liability Insurance Covering bodily injury or death suffered by third Parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities. (d) Automobile Liability Insurance Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract. (e) Workers' Compensation In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed. (f) Employer's Liability In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed. (g) Other Insurances Such other insurances as may be specifically agreed upon by the Parties hereto as listed in the Appendix to the Contract Agreement titled Insurance Requirements. 49.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1 except for the Cargo Insurance during Transportation, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. 49.3 The Contractor shall, in accordance with the provisions of the Appendix to the Contract Agreement titled Insurance Requirements, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy. 49.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such

	Subcontractors are covered by the policies taken out by the Contractor. 49.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix to the Contract Agreement titled Insurance Requirements, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insured under all such policies. All insurers' rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Sub-Clause 49.5. 49.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 49.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due to the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 49.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein. 49.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies affected by it pursuant to this GCC Clause 49, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

50. Unforeseen Conditions	50.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing beforehand: (a the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen; (b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions; (c) the extent of the anticipated delay; and (d) the additional cost and expense that the Contractor is likely to incur.) On receiving any notice from the Contractor under this GCC Sub-Clause 50.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken. 50.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price. 50.3 If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1, the Time for Completion shall be extended in accordance with GCC Clause 60.
51. Change in Laws and Regulation	51.1 Unless otherwise specified in the Contract, if after the Contract, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in Bangladesh (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Delivery Date and/or the Contract Price, then such Delivery Date and/or Contract Price shall be

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

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

	Appendix to the Tender may be used. 56.5 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.
57. Terms of Payment	57.1 The Contract Price shall be paid as specified in the Contract Agreement and **in the Appendix to the Contract Agreement titled Terms and Procedures of Payment**, which also outlines the procedures to be followed in making application for and processing payments. 57.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof. 57.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award. 57.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's tender.
58. Advance Payment Security	58.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix to the Contract Agreement titled Terms and Procedures of Payment, and in the same currency or currencies.
	58.2 The security shall be in the form provided in the tender documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.
59. Performance Security	59.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security for the due performance of the Contract in the amount **specified in the PCC.**
	59.2 The performance security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in the form provided in Section 5, Tender and Contract Forms, corresponding to the type of bank guarantee stipulated by the Employer in the PCC, or in another form acceptable to the Employer.

	59.3 Unless otherwise specified in the PCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, five hundred and forty (540) days after Completion of the Facilities or three hundred and sixty five (365) days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 42.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 42.10, is liable for an extended defect liability obligation, the performance security shall be extended for the period specified in the PCC pursuant to GCC Sub-Clause 42.10 and up to the amount specified in the PCC.
	59.4 The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract. The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.
60. Taxes and Duties	60.1 The Contractor shall be entirely responsible for all kinds of taxes, duties, fees, levies, and such other charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.
	60.2 Notwithstanding GCC Sub-Clause 60.1 above, the Employer shall bear and promptly pay (a) all customs and import duties for the Plant specified in Price Schedule No. 1; and (b) other domestic taxes such as, sales tax and value added tax (VAT) on the Plant specified in Price Schedules No. 1 and No. 2 and that is to be incorporated into the Facilities, and on the finished goods, imposed by the law of the country where the Site is located.
	60.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
61. Payments to Nominated Subcontractor(s)	61.1 The Contractor shall pay to the Nominated Subcontractor(s) the amounts shown on the Nominated Subcontractor's invoices approved by the Contractor in accordance with the subcontract included under the Contract.

62. Price Adjustment	62.1 Where the Contract Period (excluding the Defects Liability Period) exceeds eighteen (18) months, it is normal procedure that prices payable to the Contractor shall be subject to adjustment during the performance of the Contract to reflect changes occurring in the cost of labour and material components. In such cases the tender documents shall include in the Appendix 2, a formula of such price adjustment. 62.2 Where Contracts are of a shorter duration than eighteen (18) months or in cases where there is to be no Price Adjustment, the following provision shall not be included. Instead, it shall be indicated under this Appendix 2 that the prices are to remain firm and fixed for the duration of the Contract. 62.3 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.
63. Liquidated Damages	63.1 The Contractor shall be liable to pay Liquidated Damages or in other words the Delay Damages to the Employer at the rate per day as specified in the PCC for each day of delay from the Intended Completion Date, for the uncompleted delivery of goods/works/services or for any part thereof. 63.2 The total amount of Liquidated Damages shall not exceed the amount defined in the PCC. 63.3 Once the cumulative amount of Liquidated Damages reaches ten (**10**) percent of the Contract price, the Employer may rescind the Contract, without prejudice to other courses of action and remedies open to it. 63.4 The amount of Liquidated Damages may be deducted from any money due or which may become due to the Contractor under the Contract and/or collect such amount of Liquidated Damages from the Retention Money (if any) or other securities posted by the Contractor whichever is convenient to the Employer. In an extreme situation that no such foregoing recourse is available, the contractor be asked to make good the damages from his own finances in writing failing which necessary action as per the provisions of this GCC or PCC be taken. 63.5 Payment of Liquidated Damages by the Contractor shall not relieve the Contractor from its obligations. 63.6 If the Intended Completion Date is extended after Liquidated Damages have been paid, the Engineer shall correct any overpayment of Liquidated Damages by the Contractor by adjusting the next payment certificate.
G. Change in Contract Elements	
64. Change in the Facilities	64.1 **Introducing a Change** 64.1.1 Subject to GCC Sub-Clauses 64.2.5 and 64.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change,

	modification, addition or deletion to, in or from the Facilities hereinafter called "Change", provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract 64.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer with a copy to the Project Manager, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities.
	64.1.3 Notwithstanding GCC Sub-Clauses 64.1.1 and 64.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion. 64.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 64.2 and 64.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures). 64.2 **Changes Originating from Employer** 64.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 64.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following: (a) brief description of the Change (b) effect on the Time for Completion (c) estimated cost of the Change (d) effect on Functional Guarantees (if any) (e) effect on the Facilities (f) effect on any other provisions of the Contract. 64.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Project Manager an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal. Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following: (a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal (b) advise the Contractor of any part of its Estimate for Change

	Proposal that is unacceptable and request the Contractor to review its estimate (c) advise the Contractor that the Employer does not intend to proceed with the Change. 64.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 64.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 64.2.1.
	64.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change
	.64.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 64 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof. The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.
	64.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order. If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision. If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 64.2.2. 64.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal,

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

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

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

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

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

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

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

Section 4. Particular Conditions of Contract

Instructions for completing the Particular Conditions of Contract are provided in italics in parenthesis for the relevant GCC Clauses.	
GCC Clause	**Amendments of, and Supplements to, Clauses in the General Conditions of Contract**
GCC 1.1(j)	The Contractor is Name : Address : Name of authorized representative :
GCC 1.1(ll)	The Procuring Entity is: **Project Director** **"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)",** **Training Academy Building, 7th floor, Bangladesh Rural Electrification Board, Nikunja-2, Khilkhet, Dhaka-1229.** Telephone: **02-8900591** Electronic mail address: dne100rrkb.reb@gmail.com
GCC 1.1(oo)	The site is located at : **(1) Kushtia in Kushtia PBS for Sub-Package No.: DNE(W)-SSN-15-01** **(2) Mirpur in Kushtia PBS for Sub-Package No.: DNE(W)-SSN-15-02**
GCC 3.1	The Procuring Entity's address for the purpose of communications under this contract is : Contact person: : **Project Director,** **"Distribution Network Expansion for 100% Rural Electrification (Rajshahi, Rangpur, Khulna & Barisal Divisions)", BREB.** Address: : **Bangladesh Rural Electrification Board** **Training Academy Building (7th floor),** **Nikunja-2, Khilkhet, Dhaka-1229, Bangladesh.** Telephone**: 02-8900591** e-mail address: **dne100rrkb.reb@gmail.com**
	The Contractor's address for the purpose of communications under this contract is : Contact person: Address: Tel: Fax: e-mail address:
GCC6.1 (k)	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 9.1	A contractor or a Sub-contractor/JVC that is a national of, or register 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	Possession of the Site or part(s) of the Site, to the Contractor shall be given on the following date(s); **Shall be from the date of signing of the contract.**
GCC 22.3	The Contractor shall have to supply the required parts if employer desires for a period of ----- years. **Sample Addition to** PCC**22.3** The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the Plant. Other spare parts and components shall be supplied as promptly as possible, but at the most within six (6) months of placing the order and opening the letter of credit. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with sufficient time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will furnish to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested. **[Not Applicable]**
GCC 23.1	Commencement Date shall be **from the date of signing of the contract**.
GCC 24.1	The time for completion of the whole of the facilities within **12(Twelve) Months from the effective date as described in the contract agreement.**
GCC 32.1	A Subcontractor that is a national of, or registered in, the following countries are not eligible: Israel.
GCC 33.1	Nominated Subcontractor(s) named below: (Not Applicable)
GCC 38.2	i) **The pre–shipment inspection** and testing of the materials shall be carried out by BREB at the supplier's factory/show room/warehouse at contractor/supplier's own cost. Shipment clearance will be given after satisfactory completion of pre-shipment inspection of the materials. ii) The Supplier shall notify the purchaser at least **Four (4) weeks** in advance of the date or dates when the products and /or components will be ready for inspection. Such date must be fixed **at least 15 (fifteen) days** prior to the due delivery date. iii) In case the purchaser or its representative does not get the product ready for inspection on the specified date as per inspection notice of the tenderer, the fee for any further visit /visits will be borne by the contractor, in addition to liquidated damage applicable as per terms & conditions of the schedule. iv) Any factory/warehouse inspection prior to delivery or final inspection at the destination of delivery shall not relieve the supplier from full responsibility for furnishing material and / or equipment conforming to the technical specifications contained herein, nor prejudice any claim, right or privilege which the purchaser may have under the warranty furnished by the manufacturer/contractor in accordance with the Tender Document.

GCC 40.2.2	The Guarantee Test of the Facilities shall be successfully completed within 15 days from the date of Completion.
GCC 41.3	Applicable *(amount or rate)* for the bonus for early Completion: USD/GBP/EU R/JPY *delete not appropriate* ***[insert amount]*** *and/or* BDT *delete if not appropriate* – Maximum bonus:(Not Applicable) Or, **No bonus will be given for earlier Completion of the Facilities or part thereof but will give appreciation letter.**
GCC 42.2	The Defects Liability Period is **12 (Twelve) months from the date of operational acceptance of the works.**
GCC 42.3	The contractor shall submit the updated programme within 30 days in case of delaying in submission updated programme the employer may impose penalty or the amount to be withheld as justified.
GCC 45.1 (b)	The multiplier of the Contract Price is: USD/GBP/EU R/JPY *delete not appropriate* ***[insert amount]*** *and/or* BDT *delete if not appropriate* – (Not Applicable)
GCC 56.2	The Contract Price shall be adjusted in accordance with the provisions of the Appendix to the Contract Agreement titled Adjustment Clause ;(Not Applicable)
GCC 59.1	The amount of performance security, as a percentage of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided, shall be **10% of the contract price.**
GCC 59.3	The performance security shall not be reduced before the date of the Operational Acceptance.
GCC 62.1	The Contract is not subject to price adjustment.
GCC 63.1	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 63.2	The maximum amount of Liquidated Damages for the incompleted Works or any part thereof is **10%(ten) percent of the final Contract Price of the whole of the Works.**
GCC 72.3	The arbitration shall be conducted in accordance with the Arbitration Act (Act No. 1 of 2001) of Bangladesh as at present in force.

Appendix to the Tender

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

Table 1.1: Price Adjustment Data

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

Index Descriptions	Base Value	Sources of Index

Note:

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

Table 1.2: Price Adjustment Data

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

Item Group	Bill No. if applicable	Index Descriptions	Coefficients or Weightings for non-adjustable Cost Component	Coefficients or Weightings for adjustable Cost Components										Total
				a	b	c	d	e	f	g	h	i	j	
														1
														1
														1
														1
														1
														1

Note:

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

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

Appendix 1 - Terms and Procedures of Payment
Appendix 2 - Price Adjustment
Appendix 3 - Insurance Requirements
Appendix 4 - Time Schedule
Appendix 5 - List of Major Items of Plant and services and List of Approved Subcontractors
Appendix 6 - Scope of Works and Supply by the Employer
Appendix 7 - List of Documents for Approval or Review
Appendix 8 - Functional Guarantees

Appendix 1. Terms and Procedures of Payment

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

(A) Terms of Payment

Schedule No. 1 - Plant and Equipment/materials Supplied from within the Employer's Country/Abroad for GOB fund.

In respect of plant and equipment/materials supplied from within the Employer's country/abroad, the following payments shall be made:

(1) Ninety percent (90%) of the total or pro rata CIP amount shall be payable as successful Post landing inspection reports and delivery to the respective site after PSI/Pre-Delivery Inspection within forty-five (45) days after receipt .

(2) Five percent (05%) of the total or pro rata CIP amount upon issue of the Completion Certificate, within forty-five (45) days after receipt of invoice.

(3) Five percent (05%) of the total or pro rata CIP amount upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.

Schedule No. 2 - Installation and other Services

In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

(1) Ninety percent (90%) of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly within forty-five (45) days after receipt of invoice.

(2) Five percent (5%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Completion Certificate, within forty-five (45) days after receipt of invoice.

(3) Five percent (5%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's amount upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.

Schedule No. 3 - Design Services

In respect of design services for both the foreign currency and the local currency portions, the following payments shall be made:

(1) Ninety percent (90%) of the total or pro rata design services amount upon acceptance of design in accordance with GCC Clause 35 by the Project Manager /Committee within forty-five (45) days after receipt of invoice.

(2)Ten percent (10%) of the total or pro rata design services amount upon issue of the Completion Certificate with as-built design and drawing, within forty-five (45) days after receipt of invoice.

.

(B) Payment Procedures

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

(1) All costs in connection with invoice and document within Bangladesh/Employer's country shall borne by the Employer and outside of the Bangladesh/Employer's country shall be borne by the Contractor but Contractor shall be paid as per quoted price by the employer.

(2) Cost of contract Price will be paid by the Employer's designated Bank.

(3) The retention money shall be deducted @ ten(10) percent from the successful Tenderer's payable invoices during contract implementation, if awarded the contract.(i.e. retention money shall be deducted@ 10% from each Billing amount.)

(4) 10% money shall be retained for defect liability period either from retention money or from PG , it might be from both sources as per decision of employer's decision.

Appendix 2. Price Adjustment: (Not Applicable)

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

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

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

Example:

P= A + a (Lm/Lo)+ b (Blm/Blo)+ c (CEm/CEo)+ d (RSm/RSo)+ e (STm/STo)+ f (BRm/BRo)+g (Mlm/Mlo) + h (FUm/FUo)+ etc

where;

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

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

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

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

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

[deleteas appropriate]

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

The following conditions shall apply:

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

(c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

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

Appendix 3. Insurance Requirements

(Note: This form is recommended for application in a contract after consultation with the Scheduled Insurance Companies. A different structure/ method can be applied after approval of competent authority, but should be incorporated in the Tender documents to be sold/ issued to the prospective tenderers).

Details are to be completed by the Employer prior to issuing the tedner documents. In the event that the Employer provides any insurances under the Contract, appropriate details must also be given.

Insurances To Be Taken Out By The Contractor

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

(a) Cargo Insurance

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

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

(b) Installation All Risks Insurance

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

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

(c) Third Party Liability Insurance

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

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

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

(e) Workers' Compensation
In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability
In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurances
The Contractor is also required to take out and maintain at its own cost the following insurances:

Details:

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

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause49.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Insurances to be Taken Out By The Employer

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

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

Details:

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

Appendix 4. Time Schedule

The time for completion of whole facilities shall be as specified in the PCC against sub-clause GCC-24 of section-4.

Appendix 5. List of Major Items of Plant and Services and List of Approved Subcontractors

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

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

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

Major Items of Plant and Services	Approved Subcontractors/Manufacturers	Nationality

Appendix 6. Scope of Works and Supply by the Employer

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

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

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

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

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

Personnel	**Charge to Contractor (if any)**

Facilities	**Charge to Contractor (if any)**

Works	**Charge to Contractor (if any)**

Supplies	**Charge to Contractor (if any)**

Appendix 7. List of Documents for Approval or Review

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

(A) Approval

1.

2.

3.

(B) Review

1.

2.

3.

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

(a) the functional guarantees referred to in GCC Clause43 (Functional Guarantees)

(b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below

(c) the minimum level of the functional guarantees

(d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

2. Preconditions

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

3. Functional Guarantees

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

3.1 Production Capacity *[List here the production capacity that the Contractor is to guarantee, making sure to use, as functional guarantees, the figures offered by the Contractor in its tender]*

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

4. Failure in Guarantees and Liquidated Damages

4.1 Failure to Attain Guaranteed Production Capacity

If the production capacity of the facilities attained in the guarantee test, pursuant to GCC Sub-Clause40.2, is less than the guaranteed figure specified in para. 3.1 above, but the actual production capacity attained in the guarantee test is not less than the minimum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities, pursuant to GCC Sub-Clause 43.3, then the Contractor shall pay liquidated damages at the rate of *[amount in the contract currency]*.for every complete one percent (1%) of the deficiency in the production capacity of the Facilities, or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete one percent (1%).

4.2 Raw Materials and Utilities Consumption in Excess of Guaranteed Level

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

If the actual measured figure of specified raw materials and utilities consumed per unit (or their average total cost of consumption) exceeds the guaranteed figure specified in para. 3.2 above (or their specified average total cost of consumption), but the actual consumption attained in the guarantee test, pursuant to GCC Sub-Clause 25.2, is not more than the maximum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities pursuant to GCC Sub-Clause43.3, then the Contractor shall pay liquidated damages at the rate of *[amount in the contract currency]*for every complete one percent (1%) of the excess consumption of the Facilities, or part thereof, of less than a complete one percent (1%).

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

4.3 Minimum Levels

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

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

and/or

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

4.4 Limitation of Liability

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

Section 5. Tender and Contract Forms

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

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

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

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

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

To:	Date:
[Contact Person]	
[Name of Procuring Entity]	
[Address of Procuring Entity]	
Invitation for Tender No:	*[indicate IFT No]*
Tender Package No:	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

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

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

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

(b) a Tender Security is attached in the form of a *[state pay order, bank draft, bank guarantee]* in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;

(c) we have examined and have no reservations to the Tender Document, issued by you on *[insert date];* including Addendum to Tender Document No(s) [*state numbers*] , issued in accordance with the Instructions to Tenderers (ITT Clause 11). *[insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued];*

(d) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;

(e) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3

or

we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1*;*

	Name of Partner	Address of Partner
1		
2		
3		
4		

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

(g) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;

(h) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;

(i) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

(j) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

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

(k) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information (**Form PG5A-2b**);

(l) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;

(m) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;

(n) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;

(o) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 59.

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

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

[ITT Sub Clause 38.3]

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

[and, if applicable]

Attachment 2:

[ITT Sub Clause 29.2(b)]

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

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

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

To: Date:

[Contact Person]

[Name of Procuring Entity]

[Address of Procuring Entity]

Invitation for Tender No: *[indicate IFT No]*

Tender Package No: *[indicate Package No]*

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

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

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

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

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

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

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

b) a Tender Security is attached in the form of a [state pay order, bank draft, bank guarantee] in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;

c) if our Tender is accepted, we commit to furnishing a Performance Security within the time stated under ITT Sub Clause 65.1) and in the form specified in the Tender Data Sheet (ITT Sub Clause 66.1) valid for a period of twenty eight (28) days beyond the date of issue of the Completion Certificate of the Plants and Services;

d) we have examined and have no reservations to the Tender Document, issued by you on [insert date]; including Addendum to Tender Document No(s) [state numbers] , issued in accordance with the Instructions to Tenderers (ITT Clause 11). [insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued];

e) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;

f) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3 or
we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1*;*

	Name of Partner	Address of Partner
1		
2		
3		
4		

g) we are not a Government owned entity as defined in ITT Sub Clause 5.3 or

we are a Government owned entity, and we meet the requirements of ITT Sub Clause 5.3;

(delete one of the above as appropriate)

h) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;

i) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;

j) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

k) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

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

l) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information **(Form PG5A-2b);**

m) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;

n) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;

o) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;

p) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 61

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

*[If there is more than one (1) signatory, or in the case of a JVCA, add other boxes and sign accordingly].***Attachment 1**:
[ITT Sub Clause 38.3]
Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]

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

Tenderer Information (Form PG5A-2a)

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

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

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

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

1.8	Tenderer to attach photocopies of the original documents mentioned aside	[All documents required under ITT Clauses 5 and 29]
The following two information are applicable for National Tenderers		
1.9	Tenderer's Value Added Tax Registration (VAT) Number	
1.10	Tenderer's Tax Identification Number(TIN)	

[The foreign Tenderers, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]

2. Qualification Information of the Tenderer [ITT Clause 29]

2.1 General Experience in Plant and Services of Tenderer

Start Month Year	End Month Year	Years	Contract No and Name of Contract Name and Address of Procuring Entity Brief description of Plant and Services	Role of Tenderer [Contractor/Subcontractor /Management Contractor]

2.2 Specific Experience in Key Activities

Contract No Name of Contract	[insert reference no] of [insert year] [insert name]			
Role in Contract *[tick relevant box].*	Contractor	Subcontractor	Management Contractor	
\Award date Completion date Total Contract Value	[insert date] [insert date] [insert amount]			
Procuring Entity's Name Address Tel / Fax e-mail Brief description with justifications of the similarity compared to the Procuring Entity's requirements	[state justification in support of its similarity compared to the proposed works]			

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

Year	Amount & Currency	*amount in figures*

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

In order to confirm the above statements the Tenderer shall submit , as applicable, the documents mentioned in ITT Sub Clause 14.1(a), (b) and 15.1 (a), (b) & (c)

2.5	Contact Details
	Name, address, and other contact details of Tenderer Bankers and other Procuring Entity(s) that may provide references, if contacted by this Procuring Entity
2.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 16.1]

	Position Name Years of General Experience	Years of Specific Experience

[*Tenderer to complete details of as many personnel as are applicable.Each personnel listed above should complete the Personnel Information (Form PG5A-5*)]

2.7	Major Equipment proposed to carry out the Contract [ITT Sub Clause 17.1]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, less or seller)

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

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

JVCA Partner Information (Form PG5A-2b)

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

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

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

	Year	Matter in dispute	Value of Claim

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

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

	Elements of Activity	Brief description of Activity

3. Qualification Information of the JVCA Partner [ITT Clause 18]

3.1 General Experience in Plant and Services of JVCA Partner

Start Month Year	End Month Year	Years	Contract No and & Name of Contract Name and Address of Procuring Entity Brief description of Works	Role of JVCA Partner [Contractor/Subcontractor/Management Contractor]

3.2 Specific Experience in Key Activities

Contract No Name of Contract	[insert reference no] of [insert year] [insert name]		
Role in Contract [tick relevant box]	Contractor	Subcontractor	Management Contractor
Award date Completion date Total Contract Amount	[insert date] [insert date] [insert amount]		
Procuring Entity's Name Address Tel / Fax	[state justification in support of its similarity compared to the proposed plants and service]		

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

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

Subcontractor Information (Form PG5A-2c)

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

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

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

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

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

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

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

General

1. The Price Schedules are divided into separate Schedules as follows:

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

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

   Schedule No. 3: Design Services

   Schedule No. 4: Installation and Other Services

   Schedule No. 5: Grand Summary

   Schedule No. 6: Recommended Spare Parts

2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Tenderers shall be deemed to have read the Employer's Requirements and other sections of the Tender Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If tenderers are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITT 9.1 prior to submitting their tender.

Pricing

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Tenderer.

   As specified in the Tender Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.

5. Tender prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Tenderers in the Tender Document.

   For each item, tenderers shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

   Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Tender Document.

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.

7. When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Section:5 Price schedule of Rates & Prices (Form-PG5A-3)

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF NEW 33/11 KV 1X10/14 MVA INDOOR SUB-STATION UNDER DISTRIBUTION NETWORK EXPANSION FOR 100% RURAL ELECTRIFICATION (RAJSHAHI, RANGPUR, KHULNA & BARISAL DIVISIONS) PROJECT, BREB.

Total No. of Sub-Station: 01 No. (Kushtia-5 in Kushtia PBS).

TENDER PACKAGE NO.:DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-01**

Schedule No. 1: Plant, Mandatry spare parts & Micellaneous

1A. Plant- Sub-station 01 No. (One 33 Kv in only, No out)

Item no.	Description	Unit	Quantity	Unit Rate (Tk)	Total Price (Tk)
1	**2**	**3**	**4**	**5**	**6=4x5**
1A-1	33 kV Vacuum outdoor type circuit breaker (incoming) with current transformer on same structure including Control and Protection panel for the 33 kV outdoor VCB and33/11.55 kV Transformer.	Nos.	2		
1A-2	33 kV 3×1 phase link (Disconnect Switch) for circuit breaker.	Sets	2		
1A-3	Station transformer 33/0.415 kV, 100 kVA with fused isolator and fused by-pass switch.	Set	1		
1A-4	33 kV PT (3×1 phase, Bus PTs and Feeder PTs).	Set	2		
1A-5	33 kV Line isolator with earth switch, 3 phase (ES).	Set	1		
1A-6	30 kV, 10 kA Station Type Lighting arrestor, 3×1 phase.	Set	2		
1A-7	11 kV switchgear panel 10 nos. for 1×10 MVA (6 feeder breaker, two incoming, one bus riser and one bus coupler) and four sets of 11 kV PTs (two for bus & two for incoming) including necessary CTs.	Set	1		
1A-8	33/11.55 kV, 10/14 MVA ONAN/ONAF Transformer with OLTC (including OLTC panel).	Set	1		
1A-9	10 kV, 10 kA lightning arrester, 3×1 phase.	Set	10		
1A-10	A/C Distribution panel.	Set	1		
1A-11	D/C Distribution panel.	Set	1		
1A-12	Battery and battery charger.	Set	1		
1A-13	Internal feeder cabling, inclusive of all necessary LV control and auxiliary supply cable with necessary termination and kits.	Set	1		
1A-14	XLPE Power Cable 1 core 500 mm2 size Cu conductor (11 kV incoming) with necessary termination and kits (no joint is allowed).	Meter	600		
1A-15	XLPE Power Cable 3 core 185 mm2 size Cu conductor (11 kV Outgoing) with necessary termination and kits (no joint is allowed).	Meter	720		
1A-16	All supporting hot dip galvanized steel structures including CB structure, LA Structure, landing structure, bus bar structure with proper size of conductor and fittings, overhead surge protection for structures and control building.	Lot	1		
			Sub-Total=		

Note: All item in 1A shall include all accessories and components required for fitting & fixing up to commissioning.

1B. Mandatory Spare Parts: Not required.

1C. Miscellaneous					
Item no.	Description	Unit	Quantity	Unit Rate (Tk)	Total Price (Tk)
1C -1	Furniture for Control Room	Lot	1		
1C -2	Air Conditioning System for Control Room including all accessories/ components required for fitting & fixing upto commissioning.	Nos.	4		
1C -3	Desktop Computer including all accessories/ components.	No.	1		
1C -4	Laptop Computer including all accessories/ components.	Nos.	1		
1C -5	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Set	1		
1C -6	Supply of2000 liter (440 Gallon) over head water tank including all required for fitting & fixing up to Commissioning.	Lot	1		
1C -7	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning.	Lot	1		
				Sub-Total=	
TOTAL (Schedule No. 1.)				**Total=**	

Schedule No. 2. Design Services for Sub-station

TENDER PACKAGE NO.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-01**

Item no.	Description of Item	Unit	Quantity	Unit Rate	Amount
1	2	3	4	5	6=4x5
2A-1	All design drawings and documentation works including 5 (five) sets of AS-built drawings and substations operation and maintenance manual.	Nos.	1		
TOTAL (Schedule No. 2.)					

Schedule No. 3. Installation and Other Services

TENDER PACKAGE NO.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-01**

3.Electrical:					
Item no.	Description of Item	Unit	Quantity	Unit Rate	Amount
1	**2**	**3**	**4**	**5**	**6=4x5**
3A-1	All switchyard electrical installation including (a) supply & installation of Sub-station Earthing System and (b) supply & installation of Sub-station Lighting (as required).	Lot	1		
3A-2	Testing & Commissioning	Lot	1		
				Sub-Total	

3B. Civil & Others

3B-1	Two storied control room building based on three storied foundations including Chilla-Kotha along with the facilities to electricity, water supply, sewerage, etc. as per requirements of the employer. Floor Planning: Ground Floor: Complain Centre, Office Room, Rest Room and Toilet (02 Nos.). 1st Floor: 33 kV & 11 kV Switchgear, Battery Room, Toilet (01 No.). The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.	Lot	1		
3B-2	Switchyard civil [all foundations (including future provisional equipment foundations), ducts/ drainage], fencing and gates.	Lot	1		
3B-3	Installation of all switchyard supporting structures [e.g. CB structure, LA Structure, landing structure, bus bar structure, overhead surge protection structures including control building, all accessories/ components required for fitting & fixing up to commissioning.]	Lot	1		
3B-4	Site Development/Earthworks (including pilling, back filling, construction of internal roads (as required), beatification (e.g. gardening), construction of approach road, RCC Pipe Culvert (if required) and all other related works).	Lot	1		
3B-5	Construction of RCC Retaining wall with Boundary wall along the property line including main gate and guard room.	Lot	1		
3B-6	Substation yard surface finishing should be with 1" – 1.25" washed stone gravelling of 4" depth.	Lot (LS)	1		
3B-7	Installation of Air Conditioning System for Control Roomall accessories/ components required for fitting & fixing up to commissioning.	Lot	1		
3B-8	Installation, testing & commissioning of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Lot	1		
3B-9	Installation of 2000 liter (440 Gallon) over head water tank including all pipe connection complete as required/as per direction of the Engineer in charge.	Lot	1		
3B-10	Installation of Fire Detection & Protection Facilities for control room building including all Balancing, Testing & Commissioning.	Lot	1		
				Sub-Total	

3C. Technical (O & M) Training Services

3C-1	Technical Training for 7 days for 2 Nos. BREB/PBS Personnel for each S/S on operation, maintenance, protection & control of 33/11 kV S/S .	Lot	1		
	Sub-Total (Schedule No. 3) =				

Summary:

Sl. No.	Description of Item	Amount (Tk)
1	Total Schedule No. 1. Plant, and Mandatory Spare Parts.	
2	Total Schedule No. 2. Design Services	
3	Total Schedule No. 3. Installation and Other Services	
	GRAND TOTAL=	

Note:
1. All costs shall include Design, Factory inspection/material test, Manufacture/Supply, Transportation to site including Insurance, VAT & all other Taxes (as applicable in the Employer's country).

Section:5 Price schedule of Rates & Prices (Form-PG5A-3)

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF NEW 33/11 KV 1X10/14 MVA INDOOR SUB-STATION UNDER DISTRIBUTION NETWORK EXPANSION FOR 100% RURAL ELECTRIFICATION (RAJSHAHI, RANGPUR, KHULNA & BARISAL DIVISIONS) PROJECT, BREB.

Total No. of Sub-Station: 01 No. (Mirpur-3 in Kushtia PBS).

TENDER PACKAGE NO.:DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-02**

Schedule No. 1: Plant, Mandatry spare parts & Micellaneous

1A. Plant- Sub-station 01 No. (One 33 Kv in only, No out)

Item no.	Description	Unit	Quantity	Unit Rate (Tk)	Total Price (Tk)
1	2	3	4	5	6=4x5
1A-1	33 kV Vacuum outdoor type circuit breaker (incoming) with current transformer on same structure including Control and Protection panel for the 33 kV outdoor VCB and33/11.55 kV Transformer.	Nos.	2		
1A-2	33 kV 3×1 phase link (Disconnect Switch) for circuit breaker.	Sets	2		
1A-3	Station transformer 33/0.415 kV, 100 kVA with fused isolator and fused by-pass switch.	Set	1		
1A-4	33 kV PT (3×1 phase, Bus PTs and Feeder PTs).	Set	2		
1A-5	33 kV Line isolator with earth switch, 3 phase (ES).	Set	1		
1A-6	30 kV, 10 kA Station Type Lighting arrestor, 3×1 phase.	Set	2		
1A-7	11 kV switchgear panel 10 nos. for 1×10 MVA (6 feeder breaker, two incoming, one bus riser and one bus coupler) and four sets of 11 kV PTs (two for bus & two for incoming) including necessary CTs.	Set	1		
1A-8	33/11.55 kV, 10/14 MVA ONAN/ONAF Transformer with OLTC (including OLTC panel).	Set	1		
1A-9	10 kV, 10 kA lightning arrester, 3×1 phase.	Set	10		
1A-10	A/C Distribution panel.	Set	1		
1A-11	D/C Distribution panel.	Set	1		
1A-12	Battery and battery charger.	Set	1		
1A-13	Internal feeder cabling, inclusive of all necessary LV control and auxiliary supply cable with necessary termination and kits.	Set	1		
1A-14	XLPE Power Cable 1 core 500 mm2 size Cu conductor (11 kV incoming) with necessary termination and kits (no joint is allowed).	Meter	600		
1A-15	XLPE Power Cable 3 core 185 mm2 size Cu conductor (11 kV Outgoing) with necessary termination and kits (no joint is allowed).	Meter	720		
1A-16	All supporting hot dip galvanized steel structures including CB structure, LA Structure, landing structure, bus bar structure with proper size of conductor and fittings, overhead surge protection for structures and control building.	Lot	1		

Sub-Total=

Note: All item in 1A shall include all accessories and components required for fitting & fixing up to commissioning.

1B. Mandatory Spare Parts: Not required.

1C. Miscellaneous

Item no.	Description	Unit	Quantity	Unit Rate (Tk)	Total Price (Tk)
1C -1	Furniture for Control Room	Lot	1		
1C -2	Air Conditioning System for Control Room including all accessories/ components required for fitting & fixing upto commissioning.	Nos.	4		
1C -3	Desktop Computer including all accessories/ components.	No.	1		
1C -4	Laptop Computer including all accessories/ components.	Nos.	1		
1C -5	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Set	1		
1C -6	Supply of2000 liter (440 Gallon) over head water tank including all required for fitting & fixing up to Commissioning.	Lot	1		
1C -7	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning.	Lot	1		
				Sub-Total=	
TOTAL (Schedule No. 1.)				**Total=**	

Schedule No. 2. Design Services for Sub-station

TENDER PACKAGE NO.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-02**

Item no.	Description of Item	Unit	Quantity	Unit Rate	Amount
1	2	3	4	5	6=4x5
2A-1	All design drawings and documentation works including 5 (five) sets of AS-built drawings and substations operation and maintenance manual.	Nos.	1		
TOTAL (Schedule No. 2**.)**					

Schedule No. 3. Installation and Other Services

TENDER PACKAGE NO.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-02**

3.Electrical:

Item no.	Description of Item	Unit	Quantity	Unit Rate	Amount
1	**2**	**3**	**4**	**5**	**6=4x5**
3A-1	All switchyard electrical installation including (a) supply & installation of Sub-station Earthing System and (b) supply & installation of Sub-station Lighting (as required).	Lot	1		
3A-2	Testing & Commissioning	Lot	1		
				Sub-Total	

3B. Civil & Others

3B-1	Two storied control room building based on three storied foundations including Chilla-Kotha along with the facilities to electricity, water supply, sewerage, etc. as per requirements of the employer. Floor Planning: Ground Floor: Complain Centre, Office Room, Rest Room and Toilet (02 Nos.). 1st Floor: 33 kV & 11 kV Switchgear, Battery Room, Toilet (01 No.). The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.	Lot	1		
3B-2	Switchyard civil [all foundations (including future provisional equipment foundations), ducts/ drainage], fencing and gates.	Lot	1		
3B-3	Installation of all switchyard supporting structures [e.g. CB structure, LA Structure, landing structure, bus bar structure, overhead surge protection structures including control building, all accessories/ components required for fitting & fixing up to commissioning.]	Lot	1		
3B-4	Site Development/Earthworks (including pilling, back filling, construction of internal roads (as required), beatification (e.g. gardening), construction of approach road, RCC Pipe Culvert (if required) and all other related works).	Lot	1		
3B-5	Construction of RCC Retaining wall with Boundary wall along the property line including main gate and guard room.	Lot	1		
3B-6	Substation yard surface finishing should be with 1" – 1.25" washed stone gravelling of 4" depth.	Lot (LS)	1		
3B-7	Installation of Air Conditioning System for Control Roomall accessories/ components required for fitting & fixing up to commissioning.	Lot	1		
3B-8	Installation, testing & commissioning of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Lot	1		
3B-9	Installation of 2000 liter (440 Gallon) over head water tank including all pipe connection complete as required/as per direction of the Engineer in charge.	Lot	1		
3B-10	Installation of Fire Detection & Protection Facilities for control room building including all Balancing, Testing & Commissioning.	Lot	1		
				Sub-Total	

3C. Technical (O & M) Training Services

3C-1	Technical Training for 7 days for 2 Nos. BREB/PBS Personnel for each S/S on operation, maintenance, protection & control of 33/11 kV S/S .	Lot	1		

Sub-Total (Schedule No. 3) =

Summary:		
Sl. No.	Description of Item	Amount (Tk)
1	Total Schedule No. 1. Plant, and Mandatory Spare Parts.	
2	Total Schedule No. 2. Design Services	
3	Total Schedule No. 3. Installation and Other Services	
	GRAND TOTAL=	

Note:
1. All costs shall include Design, Factory inspection/material test, Manufacture/Supply, Transportation to site including Insurance, VAT & all other Taxes (as applicable in the Employer's country).

Schedule No. 2 - Recommended Spare Parts

Item	Description	Qty	Unit Price		Total Price	
			EXW Local Parts Local Currency	CIP Imported Parts Foreign Currency	Local Currency Portion	Foreign Currency Portion
1	2	3	4	5	6 = 3 x 4	7 = 3 x 5
	TOTAL					

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

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

Technical Proposal (Form PG5A-4)

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

Site Organization

Method Statement

Mobilization Structure

Construction Structure

Plant

Safety Plan

Personnel

Equipment

Proposed subcontractors for Major Items of Plant and Services

Time Schedule

Site Organization

[insert technical proposal for site organization]

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

Method Statement

[insert technical proposal for Method Statement]

[The Tenderer shall furnish an overall description covering all activities and processes from inception to site works and commissioning.
In particular methods of minimizing the impact on the environment in accordance with the relevant laws and regulations during the construction phase shall be described.]

Mobilization Schedule

[insert technical proposal for Mobilization Schedule]

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

Construction Schedule

[insert technical proposal for Construction Schedule]

[This shall be included in the overall time schedule to be provided by the Tenderer as per "Time Schedule" in Section5. Tendering Forms]

Plant

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

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

Safety Plan

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

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

Personnel Information

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

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

A.	**Proposed Position** (tick the relevant box)		
B.	**Personal Data**		
Name			
Date of Birth			
Years overall experience			
Years of specific experience			
National ID Number			
Years of employment with the Tenderer			
B. Professional Qualifications: 1. 2.			
C.	**Present Employment** *[to be completed only if not employed by the Tenderer]*		
Name of Procuring Entity:			
Address of Procuring Entity:			
Present Job Title:			
Years with present Procuring Entity:			
Tel No:	Fax No:	e-mail address:	
Contact *[manager/personnel officer]:*			

D.	**Professional Experience**		
Summarise professional experience over the last twenty years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.			
	From	To	Company / Project / Position / Relevant technical and management experience.
1			
2			
3			

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

Equipment Information

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

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

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

Omit the following information for equipment owned by the Tenderer.

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

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

Proposed Subcontractors for Major Items of Plant and Installation Services

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

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

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

Form Functional Guarantee

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

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

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

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

Invitation for Tender No: Date:
Tender Package No: Package Description: *[enter description as specified in Section 6]*
Tender Lot No: Lot Description: *[enter description as specified in Section 6]*

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

[The Tenderer should complete all the columns as required]

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

Manufacturer's Authorisation Letter (Form PG5A - 5)

[The Tenderer shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. Thisletter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Tenderer shall include it in its tender, if so indicated in the ***TDS as stated under ITT Sub-Clause29.1(b)****]*

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

WHEREAS

We *[insert complete name of Manufacturer],*

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

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

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

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

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*
Address: *[insert full address including Fax and e-mail]*
Title: *[insert title]*

Date: *[insert date of signing]*

Bank Guarantee for Tender Security (Form PG5A– 6)

[this is the format for the Tender Security to be issued by a scheduled bank of Bangladesh as stated under ITT Clauses32 and 33]

Invitation for Tender No: Date:

Tender Package No:

Tender Lot No:
To:
[Name and address of Employer]

TENDER GUARANTEE No:

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

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

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

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

This guarantee will expire:

(a) if the Tenderer is the successful Tenderer, upon our receipt of a copies of the contract signed by the Tenderer and the Performance Security issued to you in accordance with the ITT; or

(b) if the Tenderer is not the successful Tenderer,twenty eight (28) days after the expiration of the Tenderer's Tender validity period, being [*date of expiration of the Tender validity plus twenty eight(28) days]*

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

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

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

Invitation for Tender No: Date:

Tender Package No:

Lot No (*when applicable*)
To:

[*Name and address of the Procuring Entity*]

CREDIT COMMITTMENT No: [insert number]

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

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

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

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

Signature Signature

Notification of Award (Form PG5A - 7)

Contract No: Date:
To:

[Name of Contractor]

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

You are thus requested to take following actions:

i. accept in writing the Notification of Award within seven (7) working days of its issuance pursuant to ITT Sub-Clause 64.1

ii. furnish a Performance Security in the specified format and in the amount of Tk.*[state amount in figures and words]* ,within Twenty-eight (28) days from issue of this Notification of Award but not later than *(specify date),* in accordance with ITT Clause 64.3

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

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

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

Signed

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

Date:

Contract Agreement (Form PG5A - 8)

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

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

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

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

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

Signed by, for and on behalf of the Employer

For the Employer:	**For the Contractor:**
Signature	
Print Name	
Title	
In the presence of Name Address	

Bank Guarantee for Performance Security (Form PG5A – 9)

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

Contract No: Date:

To:

[Name and address of Employer]

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

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

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

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

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

[Signatures of authorized representatives of the bank]

Signature Seal

Bank Guarantee for Advance Payment (Form PG5A – 10)

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

Contract No: Date:

To:

[Name and address of Employer]

ADVANCE PAYMENT GUARANTEE No.:

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

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

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

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

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

[Signatures of authorized representatives of the bank]

Signature Seal

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

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

Demand Guarantee

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

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

Date: [insert date]

RETENTION MONEY GUARANTEE No.: [insert number]

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

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

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

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

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

Section 6. Employer's Requirements

Table of Contents

6.1 Scope of Works, General/Details Technical Specification and Employer's Requirement		158
6.2 Specification		171
6.3 Form of Completion Certificate		461
6.4 Form of Operational Acceptance Certificate		462
6.5 Change Order Procedure and Forms		463
	Annex 1. Request for Change Proposal	465
	Annex 2. Estimate or Change Proposal	466
	Annex 3. Acceptance of Estimate	467
	Annex 4. Change Proposal	468
	Annex 5. Change Order	470
	Annex 6. Pending Agreement Change Order	471
	Annex 7. Application for Change Proposal	472

6.1 Scope of Works

Scope of Works General/Details Technical Specification and Employer's Requirement.

1.0 EMPLOYER'S REQUIREMENTS

The works in this bidding document covers the supply, construction, installation and commissioning of 33/11 kV Substations at various locations in Dhaka division of Bangladesh, under the jurisdiction of the BREB/PBS, on a design, supply, and installation basis. A list of the sites is given in Table 01 below and site plans are provided in "Drawings" section of this document.

The scope of work includes design, manufacture, quality assurance, inspection & testing, packing for export, insurance & shipment to site, civil works, complete construction & installation jointing, terminating, bonding, earthing, painting, setting to work, site testing & commissioning all the equipment necessary for operation of the sub-station.

The detail requirements are listed in the technical particulars and guaranteed schedules in the technical specification. The Contractor shall remedy all defects during the defect notification period of the equipment as per the contract.

The scope also includes imparting technical training for BREB/PBS Personnel on operation, maintenance, protection & control of 33/11 kV sub-stations.

The Contractor shall be responsible for providing equipment, which shall meet in all respects the performance specifications and will have satisfactory durability for the prevailing site conditions. The Contractor is responsible for ensuring that all and any items of work (materials and labor) required for the safe efficient and satisfactory completion and functioning of the works in accordance with the specification, are included in the bid price whether they be individually described in the specification or not.

The site plans are included in the drawings and the locations are identified by pegs in the ground. Each bidder shall visit each site during the bidding period. Contact details of the relevant BERB/PBS representatives are given in Attachment 1. At least 10days' notice will be required.

The Bidders shall inspect each new site to identify the location, orientation, actual space available, extent of earth works involved, construction of control building and its ancillary facilities and sub-soil investigation and soil testing reports available (which will be supplied from PMU office)including recommendations, to determine the actual scope of work. Modifications to the lay-out provided in the drawing, may be necessary based on the Contractor's detailed design and the actual available size of the land at the site.

The detailed design arrangement of the equipment shall be the responsibility of the Contractor subject to the approval of the concern committee of BREB with the recommendation of Project Manager. The Contractor shall submit all drawings, manuals, designs and calculations for review prior to commencing manufacturing and/or installation works. Typical existing BERB designs are included in Drawings section of this document, for information only.

Transportation requirements, storage, suitable construction tools, necessary equipment and all required materials for installation and connections as well as testing and commissioning are included in the scope of work.

1.1 New 33/11 kV Substations – Electrical

There is single category of 10/14 MVA substations to be constructed. The total number of sub-station will be 4(four). Capacity of each sub-ststion will be 10/14 MVA with incoming but no outgoing circuits. In all the substations, there should be 02 Nos. of Transformer Pads/ Foundations. These foundations shall be made considering the load bearing capacity of 20/28MVA transformers along with a fire wall between the two units to facilitate up-gradation at a later date by adding another transformer. Further provision shall be made for inclusion of a future bus coupler isolator with circuit breaker between the two feeders as well as space for additional 33 kV feeders at the two ends of the bus bar system.

The key requirements for the new substations are presented hereunder; any other works required but not included below but required to complete the substation and put it into operation is to be treated as forming a part of this contract.

1.1.1 The new 10/14 MVA substation shall have the following features:

The 10/14MVA design shall take into consideration future expansion of the installation with the addition of a second 10/14MVA transformer. A fire wall and transformer foundation shall be erected to cater for this at the same time as the first transformer is installed. The 33 kV equipments will be out door and the 11 kV equipments will be indoor. The number of 33 kV feeders will be as per the substation type. The 11 kV switchgear panels will consist of 6 outgoing feeder panels (space shall be left for 6 more feeder panels for future use), two transformer incoming panels and a bus section VCB and riser panels (to utilize a split-bus arrangement at a later date). The main equipment at the substation will consist of:

- 10/14 MVA (ONAN/ONAF), three phase 33/11.55 kV transformers with OLTC having +6% to -18% tapping range and 1.5% tap step;
- 33 kV isolator and earth switch, 1250 A for each feeder bay;
- 33 kV isolator, 1250 A for each feeder bay and transformer bay;
- 33 kV lightning arresters (30 kV, 10 kA);
- 33 kV 1250 A vacuum circuit breaker for each feeder bay and transformer bay;
- 11 kV Indoor switchgear and panels with 2000 A vacuum circuit breakers for transformer and bus section panels and 630 A vacuum circuit breakers for 6 outgoing feeders ;
- 100 kVA, 33/0.415 kV three phase transformer with fused isolator and bypass switch for local station supply;
- 11 kV cables from transformer to 11 kV bus-bar, 2 Nos. single core 500 mm^2 Cu XLPE Cable per phase (allow 2 × 60 m per phase);
- 11 kV cables to feeders, 3 × 185 mm^2 Cu XLPE Cable (allow 120 m per feeder for 6 feeders);
- 11kV lightning arresters;
- Space to be left (suitably covered with metal plates) for additional six (6) 11 kV panels – two on either side of the 11kV panel;
- 33 kV and 11 kV CT’s and PT’s for metering, indication and protection;

- 33 kV panel with OLTC control, CB protection and control, and transformer protection
- 33 kV and 11 kV panels with mimic diagram embedded operating switches;
- Laminated substation Single line diagrams(A0 size) on durable paper- 5 copies;
- Station supply AC panel;
- DC panel;
- Control building, outdoor yard lighting, and all indoor and outdoor electrical facilities
- Battery and charger, battery panel;
- All relevant civil works, foundations, earth grid and structural works as detailed in this specification and shown on the drawings. In particular, a suitable fire wall shall be installed between the two transformer bays;
- The main earth grid including bonding of bays and all steel work / gantries shall be installed for the final configuration;
- The foundations for future second transformer (only) in the future second bay shall also be installed at this time;

The quantities of each item will be as indicated in the bill of quantities and the drawings.

The conceptual single line diagrams, plans and elevations are provided in Section 4 - Drawings

1.1.2 The new 20/28 MVA substation shall have the following features:

The quantities of each item will be as indicated in the bill of quantities and the drawings.

The conceptual single line diagrams, plans and elevations are provided in Section 4 - Drawings.

1.1.3 Terminal Points

Incoming 33kV Line

The landing span from the 33kV incoming line to the equipment is the responsibility of the line contractor and therefore the droppers from the landing pole to the substation equipment gantry shall be provided by the line contractor. If the substation equipment gantry is not ready at the time of the installation of the 33kV line this line span shall be left coiled for later connection by the substation contractor as directed by the Project Manager.

Cables within sub-station

Power and Multi-core cabling between equipment within the substation i.e. 11 kV, LVAC, DC, etc. shall be provided and installed by the contractor as required under this Contract.

11kV Outgoing Cables

The supply of cable boxes on the switchgear complete with cable lugs shall be provided under this Contract. The outgoing feeders from the 11kV switchgear to the overhead take off point including terminations and line surge diverters shall be provided under this contract. The termination of the cable on the pole including surge arresters shall be carried out by the Contractor.

1.1.4 New 33/11 kV 10 and 20 MVA Substations – Civil works

The Contractor shall be responsible for the construction of the control building and its facilities, Retaining and boundary Wall, fire wall and earthworks associated with each new substation. This shall include but not be limited to the following:

- Site topographical surveys and sub-soil investigations report including recommendation
- Testing of water and materials used in construction works
- Earthworks, and landscaping as per approved drawings
- Any required piling work. Preliminary soil test reports will be provided by the Employer, However final soil test reports and designs will be contractor's responsibility
- Temporary and permanent access roads to the substation from public roads, and service roads inside the Substations.
- A single two storied control room building (approx. 2 × 140 sq. meters) having three storied foundations including chila kotha along with the facilities to electricity, water supply, sewerage, etc. as per requirements of the employer.
  Floor Planning:
  (i) Ground Floor: Customer Service Centre, Office Room, Rest Room and Toilet (02 Nos.).
  (ii) First Floor: 33 kV & 11 kV Switchgear, Battery Room, Toilet (01 No.).
  The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.
- 33/11 kV transformer foundations (with one additional foundation to cater for future second transformer in single transformer substation). All the foundations should be constructed considering load baring capacity of 20/28 MVA sub-stations, oil containment bund walls and fire wall.
- Cable trenches, ducts and sump pits.
- Perimeter Retaining & boundary wall and matching main and personnel gates.
- Guard room
- Structure and foundations for line landing gantries, plant and equipment.
- Roads and footpaths as per design and site requirements.
- Waste water and surface water drainage systems and septic tank and soak well
- Building Services; ventilation, plumbing works, water supply, small power and lighting, telephones, fire detection, etc.
- Outdoor lighting
- Water tank as per specific site requirements.
- Any required temporary works.
- Master plan/site layout plan as per respective site condition.
- Architectural plan, section, all side elevation and also 3-D perspective.
- Structural design as per present code of practices in Bangladesh (BNBC), drawings and all documents necessary for, completion and maintenance of the works. Preparation of As-built documentation.
- Tube well and water pump to feed water tank.
- All required lighting systems.
- All required fire extinguishers.
- Any other works required but not included in the above to complete the substation and put it into operation.

1.2 Substation Types

1.2.1 Schedule of Substations and Types

The following Table 01, Table 02 & Table 03 lists the n**a**mes of each 33/11 kV substation to be constructed, the type of substation to be constructed and the supply arrangements from the relevant Grid SS/other sources.

Substations are either supplied direct from a new grid substation feeder bay, via a tee-off from an existing feeder from a grid substation, or via a 33 kV switching station.

Table 01

Package No.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-01**

Name of PBS	Name of Substation	Capacity (MVA)	Layout Design
1	2	3	4
Kushtia PBS	Kushtia-5	10 MVA	1×10/14MVA (33 KV in, no out)

Package No.: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-02**

Name of PBS	Name of Substation	Capacity (MVA)	Layout Design
1	2	3	4
Kushtia PBS	Mirpur-3	10 MVA	1×10/14MVA (33 KV in, no out)

Scope of works

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF NEW 33/11 KV 1X10/14 MVA INDOOR SUB-STATION UNDER DISTRIBUTION NETWORK EXPANSION FOR 100% RURAL ELECTRIFICATION (RAJSHAHI, RANGPUR, KHULNA & BARISAL DIVISIONS) PROJECT, BREB.

Total No. of Sub-Station: 01 No. (Kushtia-5 in Kushtia PBS).

TENDER PACKAGE NO: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-01**

Schedule No. 1: Plant, Mandatry spare parts & Micellaneous

1A. Plant- Sub-station 01 No. (One 33 Kv in only, No out)

Item no.	Description of Item	Unit	Quantity		
1	2	3	4		
1A-1	33 kV Vacuum outdoor type circuit breaker (incoming) with current transformer on same structure including Control and Protection panel for the 33 kV outdoor VCB and33/11.55 kV Transformer.	Nos.	**2**		
1A-2	33 kV 3×1 phase link (Disconnect Switch) for circuit breaker.	Sets	**2**		
1A-3	Station transformer 33/0.415 kV, 100 kVA with fused isolator and fused by-pass switch.	Set	**1**		
1A-4	33 kV PT (3×1 phase, Bus PTs and Feeder PTs).	Set	**2**		
1A-5	33 kV Line isolator with earth switch, 3 phase (ES).	Set	**1**		
1A-6	30 kV, 10 kA Station Type Lighting arrestor, 3×1 phase.	Set	**2**		
1A-7	11 kV switchgear panel 10 nos. for 1×10 MVA (6 feeder breaker, two incoming, one bus riser and one bus coupler) and four sets of 11 kV PTs (one for bus & two for incoming) including necessary CTs.	Set	**1**		
1A-8	33/11.55 kV, 10/14 MVA ONAN/ONAF Transformer with OLTC (including OLTC panel).	Set	**1**		
1A-9	10 kV, 10 kA lightning arrester, 3×1 phase.	Set	**10**		
1A-10	A/C Distribution panel.	Set	**1**		
1A-11	D/C Distribution panel.	Set	**1**		
1A-12	Battery and battery charger.	Set	**1**		
1A-13	Internal feeder cabling, inclusive of all necessary LV control and auxiliary supply cable with necessary termination and kits.	Set	**1**		
1A-14	XLPE Power Cable 1 core 500 mm2 size Cu conductor (11 kV incoming) with necessary termination and kits (no joint is allowed).	Meter	**600**		
1A-15	XLPE Power Cable 3 core 185 mm2 size Cu conductor (11 kV Outgoing) with necessary termination and kits (no joint is allowed).	Meter	**720**		
1A-16	All supporting hot dip galvanized steel structures including CB structure, LA Structure, landing structure, bus bar structure with proper size of conductor and fittings, overhead surge protection for structures and control building.	Lot	**1**		

Note: All item in 1A shall include all accessories and components required for fitting & fixing up to commissioning.

1B. Mandatory Spare Parts: Not required.

1C. Miscellaneous

Item no.	Description of Item	Unit	Quantity		
1C -1	Furniture for Control Room	Lot	1		
1C -2	Air Conditioning System for Control Room including all accessories/ components required for fitting & fixing upto commissioning.	Nos.	4		
1C -3	Desktop Computer including all accessories/ components.	No.	1		
1C -4	Laptop Computer including all accessories/ components.	Nos.	1		
1C -5	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Set	1		
1C -6	Supply of2000 liter (440 Gallon) over head water tank including all required for fitting & fixing up to Commissioning.	Lot	1		
1C -7	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning.	Lot	1		
TOTAL (Schedule No. 1.)					

Schedule No. 2. Design Services for Sub-station

TENDER PACKAGE NO: DNE(W)-SSN-15

Sub-Package No.: DNE(W)-SSN-15-01

Item no.	Description of Item	Unit	Quantity		
1	2	3	4		
2A-1	All design drawings and documentation works including 5 (five) sets of AS-built drawings and substations operation and maintenance manual.	Nos.	1		
TOTAL (Schedule No. 2.)					

Schedule No. 3. Installation and Other Services

TENDER PACKAGE NO: DNE(W)-SSN-15

Sub-Package No.: DNE(W)-SSN-15-01

3.Electrical:

Item no.	Description of Item	Unit	Quantity		
1	**2**	**3**	**4**		
3A-1	All switchyard electrical installation including (a) supply & installation of Sub-station Earthing System and (b) supply & installation of Sub-station Lighting (as required).	Lot	1		
3A-2	Testing & Commissioning	Lot	1		

3B. Civil & Others

3B-1	Two storied control room building based on three storied foundations including Chilla-Kotha along with the facilities to electricity, water supply, sewerage, etc. as per requirements of the employer. Floor Planning: Ground Floor: Complain Centre, Office Room, Rest Room and Toilet (02 Nos.). 1st Floor: 33 kV & 11 kV Switchgear, Battery Room, Toilet (01 No.). The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.	Lot	1		
3B-2	Switchyard civil [all foundations (including future provisional equipment foundations), ducts/ drainage], fencing and gates.	Lot	1		
3B-3	Installation of all switchyard supporting structures [e.g. CB structure, LA Structure, landing structure, bus bar structure, overhead surge protection structures including control building, all accessories/ components required for fitting & fixing up to commissioning.]	Lot	1		
3B-4	Site Development/Earthworks (including pilling, back filling, construction of internal roads (as required), beatification (e.g. gardening), construction of approach road, RCC Pipe Culvert (if required) and all other related works).	Lot	1		
3B-5	Construction of RCC Retaining wall with Boundary wall along the property line including main gate and guard room.	Lot	1		
3B-6	Substation yard surface finishing should be with 1" – 1.25" washed stone gravelling of 4" depth.	Lot (LS)	1		
3B-7	Installation of Air Conditioning System for Control Room all accessories/ components required for fitting & fixing up to commissioning.	Lot	1		
3B-8	Installation, testing & commissioning of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Lot	1		
3B-9	Installation of 2000 liter (440 Gallon) over head water tank including all pipe connection complete as required/as per direction of the Engineer in charge.	Lot	1		
3B-10	Installation of Fire Detection & Protection Facilities for control room building including all Balancing, Testing & Commissioning.	Lot	1		

3C. Technical (O & M) Training Services				
Technical Training for 7 days for 2 Nos. BREB/PBS Personnel for each S/S on operation, maintenance, protection & control of 33/11 kV S/S .	Lot	1		
TOTAL (Schedule No. 3.)				

Scope of works

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF NEW 33/11 KV 1X10/14 MVA INDOOR SUB-STATION UNDER DISTRIBUTION NETWORK EXPANSION FOR 100% RURAL ELECTRIFICATION (RAJSHAHI, RANGPUR, KHULNA & BARISAL DIVISIONS) PROJECT, BREB.

Total No. of Sub-Station: 01 No. (Mirpur-3 in Kushtia PBS).

TENDER PACKAGE NO: DNE(W)-SSN-15 **Sub-Package No.: DNE(W)-SSN-15-02**

Schedule No. 1: Plant, Mandatry spare parts & Micellaneous

1A. Plant- Sub-station 01 No. (One 33 Kv in only, No out)

Item no.	Description of Item	Unit	Quantity		
1	2	3	4		
1A-1	33 kV Vacuum outdoor type circuit breaker (incoming) with current transformer on same structure including Control and Protection panel for the 33 kV outdoor VCB and33/11.55 kV Transformer.	Nos.	**2**		
1A-2	33 kV 3×1 phase link (Disconnect Switch) for circuit breaker.	Sets	**2**		
1A-3	Station transformer 33/0.415 kV, 100 kVA with fused isolator and fused by-pass switch.	Set	**1**		
1A-4	33 kV PT (3×1 phase, Bus PTs and Feeder PTs).	Set	**2**		
1A-5	33 kV Line isolator with earth switch, 3 phase (ES).	Set	**1**		
1A-6	30 kV, 10 kA Station Type Lighting arrestor, 3×1 phase.	Set	**2**		
1A-7	11 kV switchgear panel 10 nos. for 1×10 MVA (6 feeder breaker, two incoming, one bus riser and one bus coupler) and four sets of 11 kV PTs (one for bus & two for incoming) including necessary CTs.	Set	**1**		
1A-8	33/11.55 kV, 10/14 MVA ONAN/ONAF Transformer with OLTC (including OLTC panel).	Set	**1**		
1A-9	10 kV, 10 kA lightning arrester, 3×1 phase.	Set	**10**		
1A-10	A/C Distribution panel.	Set	**1**		
1A-11	D/C Distribution panel.	Set	**1**		
1A-12	Battery and battery charger.	Set	**1**		
1A-13	Internal feeder cabling, inclusive of all necessary LV control and auxiliary supply cable with necessary termination and kits.	Set	**1**		
1A-14	XLPE Power Cable 1 core 500 mm2 size Cu conductor (11 kV incoming) with necessary termination and kits (no joint is allowed).	Meter	**600**		
1A-15	XLPE Power Cable 3 core 185 mm2 size Cu conductor (11 kV Outgoing) with necessary termination and kits (no joint is allowed).	Meter	**720**		
1A-16	All supporting hot dip galvanized steel structures including CB structure, LA Structure, landing structure, bus bar structure with proper size of conductor and fittings, overhead surge protection for structures and control building.	Lot	**1**		

Note: All item in 1A shall include all accessories and components required for fitting & fixing up to commissioning.

1B. Mandatory Spare Parts: Not required.

1C. Miscellaneous

Item no.	Description of Item	Unit	Quantity		
1C -1	Furniture for Control Room	Lot	1		
1C -2	Air Conditioning System for Control Room including all accessories/ components required for fitting & fixing upto commissioning.	Nos.	4		
1C -3	Desktop Computer including all accessories/ components.	No.	1		
1C -4	Laptop Computer including all accessories/ components.	Nos.	1		
1C -5	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Set	1		
1C -6	Supply of2000 liter (440 Gallon) over head water tank including all required for fitting & fixing up to Commissioning.	Lot	1		
1C -7	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning.	Lot	1		
TOTAL (Schedule No. 1.)					

Schedule No. 2. Design Services for Sub-station

TENDER PACKAGE NO: DNE(W)-SSN-15

Sub-Package No.: DNE(W)-SSN-15-02

Item no.	Description of Item	Unit	Quantity		
1	2	3	4		
2A-1	All design drawings and documentation works including 5 (five) sets of AS-built drawings and substations operation and maintenance manual.	Nos.	1		
TOTAL (Schedule No. 2.)					

Schedule No. 3. Installation and Other Services

TENDER PACKAGE NO: DNE(W)-SSN-15

Sub-Package No.: DNE(W)-SSN-15-02

3.Electrical:

Item no.	Description of Item	Unit	Quantity		
1	**2**	**3**	**4**		
3A-1	All switchyard electrical installation including (a) supply & installation of Sub-station Earthing System and (b) supply & installation of Sub-station Lighting (as required).	Lot	1		
3A-2	Testing & Commissioning	Lot	1		

3B. Civil & Others

3B-1	Two storied control room building based on three storied foundations including Chilla-Kotha along with the facilities to electricity, water supply, sewerage, etc. as per requirements of the employer. Floor Planning: Ground Floor: Complain Centre, Office Room, Rest Room and Toilet (02 Nos.). 1st Floor: 33 kV & 11 kV Switchgear, Battery Room, Toilet (01 No.). The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.	Lot	1		
3B-2	Switchyard civil [all foundations (including future provisional equipment foundations), ducts/ drainage], fencing and gates.	Lot	1		
3B-3	Installation of all switchyard supporting structures [e.g. CB structure, LA Structure, landing structure, bus bar structure, overhead surge protection structures including control building, all accessories/ components required for fitting & fixing up to commissioning.]	Lot	1		
3B-4	Site Development/Earthworks (including pilling, back filling, construction of internal roads (as required), beatification (e.g. gardening), construction of approach road, RCC Pipe Culvert (if required) and all other related works).	Lot	1		
3B-5	Construction of RCC Retaining wall with Boundary wall along the property line including main gate and guard room.	Lot	1		
3B-6	Substation yard surface finishing should be with 1" – 1.25" washed stone gravelling of 4" depth.	Lot (LS)	1		
3B-7	Installation of Air Conditioning System for Control Roomall accessories/ components required for fitting & fixing up to commissioning.	Lot	1		
3B-8	Installation, testing & commissioning of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Lot	1		
3B-9	Installation of2000 liter (440 Gallon) over head water tank including all pipe connection complete as required/as per direction of the Engineer in charge.	Lot	1		
3B-10	Installation of Fire Detection & Protection Facilities for control room building including all Balancing, Testing & Commissioning.	Lot	1		

3C. Technical (O & M) Training Services				
Technical Training for 7 days for 2 Nos. BREB/PBS Personnel for each S/S on operation, maintenance, protection & control of 33/11 kV S/S .	Lot	1		
TOTAL (Schedule No. 3**.)**				

6.2 Specification

The Plant & Equipment's of 10/14 MVA MVA (Each) indoor type Turn-key sub-station works shall comply with following Technical Specifications:

SPECIFICATION

TABLE OF CONTENTS

Description

A. Electrical

1.0 General Technical Requirements for Substation Electrical Equipment
2.0 Particular Technical Requirements for Substation Electrical Equipment
3.0 Testing and Commissioning

B. Civil - Technical Requirements for Substation Civil and Building Works

4.0 General Technical Requirements
5.0 Substation Building and Ancillary Facilities
6.0 Sanitary and Water Supply Works
7.0 Internal and External Electrification

C. Miscellaneous

8.0 Desktop/ Laptop Computer & Accessories
9.0 Air Conditioner
10.0 Control Room Furniture
11.0 Fire Detection & Protection Facilities

A. ELECTRICAL

1.0 GENERAL TECHNICAL REQUIREMENTS FOR SUBSTATION ELECTRICAL EQUIPMENT

TABLE OF CONTENTS

Clause No.	Description
1.0	General Technical Requirements-Electrical
1.1	Introduction
1.2	System Parameters
1.3	Climatic Conditions
1.4	Management Systems
1.5	Standards
1.6	Standards and Code Not Specified
1.7	Units of Measurement
1.8	Facilities and Transport to Site
1.9	Documentation
1.10	Erection and Checking at Site
1.11	Contractor's Responsibilities
1.12	Sub-contracts and Orders
1.13	Packing and Erection Marks
1.14	Contractor's Local Agent
1.15	Civil and Building Works
1.16	Design and Construction Requirements and Interchangeability
1.17	Plant and Equipment Identification
1.18	Safety and Security
1.19	Spare Parts
1.20	Consumable Items
1.21	Painting and Cleaning
1.22	Galvanized Work
1.23	Mechanical Items
1.24	Electrical Insulation
1.25	L.V. Circuit Protection
1.26	Electrical Equipment, Instruments and Meters
1.27	Control and Selector Switches
1.28	Auxiliary Switches
1.29	Alarm Equipment
1.30	Panels, Desks, Kiosks and Cubicles
1.31	Panel Wiring and Terminal Boards
1.32	Cable Boxes and Glands
1.33	Joints and Gaskets
1.34	Junction, Termination Marshalling Boxes, Operating Cubicles etc
1.35	Conduit and Accessories
1.36	Trunking
1.37	Push-Buttons and Separately Mounted Push-Button Stations
1.38	Drawings, Diagrams and Calculations
1.39	Operating and Maintenance Manuals
1.40	Site Storage Facilities
1.41	Switchyard Cable Ducts and Conduits

1.0 General Technical Requirement - Electrical

1.1 Introduction

This section describes the General Technical Requirements for the construction, supply, installation and commissioning of new BERB 33/11 kV indoor type substations and general switchyard equipment, and shall be read in conjunction with the project requirements, schedules and drawings in the specification.

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

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

Type test certificates shall be from an internationally accredited independent testing laboratory such as KEMA- Netherlands; CESI- Italy; Underwriters Laboratory (UL)-USA or CPRI-India. Proof of accreditation shall be provided with the certificate for any other laboratory.

The requirement for switchgear spares, tools and appliances, including test, maintenance and handling equipment shall be as stated in the bidding document. All devices necessary for operation and earthing shall be provided within the contract price.

1.2 System Parameters

Electrical Network Parameters:

Parameter	Network		
	33 kV	**11 kV**	**0.4 kV Aux.**
Nominal Voltage	33 kV	11 kV	0.4/0.23 kV
Rated System Voltage	33 kV	11.55 kV	0.415/0.240
Highest System Voltage	36 kV	13.2 kV	0.440 kV
Number of Phases	3	3phase 4 wire with PME system	3 ph,4 wire
Frequency	50Hz	50Hz	50 Hz
Neutral Point	Effective Earthing	Solid Earthing	Solid Earthing
3 Phase Short Circuit Capability	31.5 kA	31.5 kA	12 kA
Duration of Short Circuit			
For power transformers	3 sec	3 sec	3 sec
For other electrical equipment	3 sec	3 sec	3 sec
Impulse Withstand Voltage			
For Substation Equipment	170 kVp	75 kVp	
For Transformer Windings	170 kVp	75 kVp	
For Neutral Point -Equipment	125 kVp	70 kVp	

For Neutral Point -Transformer	75 kVp	28 kV	
Power Freq. Withstand Voltage			2 kV
For Substation Equipment	75 kV	28 kV	
For Transformer Windings	70 kV	28 kV	
For Neutral Point -Equipment	50 kV	28 kV	
For Neutral Point -Transformer	70 kV	28 kV	
Min creepage distance (mm/kV) for highest rated voltage			
Indoor exposed insulators	20 mm	20 mm	
Outdoor exposed insulators	25 mm	25 mm	
Minimum clearance in air	In accordance with IEC 60071		
Minimum clearance between walkway and the lowest live point	2750 mm	2590 mm	
Minimum safety clearance between ground and the lowest point not at earth potential of any insulator	2500 mm (Outdoor)	2500 mm (Outdoor)	
Minimum clearance between live parts and earth	381 mm	200 mm	
Minimum clearance between live fixed metal of different phases	432 mm	250 mm	
Minimum total air gap between terminal of same pole of disconnectors	432 mm	250 mm	

A.C.	Nominally 415 V±10%, 4 wire system. Refer 1.2.1 below.
D.C. (Control & Protection)	110 Volt nominal tolerance on rated voltage + 10% to -15%
Main station service transformers	33,000/415 Volts ±10% /Y aux complete with 415 Volt fused isolating switch.

1.2.1 Design of Low Voltage AC System

The design of the LV AC power and control system within the substation shall take into account the possible variations in the incoming 33 kV voltage. The auxiliary supply transformer is connected to the incoming 33 kV voltage to ensure that an auxiliary supply is available even when the power transformer is off line. However this means that the LV AC system is subject to the possible variation of the incoming 33 kV voltage. This voltage may vary from 24 kV up to a maximum of 36 kV.

The LV AC system in the substation, including the off load tapping range of the 33,000/415 V auxiliary transformer, the operating voltages of motors and contactors as well as any AC control systems shall be designed to cater for the above variation.

1.3 Climatic Conditions

Instructions to Bidders: The information in this clause is given solely for the general assistance of bidders and no responsibility for it will be accepted nor will any claims based on this clause be considered.

All plant and equipment supplied under the Contract shall be entirely suitable for the climatic conditions prevailing at site. Atmospheric pollution is mid level and special insulator design or washing is not required. The area is subject to high winds of typhoon strength.

Topographical and Meteorological Site Conditions

Site Location		Various locations in Dhaka Division.
Max design Altitude for all equipment operating characteristics as per IEC above sea level	m	1000
Air Temperatures		
- Maximum Peak(Design maximum ambient temperature)	°C	45
- Maximum daily average	°C	35
- Maximum yearly average	°C	30
- Minimum	°C	4
Sun temperature in direct sunlight	°C	
Maximum ground temp at depth of 1000mm	°C	30
Humidity		
Maximum relative humidity at 40degrees	%	100
Minimum relative humidity	%	50
Yearly average	%	80
Pollution level Outdoor Indoor		Medium Medium
Dust Storms	days/annum	30
Average number of days per year of thunder storms		80
Maximum wind velocity (for design purposes)	m/sec	200 km/hr (3 sec gust)
Minimum wind velocity for line rating purposes(33kV)		1.6 km/hr
Solar radiation		100 mW/sq. cm
Ice loading, radial thicknessmm		N/A
Total rainfall		1.5 m/Annum
Seismic factor (The area is designated a zone of moderate intensity for earthquakes.)		1.5 g
Soil Type		alluvial
Soil temperature (at 1.1m)	^{0}C	30
Soil thermal resistivity		1.5^{0}C m/w

1.4 Management Systems

1.4.1 General

The Contractor shall carry out the Works in accordance with sound quality and environmental management principles, and in particular shall have management systems which conform to the requirements of the ISO 9000 family of standards for Quality Management and the ISO 14000 family of standards for Environmental Management.

These quality management requirements shall apply to all activities including design, procurement, manufacturing, inspection, testing, packing, shipping, storage, site erection and commissioning.

The Contractor, major sub-contractors and suppliers shall have Quality Systems certified as complying with the requirements of ISO 9001 applicable to sales, design, construction and commissioning of high- and medium-voltage substations. If minor sub-contractors and suppliers do not have such systems then the Contractor's Quality System shall be deemed to apply.

It is preferred that the Bidder be certified as complying with ISO 14001 but this is not a qualifying requirement.

Documents submitted by the Bidder, including those provided by sub-contractors, will not be accepted unless they include evidence that they have been verified by the Bidder.

1.4.2 Quality Documentation and Audit

The Contractor shall submit a copy of its Quality Manual and relevant quality procedures, in the English language, within one (1) month of the Effective Date of the Contract. Quality Manuals from sub-contractor and suppliers shall be submitted within two (2) weeks of the Contractor making a commitment to them.

The Contractor shall clearly identify all quality records that will be used for the Contract.
The Employer may undertake an inspection or quality audit of the Contractor's or sub-contractor's facilities at any time. Full quality records of procurement and manufacture shall be made available at the start of factory inspection and testing of equipment. Full quality records to the completion of installation shall be made available before the start of site testing.

1.4.3 Quality Plan

The Contractor shall ensure that its quality procedures address all requirements of the Specification. The Contractor shall ensure that the quality procedures of sub-contractor, manufacturers and suppliers address all requirements of the Specification, and that the Contractor's quality procedures provide verification of this.

The Contractor shall prepare an overall Quality Plan for the Works, and shall provide detailed quality plans for all major sub-contractors and suppliers. Quality plans shall include:

Organization chart with identification and details of key personnel;

Inspection and Test Plans on which hold points and recommended inspections by the Employer are clearly shown.

Quality Plans shall be subject to the approval of the Employer. An initial Quality Plan shall be submitted with one (1) month of the Effective Date of the Contract. A revised Quality Plan which

includes full details of all Inspection and Test Plans shall be submitted within two (2) months of the Effective Date of the Contract.

Not less than two (2) months prior to mobilization to Site, the Contractor shall submit the Quality Plan revised to include a complete list of all site personnel detailing names, positions and responsibilities complete with an organization chart. The Contractor shall provide for approval full details, including curriculum vitae, of all engineering, technical and other key staff to be employed at site. Personnel shall not mobilize to Site prior to approval being given.

1.4.4 Measuring and Testing Equipment

All measuring and testing equipment shall have current calibration certification. Use of measuring and test equipment which is demonstrated to be calibrated against equipment which has such certification may be accepted.

1.4.5 Inspection and Test Records

The Contractor shall compile the reports of all factory and site tests into a volume of the Operation and Maintenance Manuals.

1.4.6 Equipment Identification and Preservation

The Contractor shall establish and maintain a system for the identification, preservation, segregation and handling of all equipment from receipt through manufacturing, dispatch, storage and installation to prevent abuse, misuse, damage, or deterioration by corrosion through exposure to air or moisture.

1.5 Standards

In the technical specification references have been made to various clauses of IEC; BS; ISO and ASTM and ANSI 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 a Schedule of Proposed Standards and shall have to be accepted by the Employer before contract placement.

1.6 Standards and Code Not Specified

Where not specified, the IEC Standard and the Bangladesh National Building Code (BNBC) shall be applicable.

1.7 Units of Measurement

In all correspondence, in all technical schedules, on all drawings and for all instrument scales, S.I. units of measurement are to be employed. Angular measurement shall be in degrees with 90 degrees forming a right angle.

1.8 Facilities and Transport to Site

Chittagong & Mongla sea ports and Benapole land port are the principal port of entry for material to Bangladesh. The contractor shall provide his own storage facilities, security, insurance etc.

The Contractor is responsible for performing all unloading, inland transportation and obtaining all approvals and consents etc. necessary for the movement of plant and Contractor's equipment from the port to the site.

All necessary access roads, jetties or off-loading points etc. required for the transport of the plant etc. to site will be the Contractors responsibility.

Where heavy loads are to be moved the Contractor shall be responsible for performing surveys of the routes to ensure that all portions have adequate load-bearing capacity.

A comprehensive method statement shall be submitted to the Project Manager detailing the proposed transport route(s) and requirements. Plans indicating all bridges, ducts, culverts, railway crossings, overhead lines, water mains etc. their load bearing capacity or clearances as appropriate shall be given together with proposed means of achieving the transportation requirements. Any reinforcement, strengthening, modifications or temporary works required to obtain the necessary capacity shall be the responsibility of the Contractor. The cost of the above is to be included in the Bid price.

No plant is to be consigned to Bangladesh by airfreight without the prior written approval of the Employer.

1.9 Documentation

1.9.1 Documentation

In order for the Employer to obtain the necessary import permits and satisfy the requirements of the customs authorities the following documentation is required.

Within 60 days of the effective date of Contract, the Contractor shall submit a detailed schedule of plant that is to be provided under the Contract indicating the type of equipment and the name of the manufacturer. Six copies of the schedule are to be submitted to the Project Manager and the Employer.

1.10 Erection and Checking at Site

As each part of the works is erected, the Contractor shall seek the Employer's approval that the works have been constructed in accordance with the specification and approved drawings.

For purposes of progress payments for site work a monthly and cumulative system of joint measurement of work done for each section of work shall be set up by the Contractor in a manner approved by the Employer.

Any works constructed prior to the issue of drawings approved by the Employer for the particular works may not be included in the percentage completion figures.

The Contractor is to provide such protection and watchmen as may be considered necessary to safeguard his materials and stores. The Employer will not accept responsibility for any loss or damage, which may occur during the execution of the Contract.

The carrying out of all the work included in the Contract shall be supervised by a sufficient number of qualified representatives of the Contractor, and full facilities and assistance shall be provided to the Employer to check the works. The Contractor shall obtain from the Employer details of the works that he proposes to inspect, but such inspection shall in no way exonerate the Contractor from any of his obligations. The Contractor, if required by the Employer, shall open for inspection before erection any equipment, which has been delivered to the site partly assembled.

On completion of the works the site shall be left clean and tidy to the satisfaction of the Employer. Any damage done to buildings, structures, plant or property belonging to the Employer shall be made good at the Contractor's expense.

The Contractor shall ensure the correctness of electrical and mechanical connections to all equipment supplied under the contract before such equipment is commissioned.

During erection and commissioning the Contractor shall provide all temporary scaffolding, ladders, platforms with toe boards and hand-rails essential for proper access of workmen and inspectors, cover or rail off dangerous opening or holes in floors, and afford adequate protection against materials falling from a higher level on a person below.

The maximum personal safety must be afforded to personnel either directly engaged on this Contract or who in the normal course of their occupations find it necessary to utilize temporary works erected by the Contractor or to frequent the working area.

In each and every case involving a connection between the plant supplied under this Contract and any other existing plant which may or may not be in service, the Contractor must make suitable arrangements as regards the time and manner in which the connection is made subject to the approval of Employer’s Representative who is in charge of the existing plant. Where cases arise involving the operation of the plant or work on plant in operation or whenever required by the Employer’s Representative, the Contractor must obtain a written “Permit to Work” signed by a person duly authorized by the Employer.

1.11 Contractor’s Responsibilities

1.11.1 Planning of Works

Within 30 days after the effective date of Contract, the Contractor shall prepare, in an agreed form, a detailed manufacture, delivery and erection program chart for the complete Contract works, and shall submit the chart to the Employer for approval.

The manufacture, delivery and erection program chart shall indicate for each major item of the Contract the various phases of work from the commencement of the Contract to its completion, e.g., design, ordering of materials, manufacture, delivery, installation and commissioning. The program shall include a fully comprehensive drawings production program which shall demonstrate the Contractors intended issue dates for approval.

These presentations shall be in bar chart and precedence critical path analysis format.

The program shall indicate percentage completion points of the various phases which can form the basis of progress reporting.

A cash-flow forecast of the estimated monthly invoice values shall be included in the program. This forecast shall take into account the terms of payment and indicate down-payments, release of retention's, etc. Figures may be rounded to the nearest thousands of the appropriate currency.

The Contractor shall indicate in the program the number, grade and discipline of supervisory and managerial site staff proposed throughout the site construction periods. If specialist erection and commissioning staff are to be employed by the Contractor details of the number, discipline and duration of visit of these staff are to be indicated in the program. The provision of this information will not form any contractual limit on the number of staff to be provided by the Contractor to ensure the timely completion of the Contract. Should any incident occur which, in the opinion of the Contractor will result in an over-run of any section of the Works this shall be indicated in the program and brought to the Employer's attention.

If, at any time during the execution of the Contract, it is found necessary to modify the approved manufacture, delivery and erection program chart, the Contractor shall inform the Employer and submit a modified chart for his approval. The submission, and subsequent approval, of a modified manufacture, delivery and erection program chart shall not necessarily obviate or diminish the Contractor's responsibilities and liabilities under the Contract. The chart shall be updated at monthly intervals and submitted to the Employer no later than the middle of each calendar month.

1.11.2 Progress Reports and Meetings

At monthly intervals after approval of the plant manufacture, delivery and erection program chart, the Contractor shall submit to the Employer updated bar chart programs and precedence critical path analysis networks in triplicate in an approved format indicating the stage reached in the design, ordering of material, manufacture, delivery and erection of all components of plant. In addition the Contractor will compile and submit "S-curves" based upon the approved program indicating programmed and actual percentage completion of the various stages of drawing approval, manufacture, shipping, civil works and erection for each section of the works plus the overall Contract.

An updated cash-flow forecast indicating previously forecast and actual, involving levels together with revised future requirements shall be submitted quarterly. A graphical display in the form of an "S-curve" of the actual vs. planned payment certification (on & offshore) shall be provided by the Contractor in triplicate on a quarterly basis to supplement the basic cash flow information.

If, during execution of the Contract, the Employer considers the progress position of any section of the work to be unsatisfactory, or for any other reason relating to the Contract, he will be at liberty to call meetings, either in his head office or at site. If required by the Employer, a responsible representative from the Contractor is to attend at the Contractor's expense such meetings with sufficient authority to issue instructions or effect an alteration in the works to the satisfaction of the Employer.

Access to the Contractor's and Sub-contractor's works is to be granted to the Employers representative at all reasonable times for the purpose of ascertaining progress.

1.12 Sub-contracts and Orders

As soon as practicable after entering into the Contract the Contractor may, having obtained the Project Manager's consent, enter into the sub-contracts he considers necessary, for the satisfactory completion of the Contract works. Three un-priced copies of the Contractor's sub-orders shall be supplied to the Project Manager.

One copy of any drawings where the sub-order shall refer shall also be submitted. Each sub-order and drawing shall contain the following reference and an instruction that the plant is subject to inspection and tests to be witnessed by the Project Manager or his agent with sufficient authority to issue instructions, or effect an alternation in the works to the satisfaction of the Project Manager.
Approval by the Project Manager of Contractor's sub-orders shall not relieve the Contractor of his responsibilities in meeting this specification. It is the Contractor's responsibility to ensure that a full specification based on the relevant information in the Contract is passed to the sub-contractor.

The Contractor will be responsible for progressing the Sub-contractor's works including visits to the works to ensure the work as to programme, specification, quality and drawings and to witness all necessary routine, sample and type tests. The cost of this Contract control is deemed to be included in the Contract sum.

1.13 Packing and Erection Marks

Each item is to be export packed and properly protected for shipment, transport and storage in the port area and for transport to and storage on site.

All Plant provided under this Contract shall have the packing marked in the following manner.

A green band shall be painted all around each package. The band shall be 8" wide or ¼ of the length of the packing whichever is the less. Each package should have the following information printed on it in bold letters:-

(a) Port of Loading
(b) Name of Consignee
(c) Purchase Order Number
(d) Brief description of Stores
(e) Number of Package
(f) Gross, tare and net weight
(g) Measurements
(h) Contractors Name
(i) Contract Title
(j) Contract Number
(k) Port of Landing

All members comprising multi-part assembles, e.g. steel frameworks, are to be marked with distinguishing numbers and/or letters corresponding to those of the approved drawings or materials lists.

Colour banding to and approved code is to be employed to identify members of similar shape or type but of differing strengths or grades.

Cases containing delicate items such as relays and instruments should carry a separate marking:

Sensitive equipment packages shall be opened in the presence of a representative of the Employer.

1.14 Contractor's Local Agent

Instruction to Bidder: The Bidder shall state in his bid the name and address in Bangladesh of his local Agent, if any.

1.15 Civil and Building Works

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 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 grooving. The Contractor shall make records of the alignment, leveling or positional measurement and shall maintain such records until his activities at site are concluded. The building steel work shall be designed to carry the loads/forces imposed by pipe work, cables and associated fittings which also form part of the works, and all necessary supports and fixing shall be shown on the relevant drawings.

Such supports and fixings may be secured to the steel work by bolting welding or clamping.
No other supports or fixings shall be subsequently attached to the steel work nor may any other drilling, cutting or welding be carried out without the prior permission of the Project Manager.

1.16 Design and Construction Requirements and Interchangeability

1.16.1 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 with the recommendation of the Project Manager.

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.

1.16.2 Specific Requirements

The choice of plant and design of the installation is to meet the following criteria.
Sub-station layouts are to utilize the minimum of land area.
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.
The plant and installation shall be designed for a minimum service life of 25 years.

All plant is to have a minimum of 2 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 shall be provided by the Contractor if requested by the Project Manager.

Each 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.

The design and layout of the sub-stations shall ensure the safety of personnel concerned with the operation and maintenance of the plant.

1.17 Plant and Equipment Identification

1.17.1 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.

1.17.2 Labels and Nameplates

The Contractor shall supply and install all labels, ratings, instruction and warning plates necessary for the identification and safe operation of the works.

Nameplates of labels shall be non-hygroscopic 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.

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.

The Contractor shall be responsible for the relocation, or replacement of all labels on existing plant, which became inaccurate as a consequence of the contract works.

1.18 Safety and Security

1.18.1 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 Project Manager's approval. General descriptions of interlocking requirements are given in the specifications but the Contractor shall include for any other interlocks he considers necessary.

1.18.2 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 Project Manager.

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 Project Manager for groups of equipment.

All locks shall have individual high integrity locks and shall be provided with (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.

1.19 Spare Parts

1.19.1 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.

1.20 Consumable Items

1.20.1 Chemicals and other Consumable

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.

1.21 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 program 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 Project Manager.

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 Project Manager 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 does 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 completed, 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 dispatch 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 Project Manager 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 Project Manager 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 Project Manager.

On sheltered or unventilated horizontal surfaces on which dew may linger more protection is needed and to achieve this 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 Project Manager and the painting is finished at site to the Project Manager’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, sheradized 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.

1.22 Galvanized Work

All galvanizing shall be carried out by the hot dip process (and unless otherwise specified, shall conform in all respects with the relevant IEC specification).

Attention shall be paid to the detail of members, (in accordance with IEC specification). Adequate provision for filling venting and draining shall be made for assemblies fabricated form 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 specification). 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 STEELAVERAGESECTION mm	THICKNESS OF SIZECOATINGWEIGHT microns	MINIMUM COATING g/m²
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 stops, 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 BS 4606 part 1 and I) 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 provided adequate ventilation to all surfaces to avoid wet storage staining (with rust).

Small areas of the galvanized coating damaged in any way shall be brought to the attention of the Project Manager who shall authorize repair by:

Cleaning the area of any weld slug and though wire brushing to give a clean surface.

The application of two coats of zinc rich paint or the application of low melting point zincalloy repair rod or power to the damage area, which is heated to 300°C.

After fixing, bolt heads, washes and nuts shall receive two coats zinc rich paint.

1.23 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.

1.23.1 Pipe Work

All piping shall be designed, manufactured and tested in accordance with British Standards or equivalent Nationals Standards approved by the Project Manager. In particular, pipework 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 Wall Thickness
0-100mm	Table 2BS1387
150-200mm	4.87mm
250-600mm	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 Project Manager.

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.

1.23.2 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.

1.24 Electrical Insulation

Insulating materials shall be suitably finished so as to prevent deterioration of their qualities under the specified working conditions. Account shall be taken of the IEC 60085 and IEC 60505 recommendations.

Ebonite, synthetic resin-bonded laminated material and bituminized asbestos cement-bonded panels shall be of suitable quality selected from the grades or types in the appropriate British, IEC, or approved National Standard.

All cut or machined surfaces and edges of resin-bonded laminated materials shall be cleaned and then sealed with an approved varnish as soon as possible after cutting.

Linseed oil and untreated materials of fiber, leatheroid, presspahn, asbestos or other similar hygroscope types of materials shall not be used for insulation purposes. Untreated leatheroid and

presspahn may be used for mechanical protection of winding insulation.

Wherever practicable, instrument, apparatus and machine coil windings, including wire wound resistors, with the exception of those immersed in oil or compound, shall be thoroughly dried in a vacuum or by other approved means and shall then be insulating varnish. Varnish with a linseed oil base shall not be used.

No material of a hygroscope nature shall be used for covering coils. Where inter-leaving between windings in coils is necessary, only the best manila paper, thoroughly dried, which permits penetration by the insulating varnish or wax, shall be used.

1.25 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 60269 Identification labels fixed to panels, boards and desks for MCBs and links shall describe their duty, voltage and rating.

1.25.1 Miniature Circuit Breakers

All miniature circuit breakers (MCBs) shall comply with IEC 60157 and be fitted with over-current releases of both the thermal and instantaneous type. All MCBs supplied on this contract shall be to short circuit category P2 of IEC 60157.

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 MCBs 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 MCCBs.

1.25.2 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 60439. 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 (undrilled) 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 Project Manager's approval.

Twenty-five percent spare ways shall be provided for future use.

1.26 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 or IEC 60051.

Unless otherwise specified, all indicating instruments shall have 95mm square cases to DIN standard or equivalent circular cases.

Instrument dials in general shall be white with black markings and should preferably be reversible where double scale instruments are specified.

Scales shall be of such material that 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.

A.C. ammeters for transformer, feeder or inter connector circuits, and D.C ammeter for all load circuits except motors, shall have linear scales commencing at zero.

A.C and D.C ammeters for motor circuits shall have scales commencing at zero and with a compressed overload portion for reading of the associated minor starting current.

D.C. ammeters for the main battery circuit of D.C 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 for feeders shall have linear positive and negative 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 withdrawable flush mounted type and comply with the relevant parts of IEC 60521 and BS 5685, Class 1.0 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.

If applicable, recording instruments shall be of an approved type, and unless otherwise specified, shall have two 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 primaries 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 fuse 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.

All equipment shall be colored "NEMA Standard Grey 70" unless otherwise specified by the Project Manager.

1.27 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/I 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. Such discrepancy control switches shall be arranged in the lines of the mimic diagram on the switchgear panels. 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 Project Manager.

It shall not be possible at any time to operate any switchgear equipment from more than one location simultaneously, and suitable lockable selector switches shall be provided to meet this requirement.

The contacts of all control and selector switches shall be shrouded to minimize the ingress of dust and accidental contact, and shall be amply rated for voltage and current for the circuits in which they are used.

1.28 Auxiliary Switches

Auxiliary switches shall be to approval and contacts 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 equipment.

Auxiliary switches mechanically operated by the circuit breakers, contactors, isolators, etc. shall be to approval and contacts mounted in accessible positions clear of the operating mechanism of the circuit breaker, contactor, 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 contactor immediately the breaker or contactor 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 contactors and also for isolators.

1.29 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 it is necessary to differentiate between the urgency of alarms then various approved alarm tone devices shall be provided in this Contract. In addition and where specified an alarm beacon to the approval of the Project Manager 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 Project Manager, 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 Project Manager'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 Project Manager's approval.

1.30 Panels, Desks, Kiosks and Cubicles

1.30.1 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 Project Manager.

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 taped where a through hole would permit the ingress of moisture. All metal surfaces 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.Panels shall be “top entry” types with respect to control cabling.

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 Project Manager'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.

1.30.2 Indicating Lamps

All new indicators shall have a minimum continuous burning guaranteed life of 10,000 hours, at their rated voltage.

The Indicating lamps must be LEDs only and cluster LEDs for important functions subject to approval of the Project Manager.

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 Project Manager.

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.

1.30.3 Anti-Condensation Heaters

All switchboards, panels, cubicles, motor control Centre 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.

1.31 Panel Wiring and Terminal Boards

1.31.1 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 4 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 2.5 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 Project Manager'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 Project Manager.

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.

1.31.2 Identification of Cable Cores

Where a wire or 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 functional information on the purpose of the individual conductor plus markings at both-ends.

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 Project Manager. The Project Manager is not obliged to accept the Contractor's proposal.

Each core of multi-pair wiring shall be identified by color 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 block shall have independent terminals for incoming and outgoing cabling.

1.31.3 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. Contact 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 secondary 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.

Not 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 and to be approved by the Project Manager.

The Contractor shall submit samples of the terminal blocks/mounting rail assemblies together with details of his proposed cabling/termination system to the Project Manager 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 100 mm apart, on the side of the enclosure.

Sufficient terminals shall be provided to permit all cores on multicore 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 screw/drivers) the Contractor shall provide three sets of these at each sub-station site. In addition the Contractor shall provide 8 numbers, test leads of minimum 1500 mm 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 Project Manager’s approval.

1.32 Cable Boxes and Glands

Electrical equipment supplied under this contract shall be fitted with all necessary cable boxes and glands which shall be complete with all required fittings. Boxes shall be of adequate proportions to

accommodate all cable fittings, including stress cones or other means of cable insulation grading, and designed in such a manner that they can be opened for inspection where appropriate without disturbing the gland plate of incoming cable.

Glands for termination of cables to outdoor equipment or indoor areas liable to water spray, hosing or flooding shall incorporate provision for sealing against ingress of moisture or dust, and shall comply with the requirements of BS 6121 for sealing.

Removable gasketted steel gland plates shall be provided for multi-core cables and shall be supported from the sides of the enclosures, as near to the floor or roof as possible while allowing adequate space both above and below the plate for manipulation of the cable and gland. Gland plates for marshalling boxes shall be in the form of removable gasketted steel plate, forming part of the underside of the box.

The terminals for 3 phase cables shall be clearly marked with the phase colours (approved designations) to enable the cables to be terminated in the correct sequence.

Filling and venting plugs where required, shall be positioned so as to avoid the possibility of air being trapped internally and adequate arrangements shall be made for expansion of compound etc. There shall be no possibility of oil entering the cable box from an associated oil filled compartment. Cable sealing ends shall be arranged to project at least 25mm above the gland plate to avoid moisture collecting in the crutch.

Any chamber which is to be compound filled shall be clean and dry and at such a temperature before filling that the compound does not solidify during the filling process. Filling orifices shall be sufficiently large to permit easy and rapid filling.

All cable boxes shall be designed to withstand the high voltage D.C. cable tests prescribed in BS 6346, BS 6480 and IEC 60055 as appropriate.

If applicable, cable boxes for paper-insulated cables shall be complete with universal tapered brass glands (insulated from the box in an approved manner and including an island layer for testing purposes.

Even single core cables are used, particularly for currents in excess of 500 A, adequate steps must be taken to minimize the effects of eddy currents in the gland and bushing-mounted plate.

Cable glands for extruded solid dielectric insulated cables (PVC, EPR, and XLPE) shall be of the compression type and as specified in BS 6121.

Approved glands shall be used on MICC cables

Glands for armored or screened cables above 240 sqmmshall be provided with an integral heavy duty earthing lug capable of carrying the full earth fault current for a period not less than 1 second without deterioration.

Cable lugs and terminations for the receipt of all power control and instrumentation cable cores shall be provided.

Cable boxes for the termination of elastomeric cables up in 33 kV nominal service voltage shall be designed and dimensioned to provide adequate insulation in air for cables. Clearance and creepage distances shall be adequate to withstand the specified alternating current voltages and impulse

voltages for service under the prevailing site conditions. The performance is to be met without the use of insulating 'boots' shrouds orany other material fitted over or between the cable terminations apart from permanently fitted barriers forming part of the switchgear or cable box.

Means shall be provided for preventing accumulation of dirt, dust, moisture, vermin or insects such as to maintain the anticipated life of the equipment. The Contractor shall ascertain the means by which elastomeric cables are to be terminated and shall provide such information or instructions as necessary to any other contractor or sub-contract or to ensure compliance with this clause.

The cable crutch within a cable box or equipment panel shall be protected by the use of a heat-shrink plastic 'udder' places over the conductors and crutch.

1.33 Joints and Gaskets

All joint faces are to be flat and parallel to the approval of the Project Manager and arranged to prevent the ingress of water or leakage of oil with a minimum of gasket surface exposed to the action of oil or air.

Oil-resisting synthetic rubber gaskets are not permissible, unless the degree of compression is accurately controlled. For gaskets of cork or similar, oil resisting synthetic rubber may be used as a bonding medium. No joints are allow in gaskets.

1.34 Junction, Termination Marshalling Boxes, Operating Cubicles etc

All junctions, termination and marshalling boxes shall be of substantial sheet steel construction, having enclosure classification in accordance with the specification 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 Project Manager.

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 Project Manager, the Contractor shall, as each box is completed or at intervals as requested by the Project Manager, supply to the Project Manager copies of accurate termination or destination charts showing the as-fitted arrangement of cables and cores in each box. The Contractor shall, following the Project Manager's approval, fit one plastic laminated copy of the appropriate chart to the interior of each box.

1.35 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 Project Manager. 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 60423 and IEC 60614.

No conduit smaller than 19 mm 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.

Conduits shall be supported on heavy galvanized spacer saddles so as to stand off at least 6 mm 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.

1.36 Trunking

Steel trunking etc. may be used for running numbers of insulated cables or wires in certain positions to the approval of the Project Manager. The trunking thickness shall not be less than 1.2 mm.

1.37 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 Project Manager.
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.

1.38 Drawings, Diagrams and Calculations

1.38.1 General

The term "drawing" shall also include diagrams, schedules, performance curves, and calculations etc., required for the comprehensive design of the works. The Contractor shall be responsible for the provision of all drawings required for the various stages of the contract. All drawings, apart from workshop drawings, shall be submitted to the Project Manager for his recommendation and final approval by the concerned committee of BREB, in accordance with an approved program. The Contractor shall ensure that drawings are submitted for approval in good time such that they may be approved within the specified period prior to the manufacture or construction commencing. Further adequate time must be allowed by the Contractor to permit any comments made by the Project Manager to be incorporated. Any works performed prior to approval of drawings by the concerned committee of BREB will be entirely at the Contractor's own risk including any delays that may result from modifications being found to be necessary by the Project Manager.

The Contractor shall be fully responsible for obtaining any drawing or data of existing plant and installations that he requires in order to carry out the works, and shall also be responsible for verifying that any drawings of existing plant and installations are accurate. The Contractor shall provide suitable drafting and other staff on site that he requires investigating and producing any drawings that he requires of existing equipment and installations in order to carry out the works. Any cost associated with these requirements is deemed to be included in the contract price.

Where existing installations have been modified or extended the Contractor shall provide complete new sets of drawings. In this respect the Contractor shall provide drawings detailing both the existing and new works and shall not limit the scope of the drawings to the new works only.

5 (Five) sets of As-built drawings together with operation and maintenance manual of the equipment installed shall be submitted.

1.38.2 Format

Drawings are to be submitted for approval on paper prints, folded to A4 size with the project title block and drawing numbers fully visible.

All drawings are to be submitted on "A" series paper to ISO/5457. The maximum size of drawings shall be A1 except for site survey and layout drawings which may be submitted as A0 size sheets, if necessary, to accommodate details on a scale of 1:100. Single line diagrams and schematic drawings shall preferably be on a maximum sheet size of A2. All dimensional drawings shall be to the following scales and fully detailed.
1:1, 1:2, 1:5, 1:10 and factors of 10 thereof.

Drawings symbols shall be in accordance with IEC 60117.

All drawings are to be submitted in Auto Cad format in CDR Disks.

Drawing titles shall clearly identify the specific function of the drawings and where appropriate the name of the site(s) to which the drawing applies.

1.38.3 Drawing Numbering and Revisions

The Contractor shall be responsible for adding the Employer's drawing numbers to all drawings prior to submittal. Following award of the contract, the Project Manager and the Contractor will review the numbering system, familiarize each other with requirements, and agree on the numbering system to be applied.

Comprehensive cross-references are to be included on drawings and the Contractor shall include the Employer's drawing numbers in the cross-references.

At each and every issue of a drawing the revision shall be raised, and details given in revision boxes on the drawings. Comprehensive details of revisions are to be given and phrases such as "REVISED", "UPDATED", "MODIFIED" or similar are not acceptable.

Reference to any drawing in communications shall include the Employer's drawing number.

1.39 Operating and Maintenance Manuals

1.39.1 General

The Contractor shall be responsible for compiling operation and maintenance (O&M) manuals for each section of the works and all equipments used.

Drafts of the manuals are to be submitted to the Project Manager at least six weeks prior to the commencement of pre-energization commissioning checks on Site. Following examination the Project Manager will forward copies of his comments to the Contractor to action prior to issuing Final O&M manuals. Final O&M manuals are to be available on site prior to the issue of the Taking over Certificate.

Handling, installation, storage and transit instructions, in accordance with BS 4884 part 1, which shall form part of the manuals, are to be available on site prior to the arrival of the Plant.

In addition to the compiled manuals, the Contractor shall submit copies of brochures and other explanatory literature with drawings of the plant, which will assist the Project Manager in approval of the drawings.

1.39.2 Contents

Operation and Maintenance manuals shall be prepared for the equipment supplied for the substation. The content and presentation of the manuals shall conform in full with BS 4884 parts 1 and 2.

The O&M manuals are also to contain a complete drawing list appropriate to the individual section of the works. The drawing list shall include the Project Manager's drawing numbers.

Maintenance instructions for all plant shall cover preventive and corrective maintenance procedures. For electronic or solid state control, protection equipment etc. details shall be provided to enable individual circuit cards to be checked for correct operation and faults to be traced, and repaired.

The Contractor shall provide proformas of the required maintenance record sheets for all plant, which shall include cross-reference to the appropriate section of the O&M manuals which detail how to perform the tasks required. Any other record sheets suitable for the monitoring of the plant shall also be designed and provided.

1.39.3 Binders, Presentation

The information will be provided on A4 pages, with diagrams on throw-clear pages where required to enable the text and diagrams to be refereed to simultaneously.

The front cover and spine of the manuals shall give the following information:

Project Title
Employer's name
Contract number
Identification of the Section of the Works
Volume number and total number of volumes applicable
(e.g. volume 3 of 5 volumes)
Contractor's company logo and name

The above shall also be provided on a flysheet inside the front cover of each volume. Draft O&M manuals may be presented in unprinted covers.

Four copies of draft O&M manuals are to be provided to the Project Manager; following approval 8 copies are to be provided to the Project Manager or his site Representative for each section of the works.

1.40 Site Storage Facilities

The Contractor shall provide lockable cabinets in each of the individual substations, which are to contain the following:

(a) One set of paper prints of the complete record of drawings for the section of the work. These shall be arranged in a logical sequence in accordance with the drawing list contained in the O&M manuals. Record drawings are to be grouped into labeled pockets or binders to minimize disturbance in locating specific drawings. As-built drawings are to be stored in these locations prior to the issue of record drawings.
(b) Two complete sets of O&M manuals
(c) Volumes of factory and site test reports/certificates
(d) Copies of maintenance log sheets, record sheets etc.
(e) Space for stationery and operators' log books

These cabinets shall match other furnishings being provided in the substation and the location as such items is to be included in the design of the substation layout.

1.41 Switchyard Cable Ducts and Conduits

A system of UPVC conduits (equipment to duct) and pre-cast concrete ducts shall be used for control and LV cabling between switchyard equipment and the control building. Entry to the control/ protection panels in the building shall be via the top of the panels and a suitable sealing arrangement.

HV cabling between the transformers and switchgear panels shall be installed in concrete ducts in the switchyard and within the building. HV Cabling between the control building and the feeder termination poles shall be direct buried outside the building.

PARTICULAR SPECIFICATIONS

TABLE OF CONTENTS

Description

Introduction
Power Transformers
Technical Requirement and Guarantee Schedule
(a) OLTC Type 20/28 MVA 33/11.55 K, 50 Hz Power Transformers
(b) OLTC Type 33/11.55 kV 10/14MVA Power Transformers
(c) 33 kV Surge Arrester, Station Class
(d) 11 kV Surge Arrester, Station Class
(e) 33/0.415 kV, 3 Phase 100 kVA Station Transformer
33 kV Outdoor Vacuum Circuit Breaker
Technical Requirement and Guarantee Schedule
(f) 33 kV Outdoor Type Vacuum Circuit Breaker (VCB)
(g) 33 kV Control and Energy Metering Panel
(h) Indication meter
(i) 33 kV Current Transformer (CT)
(j) 33 kV Voltage Transformer
11 kV Indoor Vacuum Circuit Breaker
Technical Requirement and Guarantee Schedule
(k) 11 kV Switchgear and Control Equipment
36 kV Underground Power Cable
15 kV Underground Power Cable
500 mm² 11 KV XLPE Cable
Technical Requirement and Guarantee Schedule
(l) 11KV, 1-Core x 500 Sq. mm U/G XLPE Copper Cable
(m) Joining kits for 11 kV XLPE, 1-Core, 500 mm2 Copper Cable
Conductors and Connections
Disconnectors and Earthing Switches
Insulators
Technical Requirement and Guarantee Schedule
(n) 33 kV Isolator/ Earth Switch
(o) 11 kV Isolator
(p) 33 kV Double Break Switched Fuse
Substation Earthing Systems
Substation Battery and Battery Charger
Overhead Earthing Screen
Section VI. Employers Requirements

1.1 INTRODUCTION

This section describes the Particular Technical Requirements for the 33 kV outdoor switchgear, the 11kV indoor switchgear, the main 33/11.55kV OLTC Transformers and all associated substation equipment, and shall be read in conjunction with the General Technical Requirements, Schedules and Drawings in the specification. The latest edition of the relevant IEC, British or American standard shall apply. Standards from other countries may be considered by the Project Manager if equivalent to or better than the above relevant standards.

PUBLICATION 916A-2014
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)
PEOPLE'S REPUBLIC OF BANGLADESH
STANDARD FOR SUB-STATION
OLTC TYPE THREE PHASE POWER TRANSFORMERS:
10 MVA & 20 MVA

PART-1: GENERAL

1. SCOPE

The transformers shall be suitable for continuous operation on a three-phase 50 Hz high voltage transmission system as specified herein. .

The transformers shall be of the three phase oil immersed type and designed with particular attention to the suppression of harmonic especially the third and fifth harmonics and to minimize the detrimental effects resulting there from. All transformers shall be suitable for outdoor installation on concrete bases and shall be designed to operate satisfactorily in parallel with each other. The transformer shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of delivery.

The cooling for the transformers shall be ONAN/ONAF as specified.

2. REFERENCES

2.1 British Standards

BS 61	Specification for threads for light gauge copper tubes and fittings
BS 3600	Specification for dimensions and masses per unit length of welded and seamless steel pipes and tubes for pressure purposes
BS 4504	Circular flanges for pipes, valves and fittings (PN designated)
BS 6121	Mechanical cable glands
BS 6346	Specification tor PVC insulated cables for electricity supply
BS 6435	Specification for unfilled enclosures for the dry termination of HV cables for transformers and reactors
BS 7354	Code of practice for design of HV open terminal stations
BS 7613	Specification tor hot rolled quenched and tempered wieldable plates

2.2 BS European Standards

BS EN 10029 Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3mm thick and above.

2.3 IEC Standards

IEC 60076	Power transformers
IEC 60137	Insulated bushings for ac voltages above l000 V
IEC 60186	Voltage transformers
IEC 60214	On load tap changers
IEC 60228	Conductors of insulated cables

IEC 60233	Tests on hollow insulators for use in electrical equipment
IEC 60296	Specification for unused mineral insulating oils tor transformers and switchgear
IEC 60354	Loading guide for oil immersed power transformers
IEC 60422	Supervision and maintenance guide for mineral insulating oils in electrical equipment
IEC 60529	Degrees of protection provided by enclosures
IEC 60551	Determination of transformer and reactor sound levels

3. CLIMATE DATA

Main climate data that must be taken into account for the goods will be the followings:

Climate	: Tropical, intense sunshine, heave rain
Maximum Temperature	: 45^0 C
Minimum Temperature	: 03^0 C
Average daily Temperature	: 30^0 C
Average isokeraunic level	: 80 days/ year
Relative humidity	: 50-100%
Average annual rain fall	: 3454 mm
Maximum wind velocity	: 200 km/hour
Altitude	: 300 meters above Sea level

Atmospherically, Mechanical and Chemical impurities: Moderately polluted

The information is given solely as a guide for Bid and no responsibility for its, Accuracy will be accepted nor will any claim based on the above be entertained.

Transformer supplied under this Contract will be installed in tropical locations that can be considered hostile to its proper operation. Particular problems that shall receive special consideration relate to operation in a humid environment and presence of insects and vermin.

4. SYSTEM CONDITIONS

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

Frequency	50 Hz
Nominal system voltages	33 kV 11 kV 400/230V
Maximum system voltages:	33 kV System 36 kV 11 kV System 13.2 kV LV System 440V
Minimum LV voltage	360 V
Nominal short circuit levels	33 Kv System 31.5 kA 11 Kv System 31.5 kA
Insulation levels: 1.2/50 ms impulse withstand (positive and negative polarity)	33 kV System 170kV 11 kV System 75 kV
Power frequency one minute withstand (wet and dry)	33 kV System 70 kV 11 kV System 28 kV LV System 3 kV
Neutral earthing arrangements	33 kV System solidly earthed 11 kV System solidly earthed LV System solidly earthed

5. INSPECTION AND TESTING

During pre-delivery/ pre-shipment inspection; BREB's inspection team will witness the following test of not less than 10% of total quantity ready for delivery on random sampling basis (sample selected by the inspection team) during factory test in manufacturer's factory premises:

1. Measurement of turn ration test;
2. Vector group test (check of phase displacement)
3. Measurement of winding resistance;
4. Measurement of no load loss & no-load current;
5. Measurement of impedance voltage & load loss;
6. Dielectric withstands test;
7. Transformer oil test;
8. Temperature rise test.
9. Impulse test.

Besides BREB's inspection team will perform some physical test of at least 10 (ten) % transformer of on random sampling basis during factory test:

1. Transformer tank sheet thickness (top bottom & side);
2. Hot dip galvanization test as per standard BS-729 of all bolts & nuts connected with transformer tank, conservator, radiator etc;
3. Dimension of bolted type bimetallic connector for H.T. and L.T. bushing;
4. Dimension of tanks;
5. Checking of creep age distance of HT/LT bushings.
6. Others visible parts as per approval drawing.

As and when the Employer is satisfied that any materials/equipment shall have passed the relevant tests, the Employer/ Project Manager shall notify the Contractor in writing to that effect.

Should any inspected/tested goods fail to conform to the specification, the Employer shall have the right to reject any of the items or complete batch if necessary. In that case the Contractor shall replace the goods or make them good without any cost to the Employer. The inspection and testing shall be carried out again and all costs thereof shall be borne by the Contractor.

Nothing in this clause shall in any way release the Contractor from any warranty or other obligations under the Contract.

5.1 Type Tests:

Instructions to the Bidders: The following shall be regarded as type tests. The Bidder shall submit all Type test reports from internationally recognized independent testing laboratory along with his/ her bid.

5.1.1 Type Tests (for Transformer):

(a) Test of temperature rise (for both ONAN and ONAF).
(b) Short circuit test.

(c) Dielectric test: (Induced over voltage test, Lightning Impulse voltage withstand test, Power frequency voltage withstand test)

Temperature Rise, Short Circuit and Dielectric test (Induced over voltage test, Lightning Impulse voltage withstand test, Power frequency voltage withstand test) on one Transformer of each type and size (i.e. same KVA, KV, AMPS, Frequency, Impedance, Weight of the Core, Oil etc. with tolerance ±5%) of Transformer. These all type tests shall be done on same Transformer.

5.1.2 HT Bushing type test:

- Dry or wet power-frequency voltage withstand test;
- Dry lightning impulse voltage withstand test;
- Temperature rise test ;
- Verification of thermal short-time current withstand;
- Cantilever load withstand test;
- Verification of dimensions.

5.2 Special Tests:

a) Noise level measurement, in accordance with IEC Publication 551 using a precision sound level meter conforming to IEC Publication 651. In addition the test shall be repeated with narrow band filters for the harmonic frequencies from 100Hz. up to 350 Hz.
b) Magnetic balance test.
c) Dissolve gas test (for transformer oil).
d) Harmonics measurement test.
e) Measurement of zero phase sequence impedance.

5.3 Routine Tests

The following shall be regarded as routine tests and shall be carried out on each transformer.

(a) Measurement of winding resistance at principal tap and two extreme taps.
(b) Voltage-ratio measurement and check of vector group.
(c) Measurement of the impedance voltage at principal tap and two extreme taps.
(d) Measurement of the load loss.
(e) Measurement of no-load loss and no-load current, including measurement of harmonics.
(f) Applied voltage test to all auxiliary circuits.
(g) Tests on on-load tap-changer (fully assembled on transformer).
(h) Induced over-voltage withstand test. The voltage applied shall be the relevant power frequency voltage specified in the clause on Insulation Levels.
(i) Separate source voltage withstand test. The applied voltage shall be the relevant power frequency voltage specified in the clause on Insulation Levels.
(j) Polarization index test (1 minute and 10 minute). Index shall be not less than 1.3.
(i) Dielectric withstands test;
(j) Transformer oil test;
(k) Lightning Impulse Voltage with Withstand test (minimum 2 nos. of each type of transformer per lot)
(l) Temperature rise test (minimum 2 nos. of each type of transformer per lot)

5.3.1 Routine Test Sequence

The sequence of tests shall be:

(a) Winding resistance measurement, voltage ratio measurement and vector group check
(b) Separate source voltage withstand test, induced over-voltage withstand test, **impulse test.**
(c) Impedance voltage and loss measurements.
(d) Tap changer test.
(e) Tests on auxiliary circuits.
(f) Temperature rise test.

The following tests on site will be carried out after plant is fully assembled:

(a) Ratio and vector group checks.
(b) Insulation resistance (HV-LV, HV-E, LV-E).
(c) Oil tests.
(d) Other necessary pre-commissioning tests.

The Contractor will be held responsible for any discrepancy or defect discovered during these tests and shall rectify immediately on receipt of notification at no cost to the Employer. The Contractor may at his own discretion witness site testing of transformers.

6. PACKING AND SHIPPING

6.1 Packing

The equipment and any supporting structures are to be transported adequately sealed against water ingress. All accessories and spares shall be packed and securely clamped against movement in robust, wooden, non returnable packing cases to ensure safe transit in rough terrain, cross country road conditions and in heavy rains from the manufacturer's works to the work sites.

- individual serial number;
- employer’s name;
- contract number;
- destination;
- a colour coded marking to indicate destination;
- contractor’s name;
- name and address of contractor;
- description and numbers of contents;
- manufacturer’s name
- country of origin;
- case measurements;
- gross and net weights in kilograms; and
- all necessary slinging and stacking instructions.

Each crate or container shall be marked clearly on the outside of the case to show TOP and BOTTOM positions with appropriate signs to indicate where the mass is bearing and the correct positions for slings. All component parts which are separately transported shall have permanent identification marks to facilitate correct matching and assembly at site. Welded parts shall be marked before welding. Six copies of each packing list shall be sent to the Employer prior to dispatching the equipment.

6.2 Shipping

The Contractor shall be responsible for the shipping of all plant and equipment supplied from abroad to the ports of entry and for the transport of all goods to the various specified destinations including customs clearance, off loading, warehousing and insurance.

The Contractor shall inform himself fully as to all relevant transport facilities and requirements and loading gauges and ensure that the equipment as packed for transport shall conform to these limitations. The Contractor shall also be responsible for verifying the access facilities specified.

The Contractor shall be responsible for the transportation of all loads associated with the contract works and shall take all reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute loads so that the risk of damage shall be avoided. The Contractor shall immediately report to the Employer any claims made against the Contractor arising out of alleged damage to a highway or bridge.

All transport accessories, such as riding lugs, jacking pads or blanking off plates shall become the property of the Employer. All items of equipment shall be securely clamped against movement to ensure safe transit from the manufacturer's facilities to the specified destinations.

The Contractor shall advise the storage requirements for any plant and equipment that may be delivered to the Employer’s stores. The Contractor shall be required to accept responsibility for the advice given in so far as these arrangements may have a bearing on the behavior of the equipment in subsequent service.

6.3 Hazardous substances

The Contractor shall submit safety data sheets for all hazardous substances used with the equipment. The Contractor shall give an assurance that there are no other substances classified as hazardous in the equipment supplied. No oil shall be supplied or used at any stage of manufacture or test without a certificate acceptable to the Employer that it has a PCB content zero. The Contractor shall accept responsibility for the disposal of such hazardous substances, should any be found.

The Contractor shall also be responsible for any injuries resulting from hazardous substances due to non compliance with these requirements.

7. SUBMITTALS

7.1 Submittals required with the bid

The following shall be required with each copy of the bid:

- completed technical data schedule;
- descriptive literature giving full technical details with calculation of heat dissipation, radiator arrangement, no-load loss, full load loss, short circuit withstand capability, with considering flux density and current density of equipment offered for both ONAN and ONAF;

- outline dimension drawing for each major component, general arrangement drawing showing component layout and general schematic diagrams;
- type test certificates, where available, and sample routine test reports;
- detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating;
- details of manufacturer's quality assurance standards and program and ISO 9000 series or equivalent national certification;
- deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;
- list of recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements.

7.2 Submittals required after contract award

7.2.1. Program

Five copies of the program for production and testing.

7.2.2. Technical Particulars

Within 30 days of contract award five bound folders with records of the technical particulars relating to the equipment. Each folder shall contain the following information:

- general description of the equipment and all components, including brochures;
- technical data schedule, with approved revisions;
- calculations to substantiate choice of electrical, structural, mechanical component size/ratings;
- detailed dimension drawing for all components, general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings for all components;
- detailed loading drawing to enable the Employer to design and construct foundations for the transformer;
- statement drawing attention to all exposed points in the equipment at which copper/aluminum or aluminum alloy parts are in contact with or in close proximity to other metals and stating clearly what protection is employed to prevent corrosion at each point;
- detailed installation and commissioning instructions; at the final hold point for Employer approval prior to delivery of the equipment the following shall be submitted;
- inspection and test reports carried out in the manufacturer's works;
- operation and maintenance instructions as well as trouble shooting char

7.2.3. Operation and Maintenance instructions

The copy of installation and commissioning instructions and of the operation and maintenance instructions and troubleshooting charts shall be supplied with each transformer. The Contractor/ Supplier should provide detail drawing including specified loss, ratio, impedance, tap position against primary voltage etc.

7.3 Drawings

Within 30 days of Contract commencement the Contractor shall submit, to the Project Manager for recommendation and approval by the concern committee of the Employer, a schedule of the drawings to be produced detailing which are to be submitted for “Approval” and which are to be submitted “For Information Only”. The schedule shall also provide a program of drawing submission, for approval by the concern committee of the Employer that ensures that all drawings

and calculations are submitted within the period specified above. All detail drawings submitted for approval shall be to scale not less than 1:20. All important dimensions shall be given and the material of which each part is to be constructed shall be indicated on the drawings. All documents and drawings shall be submitted in accordance with the provisions of this specification and shall become the property of the Employer. All drawings and calculations, submitted to the Employer, shall be on international standard size paper, either A0, A1, A2, A3 or A4. All such drawings and calculations shall be provided with a Contract title block, which shall include the name of the Employer and Consultants and shall be assigned a unique project drawing number; the Contract title block and project numbering system shall be agreed with the Employer. Script sizes and thickness of scripts and lines be selected so that if reduced by two stages the alphanumeric characters and lines are still perfectly legible so as to facilitate microfilming. For presentation of design drawings and circuit documents IEC Publication 617 or equivalent standards for graphical symbols are to be followed.

8. SHIPMENT AND DRYING OUT

8.1 Shipment

Each transformer, when prepared for shipment, shall be fitted with a shock indicator or recorder which shall remain in situ until the transformer is delivered to Site. In the event that the transformer is found to have been subjected to excessive shock in transit, such examination as is necessary shall be made in the presence of the Project Manager.

Where practicable, transformers shall be shipped with oil filling to cover core and windings but, when shipped under pressure of gas, shall be fitted for the duration of delivery to Site and for such time there after as is necessary, with a gauge and gas cylinder adequate to maintain internal pressure above atmospheric.

All earthing transformers shall be shipped full of oil.

8.2 Drying Out

All transformers shall be dried out by an approved method at the manufacturer's works and so arranged that they might be put into service without further drying out on Site.

Clear instructions shall be included in the Maintenance Instructions regarding any special precautionary measures (e.g. strutting of tap changer barriers or tank cover) which must be taken before the specified vacuum treatment can be carried out. Any special equipment necessary to enable the transformer to withstand the treatment shall be provided with each transformer.

9. APPROVAL PROCEDURE

The Contractor shall submit all drawings, documents and type test reports for approval in sufficient time to permit modifications to be made if such are deemed necessary and resubmit them for approval without delaying the initial deliveries or completion of the Contract work. The Employer's representative shall endeavor to return them within a period of four weeks from the date of receipt. Three copies of all drawings shall be submitted for approval and three copies for any subsequent revision. The Employer reserves the right to request any further additional information that may be considered necessary in order to fully review the drawings. If the Employer is satisfied with the drawing, one copy will be turned to the Contractor marked with "Approved" stamp. If the Employer is not totally satisfied with the drawing, then "Approved Subject to Comment" status will be given to it and a comment sheet will be sent to the Contractor. If the drawing submitted does not comply with the requirements of the specification then it will be given "Not Approved" status and a comment sheet will be sent

to the Contractor. In both these cases the Contractor will have to modify the drawing, update the revision column and resubmit for final Approval. Following approval, twenty copies of the final drawings will be required by the Employer within the time allocated for design and drawing approval.

Any drawing or document submitted for information only should be indicated as such by the Contractor. Drawings and documents submitted for information only will not be returned to the Contractor unless the Employer considers that such drawing needs to be approved, in which case they will be returned suitably stamped with comments.

The Contractor shall be responsible for any discrepancies or errors in or omissions from the drawings, whether such drawings have been approved or not by the Employer. Approval given by the Employer to any drawing shall not relieve the Contractor from his liability to complete contract works in accordance with this specification and the condition of contract nor exonerate him from any of his guarantees.

If the Contractor needs approval of any drawing within a period of less than four weeks in order to avoid delay in the completion of supply, he shall advise the Employer when submitting the drawings and provide an explanation of the document's late submission. The Employer will endeavor to comply with the Contractors timescale, but this cannot be guaranteed.

10. SURFACE TREATMENT

A full description of the corrosion prevention system proposed by the Contractor shall be given in the Schedule and this is subject to acceptance by the Employer. This description shall include details of surface preparation, rust inhibition, paint thickness, treatment of fasteners and painting of surfaces in contact with oil.

All machining, drilling, welding, engraving, scribing or other manufacturing activities which would damage the final surface treatment shall be completed before the specified surface treatment is carried out. Any subsequent damage occurring to the surface treatment up to the final delivery and offloading shall be made good by the Contractor.

10.1 Painting

All paints shall be applied on clean, dry surfaces under suitable atmospheric and other conditions in accordance with the paint manufacturer's instructions. All paints used shall be compatible with each other and capable of being used as a system. The system shall be capable of performance for five years in the environment specified without any need for maintenance. No consecutive coats of paint shall be of the same shade. The minimum standards acceptable are:

- Cleaning by shot blasting to Grade Sa 2.5 of ISO 8501-1.
- All sheet steelwork shall be degreased, pickled and phosphate in accordance with IS 6005 - "Code of Practice for phosphate of iron and steel."
- All rough surfaces of coatings shall be filled with an approved two pack filler and rubbed down to a smooth finish.
- Interior surfaces of mechanism chambers, boxes and kiosks, after preparation, cleaning and priming shall be painted with one coat of zinc chromate primer, one coat of phenolic based undercoating, followed by one coat of phenolic based finishing paint to white colour followed by a final coat of anti-condensation white paint of a type and make to the approval of the Employer. A minimum overall paint film thickness of 150 microns shall be maintained throughout.
- Exterior steel work and metalwork, after preparation and priming shall be painted with one coat of zinc chromate primer, one coat of phenolic based under coating and two

coats of micaceous iron oxide paint, then painted with a final coat of phenolic based hard gloss finishing paint of the Light Grey Shade No 631 of IS 5, to provide an overall minimum paint thickness of 200 microns.

10.2 Galvanizing

All galvanizing shall be carried out by the hot dip process, in accordance with Specification ISO 1460 or IS 2629. However, high tensile steel nuts, bolts and spring washers shall be electro galvanized to service condition 4. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath which could have a detrimental effect on the durability of the zinc coating.

Before pickling, all welding, drilling, cutting, grinding etc. must be completed and all grease, paint, varnish, oil, welding slag etc. completely removed. All protuberances which would affect the life of galvanizing shall also be removed.

The weight of zinc deposited shall be in accordance with that stated in standard BS 729 and shall be not less than 0.61 kg/sq. mtr with minimum thickness of 86 microns for items of thickness more than 5 mm, 0.46 kg/ sq. mtr. (64 microns) for items of thickness between 2 mm & 5 mm and 0.33 kg/ sq. mtr (47 microns) for items less than 2 mm thick. Parts shall not be galvanized if their shapes are such that the pickling solution cannot be removed with certainty or if galvanizing would be unsatisfactory or if their mechanical strength would be reduced. Surfaces in contact with oil shall not be galvanized unless they are subsequently coated with an oil resistant varnish or paint. In the event of damage to the galvanizing the method used for repair shall be subject to the approval of the Employer or that of his representative. Repair of galvanizing on site will generally not be permitted.

The threads of all galvanized bolts and screwed rods shall be cleared of splitter by spinning or brushing. A die shall not be used for cleaning the threads unless specifically approved by the Employer. All nuts and bolts shall be hot dip galvanized. Partial immersion of the work shall not be permitted and the galvanizing tank must therefore be sufficiently large to permit galvanizing to be carried out by one immersion.

After galvanizing no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. To avoid the formation of white rust, galvanized material shall be stacked during transport and stored in such a manner as to permit adequate ventilation. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

PART-2: TECHNICAL

11. TYPE OF TRANSFORMER

The transformers shall be double copper wound, three phase, oil immersed, **33/11.55 kV,** 50 Hz with on-load tap-changer for 10/14 MVA Transformer and 20/28 MVA Transformer

The transformers shall be naturally cooled type ONAN and forced cooled type ONAF.

12. RATED CAPACITY

The MVA ratings shall be 10/14 MVA and 20/28 MVA based on ONAN/ONAF. Each transformer shall be capable of supplying its rated power continuously at all tap positions. The transformers shall also be capable of delivering rated current at an applied voltage equal to l05% of the rated voltage.
Each transformer shall be capable of supplying its rated power continuously under ambient temperature conditions without the temperature rise of the top oil exceeding 55°C and without the temperature rise of the windings as measured by resistance exceeding 60°C. The ambient temperature conditions are as follows:

Maximum ambient temperature	45° C
Maximum daily average ambient temperature	35° C
Maximum yearly weighted average ambient temperature	32° C

13. VOLTAGE RATIO

Each transformer shall be supplied with an on load tap changer (as specified) connected to the high voltage winding. The tap changer shall have 17 tap positions and shall be so arranged as to give variations of transformation ratio in equal steps of 1.5% per step. The total range of the tap changer shall be from +6 percent to -18.0 percent. Tap 5 shall be the principal tap and the transformation ratio at tap 5 shall be 33.00 KV to 11.55 KV**.**

The no-load voltage ratios shall be as follows (for OLTC):

Tap No.	High Voltage	Low Voltage
1	34.98 kV	11.55kV
5	33.00kV	11.55kV
17	27.06kV	11.55kV

14. WINDING CONNECTIONS AND VECTOR GROUP

The transformers shall be connected in accordance with IEC Publication 76 as follows:

HV Winding : Delta connected.
LV Winding : Star connected.
Vector Group : Dyn 1

15. INSULATION LEVELS

The transformers shall be designed and tested to the following insulation levels:

Line Terminals	Power Frequency Voltage (rms.)	Lightning Impulse Voltage (peak)
33kV	70kV	170 kV (1.2/50 μ sec.)
11kV	28kV	75 kV (1.2/50 μ sec.)

The windings shall be uniformly insulated and the low voltage neutral point shall be insulated for full voltage.

16. IMPEDANCE VOLTAGE

The impedance shall be as follows:

10 MVA	8.0%
20MVA	10.0%

The impedance voltage refers to all tap positions i.e. the manufacturer should maintain the following impedance with it's given tolerance at any tap position of the transformer. No negative tolerance on this percentage impedance is allowed. A positive tolerance of +10% is allowed. Transformers of each rating shall have corresponding impedance per tap characteristics such that transformers of the same rating can be operated in parallel and it should be provided along with the routine test report.

17. SHORT CIRCUIT PERFORMANCE

The transformer shall be capable of withstanding the thermal and dynamic effects of short circuits, as specified in IEC 76-5 'Ability to withstand short circuits'.

Each transformer shall be capable of withstanding for 2 seconds a bolted metallic short circuit on the terminals of either winding with rated voltage on the other winding and the tap-changer in any position.

Short circuit tests shall have been carried out on the particular design of transformer offered, the test results shall be supplied with the bid.

18. REGULATION

The regulation of each transformer from no-load to continuous rated output at 1.0 power factor and at 0.85 lagging power factor shall be as guaranteed in the Technical Data Schedules.

19. FLUX DENSITY

Each transformer shall be capable of operating continuously with rated current and with system maximum voltage applied to the low voltage winding at a frequency of 96 per cent of rated frequency without exceeding the temperature rise specified in Clause 12.

The limit of flux density at normal voltage and frequency shall be subject to the requirements for losses, harmonics and noise suppression but in any event shall not exceed 1.6 Tesla.

The transformer core shall not be saturated at maximum system voltage i.e. 36 kV.

20. HARMONIC CURRENTS

The transformers shall be designed with particular attention to the suppression of harmonic voltages, especially the 3rd, 5th and 7th harmonics, so as to eliminate wave form distortion and the possibility of high frequency disturbances, induction effect or of circulating current between neutral points at different transformer stations.

21. PARTIAL DISCHARGE

Each transformer shall be partial discharge free up to 120% of rated voltage as the voltage is reduced from 150% of rated voltage i.e. there shall be no significant rise above background level.

22. VOLTAGE CONTROL

22.1 General

Transformers shall be provided with tap changers for varying the effective transformation ratio. Control schemes shall utilize 110V ac centre tap earthed voltage derived from the LV 3-Phase, 4-Wire system. Phase failure relays shall be provided to ensure a secure supply. Winding taps as called for in the Technical Requirements and Guarantee Schedule shall be provided on the high voltage winding.

All terminals shall be clearly and permanently marked with numbers corresponding to the cables connected thereto.

Tap positions shall be numbered consecutively, ranging from one upwards. The tap positions shall be numbered so that by raising the tap position the LV voltage is increased

22.2 On-Load Tap Changers

22.2.1 General

On-load tap changers are according as per IEC 60214 and be from Maschinenfabrik Reinhausen(MR) Germany/ABB Sweden and should be of the vacuum switching type in order to comply with existing equipment standards, including operational experience, spare parts, interchangeability, system reliability etc.. The On-Load Tap Changers shall be Oil/Vacuum type.

Current making and breaking switches associated with the tap selectors or otherwise where combined with tap selectors shall be contained in a tank in which the head of oil is maintained by means completely independent of that on the transformer itself. Details of maintaining oil separation, oil levels, and detection of oil surges and provision of alarm and trip contacts shall be dependent on the design of tap-changer and be to the approval of the Project Manager.

22.2.2 Mechanisms

The tap change mechanism shall be designed such that when a tap change has been initiated, it will be completed independently of the operation of the control relays and switches. If a failure of the auxiliary supply during tap change or any other contingency would result in that movement not being completed an approved means shall be provided to safeguard the transformer and its auxiliary equipment.

Limit switches shall be provided to prevent over-running of the tap changing mechanism. These shall be directly connected in the operating motor circuit. In addition, mechanical stops shall be fitted to prevent over-running of the mechanism under any conditions. For on-load tap change equipment these stops shall withstand the full torque of the driving mechanism without damage to the tap change equipment.

Thermal devices or other approved means shall be provided to protect the motor and control circuit.

A permanently legible lubrication chart shall be provided and fitted inside the tap change mechanism chamber.

22.2.3 Local and Remote Control

Equipment for local manual and electrical operation shall be provided in an indoor cubicle complying with Section-2. A thermostat controlled anti-condensation heater is to be provided in the cubicle. Electrical remote control equipment shall also be supplied as specified.

The following operating conditions are to apply to the on-load tap changer controls:-

a) It must not be possible to operate the electric drive when the manual operating gear is in use.
b) It must not be possible for two electric control points to be in operation at the same time.
c) Operation from the local or remote control switch shall cause one tap movement only, unless the control switch is returned to the off position between successive operations.
d) It must not be possible for any transformer operating in parallel with one or more transformers in a group to be more than one tap out of step with the other transformers in the group.
e) All electrical control switches and local manual operating gear shall be clearly labeled in an approved manner to indicate the direction of tap changing, i.e. raise and lower tap number.
f) Emergency stop push-button at local and remote control positions.

22.2.4 Indication

Apparatus of an approved type shall be provided on each transformer:

a) To give indication mechanically at the transformer and electrically at the remote control point of the number of the tapping in use.
b) To give electrical indication, separate from that specified above, of tap position.
c) To give indication at the remote control point that a tap change is in progress; this indication to continue until the tap change is completed.
d) To give indication at the remote control point when the transformers operating in parallel are operation out of step.
e) To indicate at the tap change mechanism the number of operations completed by the equipment.

22.4 Automatic Voltage Control

Automatic Voltage Controller shall be from 'MR' Germany/ABB Sweden which is suitable for control of transformers in parallel. This relay should have the IEC 61850 protocol. This relay shall be capable for SCADA operation.

In addition to the methods of control included in this specification, the following methods shall also be provided. This is for future addition of a similar transformer and associated parallel operation.

a) Automatic Independent – It shall be possible to select automatic independent control for each transformer irrespective of the method of control selected for any other of the associated transformers.

b) Automatic parallel – It shall be possible to select any transformer for master or follower control. It must not be possible to operate any tap changer by remote or local electrical manual control while the equipment is switched for automatic operation.

22.4.1 Voltage Regulating Relays

Automatic voltage control shall be initiated by a voltage regulating relay of an approved type and suitable for flush mounting. The relay shall operate from the nominal reference voltage stated in the Schedule of Requirements derived from a circuit mounted LV voltage transformer having Class 1.0 accuracy to IEC 60186 and the relay voltage reference balance point shall be adjustable.

The relay bandwidth shall preferably be adjustable to any value between 1.5 times and 2.5 times the transformer tap step percentage, the nominal setting being twice the transformer tap step percentage.

The relay shall be insensitive to frequency variation between the limits of 47 Hz and 51 Hz. The relay shall be complete with a time delay element adjustable between 10 and 120 seconds. The relay shall also incorporate an under voltage blocking facility which renders the control inoperative if the reference voltage falls below 80 percent of the nominal value with automatic restoration of control when the reference voltage rises to 85 percent of nominal value.

On each transformer the voltage transformer supply to the voltage regulating relay shall be monitored for partial or complete failure. The specified indicating lamp and alarm will be inoperative when the circuit- breaker controlling the lower voltage side of the transformer is open and also that when the tap changer is on control other than automatic control.

23. COOLING AND TEMPERATURE CONTROL

The banks of cooling radiators shall be detachable from the tank for transport and maintenance. Shut-off valves shall be provided on the tanks of the transformers for this purpose. An air-vent and draining plug shall be provided on each radiator bank. All external surfaces of the radiators shall be hot dip galvanized as specified in Sub-clause 13.2, Part 1 of this document. Temperature control equipment shall be housed in a local control box mounted on the side of the transformer. A 150mm diameter dial thermometer shall be provided to indicate the temperature of the top oil in the transformer. This thermometer shall be fitted in such a way that it can easily be read from ground level through a window in the door of the control box. The thermometer shall be fitted with two

adjustable contacts, one connected to give an alarm and one to trip associated circuit breakers. It shall also be fitted with a maximum temperature pointer which shall be re-settable by hand.

A similar dial thermometer shall be provided in the control box to indicate winding temperature. This thermometer shall have two sets of adjustable contacts one connected to give an alarm and the other to trip associated circuit breakers and a maximum temperature pointer which shall be re-settable by hand. The minimum range of these contacts shall be 50 C to 100 C for alarm and 60 C to 120 C for trip. The temperature control box shall be weatherproofed to IP55 of IEC 529 or IS 2147 equivalent.

23.1 Cooling Plant

23.1.1 General

Radiators and coolers shall be hot-dip galvanized, designed so that all painted surfaces can be thoroughly cleaned and easily painted in situ with brush or spray gun. The design shall also avoid pockets in which water can collect and shall be capable of withstanding the pressure tests specified in the schedule of requirements for the transformer main tank.

The clearance between any oil or other pipe work and live parts shall be not less than the minimum clearances stated in the Employer's Requirements.

23.1.2 Radiators connected directly to Tank

Where built-on radiators are used, each radiator shall be connected to the main tank through flanged valves. Plugs shall be fitted at the top of each radiator for air release and at the bottom for draining.

A valve shall be provided on the tank at each point of connection to the tank.

23.1.3 Cooler Banks

Each cooler bank shall be provided with:-

A) A valve at each point of connection to the tank.
B) A valve at each point of connection of radiators
C) Loose blanking plates for blanking off the main oil connections.
D) A 50mm filter valve at the top of each cooler bank.
E) A 50mm drain valve at the lowest point of each interconnecting oil pipe.
F) A thermometer pocket, fitted with captive screw cap in the inlet and in the outlet oil pipes.
G) Air release and drain plugs on each radiator.

The omission of any, or the provision of alternative, arrangements to the above requirements will not be accepted unless approved in writing by the Project Manager before manufacture.

23.1.4 Forced Cooling

The type of forced cooling shall be as stated in the Schedule of Requirements.
Forced cooling equipment of transformers of similar rating and design shall be completely interchangeable, one with the other, without modification on Site.

23.1.5 Oil Pipes and Flanges

All oil piping necessary for the connecting of each transformer to its conservator, cooler banks etc. shall be supplied and erected under this Contract.

The oil piping shall be of approved material with machined flanged joints. Copper pipe work is to comply with BS 61.

Dimensions of steel pipes shall be in accordance with BS 3600 and the drilling of all pipe flanges shall with BS 4504.

An approved expansion piece shall be provided in each oil pipe connection between the transformer and each oil cooler bank.

All necessary pipe supports, foundation bolts and other attachments are to be provided.

It shall be possible to drain any section of pipe work independently of the rest and drain valves or plugs shall be provided as necessary to meet this requirement.

23.1.6 Air Blowers

Air blowers for forced air-cooling shall be of approved make and design and be suitable for continuous operation out-of-doors. They shall also be capable of withstanding the stresses imposed when brought up to speed by the direct application of full line voltage to the motor.

To reduce noise to the practical minimum, motors shall be mounted independently from the coolers, alternatively, an approved form of anti-vibration mounting shall be provided.

It shall be possible to remove the blower, complete with motor, without disturbing or dismantling the cooler structure framework.

Blades shall be of material subject to approval.

Blower casings shall be made or galvanized steel of thickness not less than 2.6 mm (14 S.W.G.) and shall be suitably stiffened by angles or tees.

Galvanized wire guards with mesh not exceeding 12.5mm shall be provided to prevent accidental contact with the blades. Guards shall also be provided over all moving parts. Guards shall be designed such that blades and other moving parts cannot be touched by test fingers to IEC 529.

23.1.7 Cooler Control

Where forced cooling using multiple small single-phase motors is employed, the motors in each cooling bank shall be grouped so as to form a balanced three-phase load.

Each motor or group of motors shall be provided with a three-pole electrically operated Contractor and with control gear of approved design for starting and stopping manually.

Where forced cooling is used on transformers, provision shall be included under this contract for automatic starting and stopping from contacts on the winding temperature indicating devices as specified. The control equipment shall be provided with a short time delay device to prevent the starting of more than one motor, or group of motors in the case of multiple cooling, at a time.

Where motors are operated in groups, the group protection shall be arranged so that it will operate satisfactorily in the event of a fault occurring in a single motor.

The control arrangements are to be designed to prevent the starting of motors totaling more than15 KW simultaneously, either manually or automatically. Phase failure relays are to be provided in the main cooler supply circuit.

All contacts and other parts which may require periodic renewal, adjustment or inspection shall be readily accessible.

All wiring for the control gear accommodated in the marshalling kiosk, together with all necessary cable boxes and terminations and all wiring between the marshalling kiosk and the motors, shall be included in the contract .Each box shall have a hinged gasketed door lockable by padlock. Solar gain can give rise to high temperature in a local control box. Adequate ventilation shall be provided to ensure that all equipment contained therein shall operate satisfactorily under these conditions.

A terminal block with 10% spare terminals shall be provided in each temperature control box.

24. TANK AND ACCESSORIES

24.1 General

The transformer tank shall be skid mounted type. The transformer tank shall be designed so that the complete transformer with oil and excluding conservator and radiators can be lifted and transported without permanent deformation or oil leakage. The tank and cover including the stiffeners shall be designed in such a manner as to leave no external pockets in which water can lodge, or internal pockets where gas/air can collect. All fittings shall be designed so as to prevent entry of air or leakage of oil from the tank. All pipes, shall be externally welded to the tank wall. The tank and cover shall be of structural quality, weld-able high tensile steel with a minimum thickness of 3mm. All welding shall be stress relieved. The requirement of post weld heat treatment of tank/ stress relieving shall be based on recommendation of BS-5500.

The tank lid shall not be welded shut, but shall be secured by bolts and provided with suitable oil-tight gasket. The tank is to withstand vacuum up to 500mm of mercury for 5 MVA, 10 MVA and 20 MVA transformers and any pressure of oil developed during operation conditions including short circuits.

24.2 Surface Treatment

The transformer tank and accessories shall be adequately protected against corrosion. The inside of the tank shall be painted with an approved oil resisting varnish. The outside of the tank shall be painted as specified in Sub-clause 13.1, Part 1 of this document.

Conservator Tank:

A conservator tank shall be provided of adequate capacity between lowest and highest visible levels to meet expansion of oil from 0 C to 100 C. A suitable oil level gauge shall be located on the tank so that it can be easily read from ground level. The gauge shall be graduated for temperatures of 0 C, +45 C and +90 C.

Each gauge shall be provided with contacts for separate low oil level alarm and trip signals. The conservator shall be fitted with a filling hole with cap and drain valve. It shall be inclined towards the drain valve. The pipe connecting the conservator to the main tank shall project 20mm above the bottom of the conservator for collection of impurities.

24.3 Breather

The conservator tank shall be fitted with a breather in which silica gel is the dehydrating agent from any country of Europe, USA or Japan. The breather shall be a molded type transparent case of adequate size and so designed that:

- the passage of air through the silica gel does not give rise to any excess pressure rise;
- silica gel crystal of not less than 5mm. size is used;
- the silica gel is sealed from the external atmosphere by means of an oil seal;
- the moisture absorption indicated by a change in color of the crystals can be easily observed from a distance;
- the breather mounting height facilitates maintenance from ground level without switching out the transformer.

24.4 Explosion Vent or Pressure Relief Device

An explosion vent or pressure relief device shall be provided to release any severe build-up of pressure within the tank. The vent shall be designed such that in the event of an explosion, rain, sand or any other foreign bodies are prevented from getting into the tank. The vent shall be positioned so as to direct the explosion safely into the oil pit.

24.5 Oil Sampling Devices

Oil sampling devices shall be fitted to the main tank. They shall be located suitably for easy access especially during maintenance, one near the bottom of the tank and one near the top.

24.6 Oil Filtration

Two 50mm bore filter valves shall be fitted to the tank, one on the top and the other diagonally opposite on the bottom.

24.7 Lifting Lugs/Eyes

Lifting lugs shall be provided for supporting the weight of the transformer including core and windings and fittings and with the tank filled with oil.

24.8 Jacking Pads

Four jacking pads shall be provided near the corners of the tank of each transformer and approximately 400mm above the lowest part of the tank. These pads shall be designed to take the complete weight of the transformer filled with oil.

24.9 Hauling Eyes

Hauling eyes shall be provided on all sides of the transformer.

24.10 Earthing Terminals

Earthing terminals shall be provided on the transformer close to each of the four corners of the tank to facilitate easy earthing of the transformer on site.

24.11 Oil Valves

In addition to the valves already mentioned, a drain valve shall be provided near the bottom of the tank. All oil valves shall be provided with means for securing them in the open or closed position.

25. TERMINAL BUSHING AND CONNECTIONS

25.1 General

Transformers are to be provided with outdoor type bushing insulators and cable box on the LV side. HV and LV bushings shall be from Europe, USA or Japan origin.

All bushings shall comply with IEC 60137 and the minimum creepage distance for outdoor bushings shall not be less than 25mm per kV of rated voltage between phases. Outdoor bushing insulators shall be provided with adjustable arcing horns and for rated voltages of 36 kV and lower these shall be of the duplex gap type.

Bushings shall be of sealed construction suitable for service under the very humid conditions at site and, addition, for the very rapid cooling of equipment exposed to direct sunlight when this is followed by sudden heavy rainstorms.

Typical sections of bushing insulators showing the internal construction, method of securing the top cap and methods of sealing shall be included in the Bid.

Completely immersed bushings and lower voltage outdoor immersed bushings may be of other type of construction, subject to the approval of the Project Manager but bushings of resin bonded paper construction are not permitted. The 33 kV bushings shall be porcelain (solid or condenser type). On all condenser bushings a tapping shall be brought out to a separate terminal for testing purposes on Site.

Special precautions shall be taken to exclude moisture from any paper insulation during manufacture, assembly, transport and erection. Terminal arrangement of LV cable box position & neutral bushing position shall be as per approved drawings.

25.2 Porcelain

Hollow porcelain shall meet the test requirements of IEC 60233 and shall be sound, free from defects and thoroughly vitrified. Designs based on jointed porcelains will not be acceptable. The glaze must not be depended upon for insulation. The glaze shall be smooth, hard, of a uniform shade of brown and shall cover completely all exposed parts of the insulator. Outdoor insulators and fittings shall be unaffected by atmospheric conditions producing weathering, acids, alkalis, dust and rapid changes in temperature that may be experienced under working conditions.

The porcelain must not engage directly with hard metal and, where necessary, gaskets shall be interposed between the porcelain and the fittings. All porcelain clamping surfaces in contact with gaskets shall be accurately ground and free from glaze.

All fixing material used shall be of suitable quality and properly applied and must not enter into chemical action with the metal parts or cause fracture by expansion in service. Cement thickness are to as small and even as possible and proper care is to be taken to center and locate the individual parts correctly during cementing.
All porcelain insulators shall be designed to facilitate cleaning.

25.3 Marking

Each porcelain insulator shall have marked upon it the manufacturer's name or identification mark and year of manufacture. These marks shall be clearly legible after assemble of fittings and shall be imprinted before firing, not impressed.

When a batch of insulators bearing a certain identification mark has been rejected, no further insulators bearing this mark shall be submitted and the Contractor shall satisfy the Project Manager that adequate steps will be taken to mark or segregate the insulators constituting the rejected batch in such a way that there can be no possibility of the insulators being re-submitted for the test or supplied for the use of the Employer.

Each complete bushing shall be marked with the manufacturer's name or identification mark, year of manufacture, serial number, electrical and mechanical characteristics in accordance with IEC 60137.

25.4 Mounting of Bushings

Bushing insulators shall be mounted on the tank in a manner such that the external connections can be taken away clear of all obstacles. Neutral bushings shall be mounted in a position from which connection can be taken to a neutral current transformer mounted on a bracket secured to the transformer tank. The current transformer will be supplied by the switchgear manufacturer but provision shall be made on the tank for mounting to theProject Manager's requirements.

The clearances from phase to earth must not be less than those stated in the Technical Requirements and Guarantee Schedule.

A flexible pull-through lead suitably suited to the end of the winding copper shall be provided for the bushings and is to be continuous to the connector which is housed in the helmet of the bushings. When bushings with an under-oil end of a re-entrant type are used the associated flexible pull-through lead is to be fitted with suitably designed gas bubble deflector. The bushing flanges must not be of re-entrant shape which may trap air.

Clamps and fittings made of steel or malleable iron shall be galvanized and all bolt threads are to be greased before erection.

25.5 Tests

Routine, sample and type tests of Bushing shall be carried out in accordance with the specified standards. Type tests shall also be carried out unless approved type test evidence is submitted. These tests shall include temperature cycle and porosity tests.

The following standards shall apply:-

- IEC 60233(BS 4963) for hollow porcelains.
- IEC 60137 for bushings.
- IEC 60148 and 60273 (BS 3297) for high voltage post insulators.
- IEC 60383 and 60305 (BS 137 Part 1 and Part 2) for cap and pin string insulators.

26. CORE AND WINDINGS

26.1 General

The winding shall be of high-conductivity electrolytic copper and transposed winding conductors shall be employed where applicable. Maximum current density for HV and LV windings should not exceed 2.5 A/mm^2.

The Windings shall have uniform insulation as defined in IEC 76. All neutral points shall be grounded.

The windings shall be located in a manner which will ensure that they remain electro- magnetically balanced and that their magnetic centers remain coincident under all conditions of operation.

The windings shall also be thoroughly dried and shrunk by the application of axial pressure for such length of time as will ensure that further shrinkage will not occur in service.

The windings and leads of all transformers shall be braced to withstand the shocks which may occur through rough handling and vibration during transport, switching and other transient service conditions including external short circuit

26.2 Core

The core shall be constructed from high grade, non-ageing, cold rolled grain oriented silicon steel laminations. The core and winding shall be capable of withstanding shocks during transport, installation and service. Provision shall be made to prevent movement of the core and windings relative to the tank during these conditions and also during short circuits.

The design shall avoid the presence of pockets which would prevent the complete emptying of the tank through the drain valve.

26.3 Windings

The winding conductor shall be of electrolytic copper, free from burs and splinter. Paper shall be used for conductor insulation. The insulation shall be free from insulating compounds which are iliable to soften, ooze out, shrink or collapse. It shall be non catalytic and chemically inert in transformer oil during normal service.

The stacks of windings are to receive adequate shrinkage treatment.

The windings and connections are to be braced to withstand shocks during transport, switching, short circuit or other transient conditions. The manufacturer must provide the thermal damage curve or thermal damage description of the transformer winding or the transformer as per relevant IEC standard.

The winding shall be of electrolytic copper, free from burs and splinter. Paper shall be used for conductor insulation.

27. INTERNAL EARTHING

27.1 General

All metal parts of the transformer, with the exception of the individual core laminations, core bolts and associated individual clamping plates, shall be maintained fixed potential.

27.2 Earthing of Core clamping Structure

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

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

27.3 Earthing of Magnetic Circuits

The magnetic circuit shall be earthed to the clamping structure at one point only through a removable link placed in an accessible position just beneath an inspection opening in the tank cover and which, by disconnection, will enable the insulation between the core and clamping plates, etc., to be tested at voltages up to 2 kV. The link shall have no detachable components and the connection to the link shall be on the same side of the core as the main earth connection. These requirements are compulsory.

All insulating barriers within magnetic circuits shall be bridged by means of aluminum or tinned copper strips, so inserted as to maintain electrical continuity.

27.4 Earthing of Coil Clamping Rings

Where coil clamping rings are of metal at earth potential, each ring shall be connected to the adjacent core clamping structure on the same side of the transformer as the main earth connection.

27.5 Size of Earthing connections

Main earthing connections shall have a cross-sectional area of not less than 80 sq.mm but connections inserted between laminations may have cross-sectional areas reduced to 20 sq. mm when in close thermal contact with the core.

28. TANKS AND ANCILLARY EQUIPMENT

28.1 Transformer Tanks

Each transformer shall be enclosed in a suitably stiffened weld-able high tensile steel tank such that the transformer can be lifted and transported without permanent deformation or oil leakage. The construction shall employ weld-able structural high tensile steel of an approved grade to BS 7613 and BS EN10029. The final coat colour of Transformers shall be to Munsell notation N5Y-7/l.

Lifting lugs shall be provided, suitable for the weight of the transformer, including core and windings, fittings, and with the tank filled with oil. Each tank shall be provided with at least four jacking lugs, and where required, with lugs suitably positioned for transport on a beam transporter. Haulage lugs should also be provided to enable a cable to be used safely for haulage in any

direction.

The transformer tank shall be capable of withstanding vacuum up to 500 mm of mercury without defection exceeding the value stated in the Schedule of Requirements.

Where the design of the tank is such that the bottom plates will be in direct contact with the surface of the foundations. The base of each tank shall be so designed that it is possible to move the complete transformer unit in any direction without injury when using rollers, plates, or rails

All joints, other than those which may have to be broken, shall be welded.

The tank and cover shall be designed in such a manner as to leave no external pockets in which water can lodge, no internal pockets in which oil can remain when draining the tank or in which air can be trapped when filling the tank, and to provide easy access to all external surfaces for painting. Where cooling tubes are used, each tube shall be of heavy gauge steel welded into the tank sides, top and bottom.

Each tank cover shall be of adequate strength, must not distort when lifted and shall be provided with suitable f1anges having sufficient and properly spaced bolts. Inspection openings shall be provided to give access to the internal connections of bushings, winding connections and earthing links. Each opening shall be correctly located and must be of ample size for the purpose for which it is intended. All inspection covers shall be provided with lifting handles.

It must be possible to remove any bushing without removing the tank cover.

Pockets shall be provided for a stem type them1ometer and for the bulbs of temperature indicators where specified. These pockets shall be located in the position of maximum oil temperature and it must be possible to remove any bulb without lowering the oil level in the tank. Captive screwed caps shall be provided to prevent the ingress of water to the thermometer pockets when they are not in use. Where called for in the Technical Requirements and Guarantee Schedule, accommodation shall be provided for outdoor weatherproof neutral current transformer. A ladder shall be provided on one side of the tank as a means for inspection and access to the top of the transformer. The lower section of the ladder shall be equipped with a barrier complete with provision for locking with a padlock.

28.2 Conservator Tanks, Breathers and Air Dryers

Each transformer shall be provided with an overhead conservator tank formed of substantial steel plates and arranged above the highest point of the oil circulating system. Connections into the main tank shall be at the highest point to prevent the trapping of air or gas under the main tank cover. A steel ladder shall be fixed between conservator top and the transformer top cover.

The capacity of each conservator tank shall be adequate for the expansion and contraction of oil in the whole system under the specified operating conditions. Conservator tanks shall also be provided with a cleaning door, filling cap, drain valve with captive cap and an oil level indicator with minimum and maximum levels indicated. The normal level at an oil temperature of 25°Cshall be indicated and the minimum and maximum levels shall also be correlated with oil temperature markings. The temperature markings shall preferably be integral with the level indicating device. The Oil level indicator shall be from MR. Germany or equivalent European class.

The location of the conservator tank shall be so arranged that it does not obstruct the passage of high voltage conductors immediately above the transformer.

The pipe work between the conservator and the transformer tank shall comply with the standard requirements and a valve shall be provided at the conservator to cut-off the oil supply to the tank.

Each conservator shall be fitted with an air cell which shall be connected to a silica gel breather of a type which permits the silica gel content to be removed for drying. Due to the climatic conditions at site, this breather shall be larger than would be fitted for use in a temperate climate. All breathers shall be mounted at a height of approximately 1400 mm above ground level. The silica gel container shall be fully transparent.

28.3 Valves

Each transformer shall be fitted with the following valves as a minimum requirement:

28.3.1 Main Tank

a) One 50mm bore filter valve located near to the top of the tank.

b) One 50 mm bore filter valve located near to the bottom of the tank and diagonally opposite to the filter valve required against(A).Where design permits, this valve may be combined with item (C).

c) One 50mm drain valve with such arrangements as may be necessary inside the tank to ensure that the tank can be completely drained of oil as far as practicable. This valve shall also be provided with an approved oil sampling device.

d) One valve between the main tank and gas actuated relay, complete with bypass facility to facilitate removal of relay and maintain oil flow.

28.3.2 Conservator

a) One valve between the conservator and gas actuated relay for the main tank and where appropriate, for the tap change diverter switch tank complete with by pass for Buchholzrelay to facilitate maintenance of the relay.

b) One drain valve for oil conservator tank so arranged that the tank can be completely drained of all oil.

28.3.3 Radiators and Cooler Banks

a) Valves at each point of connection to the tank.

The two valves 28.3.1 (d) and 28.3.2 (a) arrangement across the gas actuated relay are to be connected with an oil pipe work bypass facility to facilitate removal of the relay, due to failure etc, and still maintain the oil flow system between the conservator and main tank.

Blank flanges, plates or captive screw caps shall be fitted to all valves and pipe ends not normally connected in service.

The omission of any, or the provision of alternative arrangements to the above requirements, will not be accepted unless approved in writing by the Project Manager before manufacture.

28.4 Joints and Gaskets

All joint faces shall be arranged to prevent the ingress of water or leakage of oil with a minimum of gasket surface exposed to the action of oil or air.

Oil resisting synthetic rubber gaskets are not permissible except where the synthetic rubber is used as a bonding medium for cork, or where metal inse1ts are provided to limit compression.

Gaskets shall have sufficient thickness consistent with the provision of a good seal and full details of all gasket sealing arrangements shall be shown on the Plant drawings.

All gaskets shall be closed design (without open ends) and shall be one piece only. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight. Care shall be taken to secure uniformly distributed mechanical strength over the gaskets and retains throughout the total length. No gaskets shall be used in which the material of the gasket is mounted on a textile backing. Gaskets of neoprene or any kind of impregnated/ bonded core or cork only which can easily damage by over pressing is not acceptable. Use of hemp as gasket material is also not acceptable.

28.5 Pressure Relief device

An approved pressure relief device of sufficient size for the rapid release of over pressure that may be generated in the tank, and designed to operate at a static pressure lower than the hydraulic test pressure, shall be provided. It shall be of the spring operated valve type and shall be provided with one set of normally open signaling contacts which will be used for trip alarm purposes. The pressure relief device shall be from 'MR' or equivalent European made.

The relief device is to be mounted on the tank cover and is to be provided with a skirt to project at least 25 mm in to the tank to prevent gas accumulation. Discharge of oil shall be directed away from the transformer top cover and clear of any operating position.

28.6 Earthing Terminals

Two substantial steel flag type terminals having two 14mm diameter holes on 55mm centers shall be located one on either side and near to the bottom of the transformer to facilitate connection to the local earthing system.

28.7 Rating, Diagram and Valve Plates

The following plates, or an approved combined plate, shall be fixed to each transformer tank at an average height of 1500 mm above the ground level:

a) A rating plate bearing the data specified in IEC 76 Part 1. This plate shall also include the short-circuit current rating and time-factor for each winding.

b) A Diagram plate showing in an approved manner the internal connections and the voltage vector relationship of the several windings, in accordance with IEC 76 Part1 with the transformer voltage ratio for each tap and, in addition a plan view of the transformer giving the correct physical relationship of the terminals.

c) A plate showing the location and function of all valves and air release cocks or plugs. This plate shall also if necessary warn operators to refer to the Maintenance Instructions before applying vacuum.

Plates are to be of stainless steel or other approved material capable of withstanding the rigorous of continuous outdoor service at site.

29. STATION AUXILIARY TRANSFORMER:

The Contractor shall supply Station Auxiliary transformer with 10 MVA & 20 MVA OLTC Transformer.
Auxiliary transformers shall be hermetically sealed two-winding, conservator type, three-phase, oil immersed, ONAN, with Off Load Tap Changing, suitable for outdoor use.

The station auxiliary transformers shall be 33/0.415 kV and have a maximum continuous rating of 100 kVA, shall be capable of supplying the maximum continuous rating for all tap positions and maintaining rated voltage on the low voltage winding, under the maximum ambient temperature conditions, without the temperature rise of the top oil exceeding 50°C or the temperature rise of the windings as measured by resistance exceeding 55°C.

Transformers shall be in accordance with the relevant IEC standard and this specification. Refer to the Schedule of Technical Particulars and Guarantees for other relevant requirements.

Off-load tap-changing shall be carried out by means of an external hand-operated tapping switch mounted on the side of the tank. All phases of the tapping switch must be operated by one hand wheel.

The tapping switch shall have a spring-loaded captive bolt or other approved means on the moving part which positively locates the switch correctly at each tapping position. This bolt must be

lockable at each tapping position and shall be provided with a suitable padlock and keys. Moving the switch from one tapping position to another shall require that the bolt be withdrawn by hand from its locating socket on the transformer tank against the spring pressure.

Tap-position numbers corresponding to the tapping switch bolt-locating sockets shall be cast or engraved in a metal indication plate fixed to the tank and a keyed metal pointer on the tapping switch operating handle shall show clearly at which tapping number the transformer is operating.

All tap-position indicators shall be marked with one integer for each tap position, beginning at number 1. Adjacent taps shall be numbered consecutively in such a manner that when moving a tap to a new tapping position which has a higher number, the no-load output voltage of the untapped winding increases.

29.1 Technical Requirements

Transformers shall be provided with the following fittings:

- Off-load tap changer.
- Oil filler plug and drain valve.
- Thermometer.
- Pressure release device.
- Four lifting lugs.
- Air insulated terminals for 33kV and 0.4 kV connections using adequately sized conductor.
- Galvanised tank, conservator and radiators.

30. CABLE TERMINATIONS AND GLANDS

30.1 Cable Boxes

The transformers may have cable boxes with all necessary fittings and attachments **as** per approval of Drawings (submitted by the bidder) by the proper authority of BREB. Cable boxes shall be of adequate proportions and designed in accordance with BS 6435 in such the manner that they can be opened for inspection without disturbing the gland plate or incoming cable(s).Cable boxes shall be designed for ease of access for jointing and connecting the cable. They shall be constructed to minimize the danger of fragmentation; cast iron boxes shall not be used. The cable box shall be of such a design as to prevent ingress of moisture. Where blind tapped holes have to be provided, studs shall be used and not bolts or set screws.

All gaskets, unless otherwise approved, shall be in one continuous piece without joints. Gaskets shall not be compressed before use. Provision shall be made for earthing the body of each cable box. Removable blank gland plates and suitable type and size of cable glands shall be supplied and fitted for termination of the cables.

Dehydrating breather and draining holes protected by 1 mm aperture mesh shall be incorporated at the base of the box to avoid moisture condensation within cable box and ensure drainage of condensation respectively. Cable boxes shall be provided with suitable means for clamping the armor wires of the cables.

Gland plates for single core cable shall be made from non-ferrous metal. The Contractor shall guarantee (test certificate shall be supplied to prove) that the air clearances and the creep age path on the bushing connecting to the associated switchgear or transformers shall be such that the completed installation shall withstand in air the impulse and power frequency voltages appropriate to the plant.

The cable box clearances would meet the requirements for BS 6435 for partially insulated cable boxes. An earthing terminal shall be provided in each sealing end chamber to which the connections from the transformer winding can be earthed during cable testing. Cable boxes shall be

provided on 33kV/11kV sides suitable for air insulations terminations of XLPE Copper Conductor cables of minimum sizes as mentioned below:

31. TEMPERATURE AND ALARM DEVICES

31.1 Temperature Indicating Devices and Alarms

The transformers shall be provided with approved devices of Kilhstrom for indicating the top oil temperature and hottest spot winding temperatures. The devices shall have a dial type indicator and, in addition, a pointer to register the highest temperature reached. Each winding temperature device shall have four separate contacts fitted, two of which shall be used to control the two groups of cooling plant motors (i.e. AF1 and AF2), one to give an alarm and one to trip the associated circuit breakers. The Temperature indicating device shall be from MR Germany or equivalent European class.

To simulate indication of the hottest spot temperature of the winding the device shall comprise a current transformer associated with one phase only and a heating device designed to operate continuously at 130 percent of transformer CMR current and for30 minutes at 150 percent of CMR current, associated with a sensing bulb installed in an oil tight pocket in the transformer top oil.

The winding temperature indicators (WTI) shall be housed in the marshalling cubicle. The tripping contacts of the winding temperature indicators shall be adjustable to close between 80°Cand 150°C and to re-open when the temperature has fallen by not more than 10°C.

The alarm contacts and the contacts used to control the cooling plant motors on the above devices shall be adjustable to close between 50° C and 100° C and to re-open when the temperature has fallen by a desired amount between 10° C and l5° C.

All contacts shall be adjustable to a scale and must be accessible on removal of the relay cover. Alarm and trip circuit contacts shall be suitable for making or breaking 150 VA between the limits or 30 volts and 250 volts AC or DC and of making 500 VA between the limits of 110 and250V DC. Cooler motor control contacts shall be suitable for operating the cooler Contractors direct or, if necessary, through an interposing relay.

The temperature indicators in the marshalling kiosk shall be so designed that it is possible to move the pointers by hand for the purpose of checking the operation of the contacts and associated equipment. The working parts of the instrument shall be made visible by the provision of cut-away dials and glass-fronted covers and all setting and error adjustment devices shall be easily accessible.

Connections shall be brought from the device to terminal boards placed inside the marshalling cubicle.

Terminals, links and a 63mm moving iron ammeter shall be provided in the marshalling kiosk for each WTI for:

a) Checking the output of the current transformer.
b) Testing the current transformer and thermal image characteristics.
c) Disconnecting the bulb heaters from the current transformer secondary circuit to enable the instrument to be used as an oil temperature indicator. Links shall be provided as shown on the drawing enclosed with the offer.

31.2 Gas and Oil-Actuated Relays (Buchholz Relays)

Each transformer shall be fitted with gas and oil-actuated relay equipment having alarm contacts which close on collection of gas or low oil level, and tripping contacts which close following oil surge conditions. The Relay shall be from MR, Germany or equivalent European class.

Each gas and oil-actuated relay shall be provided with a test cock to take a flexible pipe connection for checking the operation of the relay by inserting air in the relay. The floats of the Buchholz shall be solid body. Each relay shall be fitted with UV protective covered glass window for indication of gas volume.

To allow gas to be collected at ground level, a small bore pipe shall be connected to the gas release cock of the gas and oil-actuated relay and brought down to appoint approximately1400 mm above ground level, where it shall be terminated by a cock which shall have provision for locking to prevent unauthorized operation.

The design of the relay mounting arrangements, the associated pipe work and the cooling plant shall be such that multi operation of the relay will not take place under normal service conditions, including starting or stopping of oil circulating pumps, whether by manual or automatic control under all operating temperatures.

The pipe work shall be so arranged that all gas arising from the transformer will pass into the gas and oil-actuated relay. The oil circuit through the relay must not form a delivery path in parallel with any circulating oil pipe, nor is it to be fed into or connected through the pressure relief vent. Sharp bends in the pipe work shall be avoided.

When a transformer is provided with two conservators, the gas and oil-actuated relays shall be arranged as follows:

a) If the two conservators are connected to the transformer by a common oil pipe, one relay shall be installed in the common pipe.

b) If the two conservators are piped separately to the transformer, two relays shall be installed, one in each pipe connection.

The clearance between oil pipe work and live metal shall be not less than the minimum clearances stated in the schedule of requirement.

32. TRANSFORMER OIL

Insulating oil shall comply with the requirements of IEC 60296. Insulating oil shall be provided by the Contractor for all oil-filled apparatus and 10% excess shall be provided for topping up purposes in sealed drums. The Contractor shall satisfy himself that suitable oil treatment facilities are available at Site for his use. If the Contractor is unable to obtain written assurances to this effect he shall provide such oil treatment facilities as required to meet the specification, at no additional cost.

The Contractor shall supply the first filling of all insulating oil required for the operation of the Plant and, after treatment, a test shall be made in the Project Manager's presence to prove that the breakdown voltage is at least 60kV at 2.5mm electrode gap.

Transformer Oil	
Application	Insulating mineral oil for Transformer
Grade of oil	Class-1
a) Physical Properties	
Appearance	Liquid and free from suspended matter or sediment
Density at 20^0C	0.895g/cm^3 (maximum)
Flash point (Closed cup)	140^0C (minimum)
Kinematics Viscosity at-15^0C	800 cst. (Maximum)
Kinematics Viscosity at-20^0C	40 cst. (Maximum)
Pour point	-30^0C (maximum)
b) Electrical Properties	
Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	On new untreated oil, the break down voltage shall be at least >60KV.
Loss tangent/ Dielectric dissipation factor at temp 90 C, stress 500V/ mm to 1000 v/ mm and frequency 40 Hz to 62 Hz.	0.005 (maximum)
c) Chemical Properties	
Neutralization value	0.03mg KOH/g (maximum)
Neutralization value after oxidation	0.40mg KOH/g (maximum)
Total sludge after oxidation	0.10% weight (maximum)
PCB Content	Free from PCB
d) Standards	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148; 1972 IEC – 60296or latest revision there on.

33. SURGE ARRESTERS (Station Class):

Required numbers of 33 KV & 11 KV Station Class Surge Arresters shall be provided along with each transformer. The transformers will have mounting facilities for required 33 KV & 11 KV surge arresters.

Surge arresters shall be of the type employing non-linear metal oxide resistors without spark gaps. The Contractor shall demonstrate by calculations that the surge arresters will adequately protect the switchgear arrangement.

Surge arresters shall be housed in porcelain insulators designed to withstand extremes of the environment described. The insulation shall have a minimum creepage distance of 25mm/kV rated system phase to phase voltage. Porcelain shall comply with IEC 60233. The method of sealing against the ingress of moisture shall be of a type well proven in service and the manufacturing procedures shall include an effective leak test which can be demonstrated to the inspecting engineer if required. The MCOV of the Arresters are given below. MCOV exceeding the given range will not acceptable.

The detailed calculation for Surge arrester operation and performance should be provided during implementation prior to supply of each Surge arrester.

Arrester according to Voltage class	MCOV range (KV)
10 KV	8 kV – 10 kV
30 KV	22 kV– 27.5 kV

Good electrical contact shall be maintained between resistor blocks taking account of any thermal expansion and contraction of the block or mechanical shock during transport and erection, by installing a well proven clamping system.

Metal oxide arresters installed outdoors shall be able to dissipate, when new, twice the energy generated in the resistor blocks when energized at their maximum continuous operating voltage immediately having been subjected to the discharge duties specified in IEC 60099-4 and assuming that the porcelain housing and the surrounding air is at least 5 degree centigrade higher than the maximum ambient air temperature specified.

All surge arresters shall be fitted with a pressure relief diaphragm which shall prevent explosive shattering of the porcelain housing in the event of an arrester failure and the arrester shall have been tested according to the high and low current tests specified in IEC 60099-1. Arresters shall be supplied complete for installation in an outdoor switchyard, including insulating bases and surge counters, one per phase, and, if applicable, grading rings. The material used for terminals shall be compatible with that of the conductors to which they are to be connected.

Each arrester shall be identified by a rating plate in accordance with the requirements of IEC 60099-4. In addition an identification mark shall be permanently inscribed on each separately housed unit of a multi-unit arrester so that units can be replaced in the correct position in the event of them being dismantled.

Each surge arrester should have surge counter. The Surge counters shall have an internal assembly which is matched to the line discharge capability of the arrester and shall include a leakage current meter with a bi-linear scale for ease of reading. Auxiliary contacts are to be provided to signal remote indication of counter operation. The manufacturer should declare the maximum count number/ life of each surge arrester.

Surge arrester shall have suitable earth terminal to connect surge counter with insulated cable.

33.1 Tests

Routine tests and type tests shall be carried out to the specified standards. Bidder shall submit type and routine tests reports of surge arresters along with bid proposal.

The following routine tests shall be carried out on all arrester units in accordance with clause 8.1 of IEC 60099-4.

- Measurement of reference voltage
- Residual voltage test
- Partial discharge test
- Housing leakage test
- Current distribution test for multi-column arrester.

34. LOSSES AND EVALUTION OF LOSSES

An adjustment will be made for evaluation purposes (only) for distribution transformer losses as given below:

No load losses6384 USD/kW/unit of each type
Load losses1915 USD/kW/unit of each type

Load losses will be at full load and 75□C

Guaranteed loss values must be supported by test reports from internationally recognized independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the test report, the higher loss value will be taken into account for the purpose of loss evaluation.
The Purchaser reserves the right to make independent test of transformer losses, in which case these values will be used as actual tested losses. Further tests carried out during manufacture or during pre-shipment inspection may also be taken account of in determining the loss values.

The acceptance of transformers yielding component losses higher than the guaranteed values shall be governed by- IEC60076 part1. For actual tested losses higher than guaranteed figures but within acceptable tolerance limits, the bidder will be penalized as follows:

a. US $ 9576 per kilowatt of increased amount of no-load loss per transformer.
b. US $ 2873 per kilowatt of increased amount of load loss per transformer.

The above penalties will be subtracted from any funds due to the Bidder. Final payment will not be made until tests are reviewed and approved by Purchaser.

34.1 LOSSES

Instructions to Bidders: The maximum acceptable losses at 75 deg. C and at rated voltage, full site rated load at any tap shall be as stipulated in the following table. Bidder's quoting for transformers with losses exceeding the following figures i.e. the declared loss at any tap (max., min., or principal) is higher than the following losses shall not be accepted.

Transformer Rating ONAN	Losses in kW	
	No Load Loss (Iron Loss)	Load Loss (Copper Loss)
10 MVA	≤10	≤57
20 MVA	≤12	≤80

NOTE 1:
The no-load offered losses of a transformer shall not exceed the independent laboratory testvalue by more than 10 % and the total offered losses of a transformer shall not exceed the independent laboratory test value by more than 6%. It is noted that no-load and full-load losses offered by the supplier shall not exceed the losses specified by BREB (mentioned in the clause 34.1 in the specification).

34.2 REJECTION

The Employer may reject any transformer or whole lot, if during testing the following is found:

(a) Load and/or no-load losses exceed the guaranteed value by 15%.
(b) Total losses exceed the guaranteed values by 10%.
(c) Impedance exceeds the guaranteed value by more than 10%.
(d) Transformer fails any test.

NOTE 2:
If the measured losses exceeds the offered component losses (No load loss and full load loss) more than 15% or measured total loss exceeds more than 10% of the offered total losses and percentage impedance exceeds +10% of the specified percentage impedance then the whole lot will be rejected. If the measured losses are in within above tolerance with the offered losses but exceeds the specified value (mentioned in the clause 34.1 in the specification) then whole lot will also be rejected.

The Contractor shall supply the replacement transformer and the requirements stated in this section shall apply to the replacement units.

35. FOR OLTC Type 20/28 MVA 33/11.55 KV (ONAN/ONAF) TRANSFORMER

a) 20/28 MVA ONAN/ONAF indoor/outdoor mounting, 3-phase, 50 Hz, Dyn1, uniform insulation, 33 kV +4×1.5% and -12×1.5% (HV taps on-load operating), mineral oil immersed, equipped with BCT. The supply of transformer will also include suitable size of MS rail for placing of transformer on foundation.

b)

Nominal System Voltage between Phases	kV	33	11
System Frequency	Hz	50	50
Rated Voltage between Phase	kV	33	11.55
Highest system voltage	kV	36	12.2 kV
Lightning Impulse withstand	kV	170	75 kV
50 Hz withstand, 1 minute	kV	70	28
Symmetrical Short Circuit Current (3sec.)	kA	25	25

c) The three H.T. bushing shall be porcelain type being brown glazed. The BCT fitted in the neck of each bushing shall be 15VA, 600/5A, Class: 5P20

d) The three L.T bushings, one for each phase and one bushing for the neutral may be of capacitor type or porcelain type with outside glazed of brown porcelain. The BCT fitted in the neck on each phase bushings shall be 20 VA. 1800/5 A, Class: 5P20 and that on the neutral bushing shall be 20VA, 1800/5 A, Class: 5P20. In addition to that the "b" phase bushing of the LT side should have a BCT having ratio 1800/5A, 20VA, 5P20 (for WTI), in "a" phase bushing of the LT side should have another BCT having ratio 1800/5A. 20 VA, accuracy class .2(Metering CT FS < 5) (for OLTC by auto voltage regulating relay) and in neutral phase bushing should have another BCT having ratio 1800/5A, 20 VA, 5P20 (for Stand by Earth Fault)."

e) The winding shall be of electrolytic copper, free from burs and splinter. Paper shall be used for conductor insulation. The manufacturer must provide the thermal damage curve or thermal damage description of the transformer winding or the transformer as per relevant IEC standard

f) The insulating oil shall meet all requirements as defined by NEMA standard/BS shall be chemically stable, free from acidity and other corrosive ingredients and shall possess high dielectric strength oil for first filling shall be shipped in non-returnable drums. 10% of the quantity required for a transformer is to be supplied in addition in respect of each transformer due to usual losses during installation, centrifuging, etc.

g) The transformer tank shall be of welded construction, fabricated from high tensile steel plate and shall be designed so that the tank is to withstand vacuum up to 500mm of mercury for 10 MVA and 20 MVA transformers and any pressure of oil developed during operation conditions including short circuits.

h) The transformer shall have air seal conventional type oil conservator tank (the oil surface is completely isolated from the atmosphere by installing an oil resistant rubber seal in the interior of the conservator) at the top divided in to two halves internally: one part to be connected with transformer main tank through Buchholz Relay (with cocks on both side) and the other part with OLTC tank through another gas Relay (with cock either side). Both the halves will have oil level indicator (visual) with contacts for indication "LOW OIL LEVEL" in the control panel.

i) Pressure Release Devices for both main tank and OLTC Tank shall be provided.

j) Silica Gel Breather with glass window shall be provided for both halves of the conservator tank.

k) The on-load Tap Changer operating device shall be equipped with local (manual and electrical) and remote electrical operating device with appropriate interlocking. The OLTC motor shall be 3-phase 400 V operating type. The mechanical position indication shall be there both at the tap changer as well as on the operating device. Contacts/Arrangements shall be there for remote position indication (by lamp glowing) of the tap. Appropriate glands for the entry of control cable shall be provided.

l) Sufficient cooling Fans (3-phase, 415V, 50 Hz) of adequate capacity shall be fitted on the body of the transformer for cooling purpose to achieve the ONAF rating over the average ambient temperature of 40 degree C. There shall be a control device in weather proof housing fitted on the body of the transformer and equipped with control relay operated by sensing device of oil temperature inside the transformer and operate requisite no. of fans. Besides there shall be manual switching device of cooling fans.

m) The Radiators shall be in banks which can be fitted with or removed from the body of transformer tank. Sufficient radiators shall be provided to achieve the ONAN rating at average ambient temperature of 40 degree C. Each bank of radiator must have two stop valve one of which should be fixed at the top and the other at the bottom.

n) Besides the main components of the transformer the other features and accessories to be associated which are as follows:

   i) Inspection hole with cover.
   ii) Manhole.
   iii) Name plate with complete diagrams and main specifications. iv) Upper and lower oil valves, oil sampling valve and drain valve.
   v) Ladder to climb up to top with barrier at the bottom.
   vi) Thermometer for sensing oil and winding temperature and display.
   vii) All HV (33 KV) terminals shall be provided with appropriate connecting clamps to be connected with 500 MCM Copper wire or Copper Bar or Copper Hollow

Pipe which must be capable to carry at least 800 amps current. The LV (11 KV) terminals shall have also connecting clamps appropriate for being connected with on 4×500 mm^2 single core cables per phase. The neutral terminal shall have connecting clamps to be connected with 2/0 HDBS wire.

viii) There shall be four wheels (flanged type) suitable for mounting on rails and to carry the transformer as a whole.

ix) The transformer shall have at least two grounding terminals on its body.

All ferrous parts of the transformer shall be galvanized or painted with appropriate paints of MUNSELL NO-5y 7/1 transformer with maximum shipping height (not exceeding 11 feet) will be preferred.

o) One set of extra gaskets for each transformer is to be supplied with the transformer lot without extra cost.

36. FOR OLTC TYPE 10/14 MVA 33/11.55 KV (ONAN/ONAF) TRANSFORMER

a) 10/14 MVA ONAN/ONAF indoor/outdoor mounting, 3-phase, 50 Hz, Dyn1, uniform insulation, 33 kV +4×1.5% and -12×1.5% (HV taps on-load operating), mineral oil immersed, equipped with BCT. The supply of transformer will also include suitable size of MS rail for placing of transformer on foundation.

b)

Nominal System Voltage between Phases	kV	33	11
System Frequency	Hz	50	50
Rated Voltage between Phase	kV	33	11.55
Highest system voltage	kV	36	12.2 kV
Lightning Impulse withstand	kV	170	75 kV
50 Hz withstand, 1 minute	kV	70	28
Symmetrical Short Circuit Current (3sec.)	kA	25	25

c) The three HT bushing shall be porcelain type being brown glazed. The BCT fitted in the neck of each bushing shall be 15VA, 400/5A (for 10 MVA) Class: 5P20.

d) The three L.T bushings, one for each phase and one bushing for the neutral may be of capacitor type or porcelain type with outside glazed of brown porcelain. The BCT fitted in the neck on each phase bushings shall be 20VA. 1200/5 A, Class: 5P20 and that on the neutral bushing shall be 20 VA, 1200/5 A, Class: 5P20. In addition to that the "b" phase bushing of the LT side should have a BCT having ratio 1200/5A, 20VA, 5P20 (for WTI), in "a" phase bushing of the LT side should have another BCT having ratio 1200/5A. 20 VA, accuracy class .2 (Metering CT FS < 5) (for OLTC by auto voltage regulating relay) and in neutral phase bushing should have another BCT having ratio 1200/5A, 20 VA, 5P20 (for Stand by Earth Fault)."

e) The winding shall be of electrolytic copper, free from burs and splinter. Paper shall be used for conductor insulation.
The manufacturer must provide the thermal damage curve or thermal damage description of the transformer winding or the transformer as per relevant IEC standard

f) The insulating oil shall meet all requirements as defined by NEMA standard/BS shall be chemically stable, free from acidity and other corrosive ingredients and shall possess high dielectric strength oil for first filling shall be shipped in non-returnable drums. 10% of the quantity required for a transformer is to be supplied in addition in respect of each transformer due to usual losses during installation, centrifuging, etc.

g) The transformer tank shall be of welded construction, fabricated from high tensile steel

plate and shall be designed to withstand 500 mm of mercury.

h) The transformer shall have air seal conventional type oil conservator tank (the oil surface is completely isolated from the atmosphere by installing an oil resistant rubber seal in the interior of the conservator) at the top divided into two halves internally: one part to be connected with transformer main tank through Buchholz Relay (with cocks on both side) and the other part with OLTC tank through another gas Relay (with cock either side). Both the halves will have oil level indicator (visual) with contacts for indication "LOW OIL LEVEL" in the control panel.

i) Pressure Release Devices for both main tank and OLTC Tank shall be provided.

j) Silica Gel Breather with glass window shall be provided for both halves of the conservator tank.

k) The on-load Tap Changer operating device shall be equipped with local (manual and electrical) and remote electrical operating device with appropriate interlocking. The OLTC motor shall be 3-phase 400 V operating type. The mechanical position indication shall be there both at the tap changer as well as on the operating device. Contacts/Arrangements shall be there for remote position indication (by lamp glowing) of the tap. Appropriate glands for the entry of control cable shall be provided.

l) Sufficient cooling Fans (3-phase, 415V, 50 Hz) of adequate capacity shall be fitted on the body of the transformer for cooling purpose to achieve the ONAF rating over the average ambient temperature of 40 degree C. There shall be a control device in weather proof housing fitted on the body of the transformer and equipped with control relay operated by sensing device of oil temperature inside the transformer and operate requisite no. of fans. Besides there shall be manual switching device of cooling fans.

m) The Radiators shall be in banks which can be fitted with or removed from the body of transformer tank. Sufficient radiators shall be provided to achieve the ONAN rating at average ambient temperature of 40 degree C. Each bank of radiator must have two stop valve one of which should be fixed at the top and the other at the bottom.

n) Besides the main components of the transformer the other features and accessories to be associated which are as follows:
   i) Inspection hole with cover.
   ii) Manhole.
   iii) Name plate with complete diagrams and main specifications. iv) Upper and lower oil valves, oil sampling valve and drain valve.
   v) Ladder to climb up to top with barrier at the bottom.
   vi) Thermometer for sensing oil and winding temperature and display.
   vii) All HV (33 KV) terminals shall be provided with appropriate connecting clamps to be connected with500 MCM Copper wire or Copper Bar or Copper Hollow Pipe which must be capable to carry at least 600 amps current. . The LV (11 KV) terminals shall have also connecting clamps appropriate for being connected with on 2×500 mm^2 single core cables per phase. The neutral terminal shall have connecting clamps to be connected with 2/0 HDBS wire.

   viii) There shall be four wheels (flanged type) suitable for mounting on rails and to carry the transformer as a whole.
   ix) The transformer shall have at least two grounding terminals on its body.

   All ferrous parts of the transformer shall be galvanized or painted with appropriate

paints of MUNSELL NO-5y 7/1 transformer with maximum shipping height (not exceeding 11 feet) will be preferred.

37. WARRANTY

The Contractor shall warrant that the transformers furnished have conformed to this specification. The warranty shall state that if, within three (3) years from the date transformers are delivered , a transformer is found to have defects in workmanship or material or fails in service , the Contractor shall repair or replace such defective parts (and other parts damaged as a result) within 15 days with free of charge .

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

For OLTC Type 33/11.55 kV 10/14MVA POWER TRANSFORMERS

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)
Failure to provide all of the information requested may lead to the rejection of the tender.

Description	Unit	10/14 MVA Power Transformer	
		BREB Requirement	Tenderers Guaranteed Values
1.Manufacturer's Name		Required	
2.Manufacturer's Address		Required	
3. Applied Standard		Required	
4. Type		Outdoor Oil immersed	
5. (a)Rated Power	MVA	ONAN/ONAF10/14 MVA Three Phase	
(b) Overload Capability		In accordance with IEC 603564	
6. Number of Phase		Three	
7. Rated Voltage, Phase to Phase		Required	
High Voltage winding	KV	33	
Low Voltage winding	KV	11.55	
8. Rated frequency	Hz	50	
9. Rated insulation level		Required	
a)Impulse withstand, full wave			
High voltage winding	KV	170	
Low voltage winding	KV	75	
Neutral side		Full insulation	
(b) AC withstand voltage			
High voltage winding	KV	70	
Low voltage winding	KV	28	
10. Vector Diagram (IEC76-4)	Dyn1	Required	
11. Type of Cooling	ONAN/ ONAF	Required	
12. On load Tap – changer MR Germany/ABB Sweden with Oil/Vacuum Switches		Required	
Type		Required	
Rated Capacity	In Amps	Required	
Rated tap	KV	33	
Tap range	%	- 18 to +6	
Numbers of tap	Taps	17	
Tap step	%	1.5	
Location of tap		Primary side	
Rated short time current	KA	Required	
Oil volume	Litre	Required	
Duration of one step change	Sec	Required	
Motor rating	KW	Required	
13. Impedance voltage at 75° C and at nominal ratio and 100% rated power at principal tap (with tolerance of +10%)	%	8% (with tolerance of +10%)	
14.Temperature rise at rated power (Max. ambient temperature: 40° C)		Required	

Description	Unit	10/14 MVA Power Transformer	
		BREB Requirement	Tenderers Guaranteed Values
Oil by thermometer	Deg. C.	55	
Winding by resistance	Deg. C.	60	
Winding hot spot temperature on emergency overload not to exceed	Deg. C.	140	
Maximum hot spot temperature when loaded in accordance with IEC 354	Deg. C.	118	
15. System symmetrical fault level at terminal of			
33 KV	KA	31.5	
11KV	KA	31.5	
Duration of symmetrical short circuit current for which the transformer is to be designed	Sec	2	
16. Transformer core: Type of core, max. flux density At nominalvoltage	Tesla	≤1.6	
17. Transformer bushings			
(a) H.V. Bushing			
Voltage class		Required	
Cantilever strength		Required	
Transformer bushing HV CT		Required	
- Currrent Ratio	A	400/5	
- Rated burden	VA	20	
- Accuracy		Class 5P20	
(b) L.V. Bushing			
Voltage class		Required	
Cantilever strength		Required	
Transformer bushing HV CT		Required	
(c) Neutral Bushing			
Voltage class		Required	
Cantilever strength		Required	
18. Conservator		Required	
19. Auxiliary circuit voltage for fan, etc, 3phase – 4 wire	V	415/240 AC	
20. Control Voltage	V	110 DC	
21. Sound level (IEC 60551)			
ONAN	dB	Required	
ONAF	dB	<80	
22. Transformer Bushing CT			
HV Side			
On phase “a, b & c” (Differential)			
- Current Ratio	A	400/5	
- Rated burden	VA	20	
- Accuracy		5p20	
- Short time current		Required	
LV Side			
On phase “a, b & c”			
- Current Ratio	A	1200/5	
- Rated burden	VA	20	
- Accuracy		5p20	
- Short time current		Required	
On phase “a” (OLTC)			

Description	Unit	10/14 MVA Power Transformer	
		BREB Requirement	Tenderers Guaranteed Values
- Current Ratio	A	1200/5	
- Rated burden	VA	20	
- Accuracy		Class 5P20	
- Short time current	kA	Required	
On phase "b" (WTI)			
- Current Ratio	A	1200/5	
- Rated burden	VA	20	
- Accuracy		Class 5P20	
- Short time current	kA	Required	
Neutral Bushing CT for REF :			
- Current Ratio	A	1200/5	
- Rated burden	VA	20	
- Accuracy		Class 5P20	
Neutral Bushing CT for stand by earth fault			
- Current Ratio	A	1200/5	
- Rated burden	VA	20	
- Accuracy		Class 5P20	
- Short time current	KA	Required	
23. Number of Cooling fan (main + spare)	Nos.	Required	
24. Rating of Fan motors	Kw (Maxm. 0.5 KW for Each)	Required	
25. Cooling fan losses at full ONAN/ONAF capacity operation	Kw	Required+2	
26. Core Loss at rated frequency and rated voltage at nominal tap.	Kw	Required	
27. Copper Loss at full load, at rated frequency and at 75° C		Required	
(i)At ONAN			
(a) At Maximum Tap	Kw	Required	
(b) At Nominal Tap	Kw	Required	
(c) At Minimum Tap	Kw	Required	
(ii)At ONAF			
(a) At Maximum Tap	Kw	Required	
(b) At Nominal Tap	Kw	Required	
(c) At Minimum Tap	Kw	Required	
28. Exciting Current at nominal tap and rated voltage.	A	Required	
29. Dimensions and Weight		Required	
Maximum size for transport L x W x H	mm	Required	
Heaviest weight for transport	Kg	Required	
Overall height	mm	Required	
Oil volume	Litre	Required	
Weight of oil	Kg	Required	
Weight of core	Kg	Required	
Total weight	Kg	Required	
30. Oil level indicator			
Type & model		Required	
31. Pressure Relief Device			
Type & model		Required	

Description	Unit	10/14 MVA Power Transformer	
		BREB Requirement	Tenderers Guaranteed Values
32. Buchholz Relay			
Type & model		Required	
Float Type			
Petcock is provided for testing by injecting air		Yes	
Pipe arrangement for gas release and oil collection from ground level		Yes	
Oil surge protection		Yes	
Oil drain screw provided		Yes	
33. Oil & Winding temperature indicator			
Type & model		Required	
34. Efficiency at 75^0 C & unity power factor			
a) At 28 MVA load	%	-	
b) At 20 MVA load	%	-	
c) At 14 MVA load	%	Shall be Provided	
d) At 10 MVA load	%	Shall be Provided	
35. Transtormer Tank	Shall be provided	Shall be high tensile steel plate	
36. Pressure release device for both main and OLTC Tank	Shall be provided	Shall be provided	
37. Winding shall be of electrolytic copper.	Shall be provided	Shall be electrolytic copper	
38. Pressure release device, Temperature indicationg device and Buchholz relay shall be from MR Germany or Equivalent European Origin.	Shall be provided	shall be from MR Germany or Equivalent European Origin.	
39. Manual		Shall be Provided	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
FOR 33 KV SURGE ARRESTER, STATION CLASS

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

Sl No	Description	Unit	REB Requirement	Tenderers Guaranteed Values
33 KV SURGE ARRESTER				
1.	Manufacturer's Name & Address		Required	
2.	Class of diverter to IEC 99-4		Heavy duty, ZnO	
3.	Rated voltage (RMS)	KV	30	
4.	Rated current	KA	10	
5.	Neutral connection		Effectively earthed	
6.	Power frequency withstand voltage of housing:			
	Dry :	KV	70 (RMS)	
	Impulse:	KV	170	
7.	Lighting impulse residual voltage	KV	100 peak	
8.	Steep current impulse residual voltage at 10 kA or 1 S front time	KV	110	
9.	Pressure relief device fitted?	Y/N	Required	
10.	Leakage current at rated voltage	A	Required	
11.	Minimum reset voltage	V	Required	
12.	MCOV	KV	22 -27.5	
13.	Total creepage distance	mm	Required	
14.	Surge monitor		Required	
15.	Connecting Lead from LA terminal to surge monitor:		Shall be Insulated 16 mm^2 copper cable	
16.	Overall dimension and Weight :			
	Height	mm	Required	
	Diameter	mm	Required	
	Total weight of arrester	Kg.	Required	
	Height	mm	Required	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
FOR 11 KV SURGE ARRESTER, STATION CLASS

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

SI No	Description	Unit	REB Requirement	Tenderers Guaranteed Values
11 KV SURGE ARRESTER				
1.	Manufacturer's Name & Address		Required	
2.	Class of diverter to IEC 99-4		Heavy duty, ZnO	
3.	Rated voltage (RMS)	kV	10	
4.	Rated current	kA	10	
5.	Neutral connection		Effectively earthed	
6.	Power frequency withstand voltage of housing:		Required	
	Dry :	KV	28(RMS)	
	Impulse:	KV	70	
7.	Lighting impulse residual voltage	KV	Required	
8.	Steep current impulse residual voltage at 10 kA or 1 S front time	KV	Required	
9.	Pressure relief device fitted?	Y/N	Required	
10.	Leakage current at rated voltage	A	Required	
11.	Minimum reset voltage	V	Required	
12.	Total creepage distance	mm	Required	
13.	MCOV	KV	8.0 -10.0	
14.	Surge monitor		To be provided	
15.	Connecting Lead from LA terminal to surge monitor:		Shall be Insulated 16 mm^2 copper cable	
16.	Overall dimension and Weight :			
	Height	mm	Required	
	Diameter	mm	Required	
	Total weight of arrester	Kg.	Required	
	Height	mm	Required	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
FOR 33/0.415 KV, 3 PHASE 100 KVA STATION TRANSFORMER

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

Description	Unit	REB Requirement	Tenderers Guaranteed Values
STATION SERVICE TRANSFORMERS			
1. Manufacturer's Name		Required	
2. Manufacturer's Address		Required	
3. Type		Required	
4. Applicable Standard		Required	
5. Rated power	KVA	100	
6. Rated voltage :			
- High voltage winding	KV	33	
- Low voltage winding at nominal tap – no load	V	415/ 240	
7. Vector diagram		Dyn11	
8. Rated Frequency	Hz	50	
9. Type of cooling		ONAN	
10. Type of bushing :			
-High voltage		Required	
-Low voltage		Required	
11. Off load tap-changer :			
-Rated tap	KV	33	
-Tap range	%	+ 5 to – 5	
- Number of taps	Taps	5	
12. Impedance voltage at 75deg C., at nominal ratio and rated power	%	4%	
Temperature rise at rated power		Required	
(Max. ambient temp.: 40° C)		Required	
13. - Oil by thermometer	Deg. C	60	
14. Winding by resistance measurement	Deg. C	65	
15. Dimensions and Total Weight		Required	
16. Height x width x depth	mm	Required	
17. Total weight	Kg	Required	
18. Dimensions and Total Weight		Required	
19. No Load Loss	Kw	Required	
20. Full Load Loss at 75° C	Kw	Required	

PUBLICATION NO: 1001-1999
RURAL ELECTRIFICATION BOARD (REB)
PEOPLESREPUBLIC OF BANGLADESH
STANDARD FOR

TECHNICAL SPECIFICATION FOR 33 KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER WITH CONTROL PANEL

1. SCOPE:

1.1 This Specifications intended to cover the design, manufacture, assembly and Testing at manufacturer's works of 33 KV, 3 Ph, 50 Hz, 1250A, 31.5 KA 3s, Outdoor Type Porcelain Clad, Vacuum Circuit Breaker for efficient and trouble-free operation as specified hereunder.

1.2 The Circuit Breakers are required complete with structures, operating mechanism and all associated accessories and auxiliaries.

2. STANDARDS:

The Equipment to be furnished under this Specification, shall be designed, constructed and tested in accordance with the latest revisions of relevant International Electric-Technical Commission (IEC 56/IEC-62271-100). The Equipment conforming to any other national Technical standards which ensure equivalent quality are acceptable.

Instructions to Bidders: In such cases the Bidders shall clearly indicate the standard adopted and should furnish a copy of the English translation of the standard along with the bid.

International Electric-Technical Commission Standards of 60044-1 for CT and 60044-2 for PT and Insulators and other devices, accessories etc. shall be followed relevant IEC standard.

3. GENERAL INFORMATION:

3.1 The Circuit Breakers specified herein are to be normally installed anywhere in Bangladesh at an altitude not exceeding 1000 meters above mean sea level. For higher altitude beyond 1000 meters adequate creep age distance, pole to pole distance etc. shall be designed and offered.

3.2 The general Weather Conditions are stated below.

i)	Climate condition	:	The area is Tropical with monsoon from June to October, about 3000 mm annual rain fall.
ii)	Number of Thunderstorm days	:	80 days/year.
iii)	Ambient Temp	:	45^0 C (max) and 4^0 C (min).
iv)	Maximum Wind Pressure	:	150 Kg. Mtr. Sq.

3.3 The Equipment offered shall be suitable for heavily polluted atmosphere.

3.4 The Equipment to be furnished under this Specification shall be packed for shipment so as to meet the weight and space limitations of transport facilities, specifically along with Rail, Road, right of way.

3.5 The Equipment covered by this Specification shall be complete in all respects. Any material or accessory which may not have been specifically mentioned, but is essential or necessary for satisfactory and trouble free operation and maintenance of the Equipment shall be furnished without any extra charge to the Employer.

3.6 The Equipment shall be supplied with all accessories listed in this Specification with such modifications and alternations as to safeguard the Technical requirements.

4. DESIGN CRITERIA:

4.1 The Equipment will be used in effectively neutral grounded System with fault level of 31.5 KA at highest system voltage of 36 KV.

4.2 Continuous current rating shall be 1250 Amp. Maximum temperature attained by any part of the Equipment at specified rating should not exceed the permissible limit as stipulate in the relevant standards. Equipment shall be designed taking 500C as maximum ambient temperature.

4.3 The circuit breakers and their components shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current of the system without any damage or deterioration of material.

4.4 The circuit breakers shall have motor wound spring charged trip free mechanism with anti-pumping feature, and shunt trip. In addition, facility for manual charging of spring shall be provided.

4.5 Each breaker shall be provided with manual close & open facility, mechanical ON-OFF indication, an operation counter and mechanism charge/discharge indicator.

4.6 For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. A visual mechanical indicating device will also be provided to show the position of the spring.

4.7 All controls shall be suitable for 80%, to 110% for closing & 70% to 110% for tripping of 110V D.C. The A.C. supply shall be available 415/230 Volt, 50 Hz.

4.8 The operating duty of the Breaker will be 0-0.3 sec-CO-3 min-CO.

4.9 There shall be no radio interference when the Equipment is operated up to maximum service voltage.

4.10 The minimum safe clearance of all live parts of the Equipment shall be as per relevant standards. Clearances of 33 KV Low Level pipe bus of switchyard are:

a) Phase to Phase : 1200 mm and
b) Pipe bus to ground level of supporting structure : 4000 mm

4.11 All electrical and mechanical interlocks which are necessary for safe and satisfactory operation of the Breaker shall be furnished. The interlocking device shall be of proven quality.

4.12 The condition of Breaker and its contacts shall be intact even under conditions of phase opposition that may arise due to faulty synchronization or otherwise. Bidders should confirm in this regards.

4.13 The Breaker shall be capable of smooth and rapid interruption of current under all conditions, completely suppressing the undesirable phenomenon even under the most severe and persistent rated short circuit conditions. There will be no abnormal voltage rise subsequent to the switching ON/OFF a capacitor bank within the rated capacity.

4.14 The total make and break time (in m sec/cycle) for the breaker throughout the range of their operating duty shall be indicated and guaranteed.

4.15 The breaker shall be suitable for interrupting low inductive currents without generation of abnormal over voltage.

4.16 The breaker shall be capable of interrupting rated breaking current with recovery voltage equal to maximum line Service Voltage and at all inductive power factor of the Circuit equal to or exceeding 0.15.

4.17 The Circuit Breaker shall be capable to withstand power frequency over Voltage 70 KV for 1 min.

4.18 Instructions to Bidders: The Bidder may indicate in his offer the methods adopted for limiting over voltage.

4.19 The Circuit Breaker with its hot dip galvanized steel structure shall be suitable for mounting on concrete foundation. The height of the supporting structure will be such that it will be able to maintain clearance as indicated in clause 4.10 above.

4.20 The detail of steel structure, foundation design and erection drawing shall be given. In GA/Structure drawing please indicate the location of CB point of application of dynamic load and its amplitude, dead load etc.

4.21 Special tools & tackles required for erection and dismantling and fitting of the Breaker and its accessories, if required shall be offered indicating the prices etc.

5. CONSTRUCTION:

Each vacuum Circuit breaker shall comprise of three identical poles linked together electrically and mechanically for synchronous operation.

Vacuum Interrupter

The vacuum interrupter, consisting of fixed contact and moving contact, shall be interchangeable among the same type interrupter. Short circuit capacity of vacuum bottle should be 31.5 KA and design life should be 100 nos. Operation at rated short circuit level. The operation of the interrupter will be 30000 nos. at rated current.

i) Instructions to Bidders: Constructional features of the vacuum chamber along with its functional arrangements are to be shown in a drawing submitted along with bid documents.

ii) The gap between contacts of the Circuit Breaker inside interrupter should be capable of withstanding 1.3 time voltage to neutral at one atmospheric pressure at normal ambient condition within Breaker in the event of vacuum pressure drop due to leakage.

iii) Vacuum Bottle shall be of Siemens/ABB or/ALSTOM and of reputed indigenous make. Offered bottle shall be identical with Type tested one. Brochures/leaflet on technical data sheet for vacuum bottle shall be enclosed with technical bid.

Control Panel and Protective Relays

i) Protective relays must be provided by the Contractor with the breaker. The relays must be numerical relays (from ABB, Sweden or Siemens, Germany or GE, USA) for over current, earth fault protection and differential of 33 kV feeder. There must be one master trip relay for inter tripping.
ii) All the relays should be 61850 protocol type for automation network of the 33/11.55 kV Sub-station.
iii) Plug setting range will be from 5% to 2500% and time setting range from 2.5% to 1000%.
iv) All indicating instruments shall be switch board type connected suitable for flush mounting and provided with dust and vermin proof cases for tropical use and finished in suitable color. All instrument have practical lab. means of adjustment of accuracy. The limit error of voltmeter and ammeter shall be permissible for 0.2 instrument
v) There must have minimum 3 nos. Ammeter, 3 nos.voltmeter,1nos KW meter,1nos KVAR meter, 1nos Pf meter, 1 nos. frequency meter 1 no. ammeter selector switch, 1 no. voltmeter selector switch, Test terminal block, ON/OFF/Auto Trip/Spring Charge etc. indication lamps of different colors. All indication meters will be Digital.

6.1 MAIN CONTACTS:

a) In vacuum interrupter the contact configuration, contact area, contact pressure will be sufficient for carrying rated current and short time rates current, without any abnormal phenomena.

b) Complete details of main contacts shall be furnished. The material of contacts and coating of the contacts shall be suitable for vacuum Breaker technology. Evaporation of metal during arcing and deposition of the same in the inner surface of vacuum interrupter should be restricted by adopting suitable material. Bidder shall furnish the justification of using the materials for contacts.

c) Complete details of main contacts and arc quenching device, if any with sectional drawings shall be furnished at the time of offer. Measures taken to free the contacts from vibration during closing shall be clearly explained in the drawing, support by tests results.

d) The contact erosion should be limited up to 3 mm for useful life and indication to monitor the progress of contact erosion has to be provided.

6.2 The vacuum pressure within interrupter shall be adequate to interrupt the fault current. Precaution shall be taken so that there will be no flush over on outside of the vacuum interrupter inside the porcelain insulator.

6.3 Design of the vacuum bottle and its insulator encasing should be suitable for outdoor use, taking care of required creepage distance considering possibility of moisture condensation if

any, in the annular space between the vacuum bottle and insulator enclosure. Type test with identical bottle type with similar encasing arrangement shall be done and accordingly Report shall be submitted along with bid document.

6.4 Vacuum bottle with its insulator encasing chamber shall be hermetically sealed. Free passage of air in the chamber with or without provision of circulation of hot air is not accepted.

6.5 Tripping/Closing Coil burden of Equipment should not be more than 200 watts at 110 V D.C. The value will not be relaxed, specially for tripping coil.

6.5 OPERATING MECHANISM:

a) The operating mechanism shall be suitable for rapid closing and tripping. The opening and closing energy shall be obtained from spring charge mechanism. The spring charging may be done by either motor operation with facility for manual charging when required or by other suitable trouble free mechanism. Local arrangement for operating breakers both electrically and mechanically shall be provided in addition to remote operation.

b) The mechanism shall have anti-pumping circuitry and will be trip free electrically and mechanically. The anti-pumping arrangement shall be initiated through normally „NO" type, direct auxiliary contact of circuit breaker and shall be of self hold type. Plug-in type relay/Contactor for Anti-pumping Relay will not be acceptable.

c) Spring operated mechanism will be complete with opening spring, closing spring, limit switch and all necessary accessories to make the mechanism a complete operating unit.

d) Contactor used for anti-pumping relay shall be of reputed make.

e) There shall be mechanical ON/OFF indicator spring charge and operation counter for each Breaker and also provision for remote indication.

f) The operating mechanism box shall be fixed at a working height from ground level. View glass shall be provided on hinged door at the front side.

g) Spring charging LS shall have sufficient no. of spare contact.

6.6 COMMON CONTROL CUBICLE:

a) A free standing outdoor type weather proof, dust and vermin proof cubicle shall be provided to house the operating mechanism and all other accessories except those which must be located in the pole box.

b) The cubicle shall be of 3.00 mm thick sheet steel and shall have hinged doors at front and hinged/bolted door or cover at rear for access to the mechanism. Doors should be of proper design for smooth opening and closing with pad locking arrangement.

c) A removable gland plate of 3 mm thickness shall be provided at the bottom of the cubicles for the Employer's Cable entry. Glands of sizes suitable for entry of 1 no. 12 core, 2 nos. 8 core and 2 nos. 4 core Cables for Control etc.

d) Terminal blocks for AC & DC shall be kept separate. Terminals shall be suitable for at least 2X 2.5 sq.mm copper leads. All wiring shall be of 1100 V grade PVC.

e) Thermostat controlled heaters shall be provided to prevent condensation within cubicle. Cubicle illumination Lamp with switch and a 230 V., 15A, 3 pin sockets with a Control Switch shall be provided.

f) All controls, alarms, indications and interlocking devices furnished with breaker shall be wired up to the terminal Black in the common control cubicle. Not more than two wires shall be connected to one terminal.

g) All wires shall be identified at both ends with ferrule marking in accordance with approved wiring diagram.

h) Terminal blocks shall have compression type multi-way terminals with bonding screws and washers. At least 15% spare terminal shall be provided.

i) Scheme diagram on a durable sticker shall be fixed on inside door of Control Cubicle.

j) Degree of protection of control cubicle shall be IP-55.

7. INSULATORS:

a) Porcelain supports, interrupter housing of adequate mechanical and dielectric strength with suitable creep age distance shall have to be used. All Support/Interrupter Housing of identical ratings shall be interchangeable. Each Interrupter-Housing shall be provided with terminal stud/pad.

b) The porcelain used in interrupter housing shall be made from wet process and shall be homogeneous, free from laminations, caustics and other flaws which may impair its mechanical or dielectric strength and shall be glossy, tough and impervious to moisture.

c) The porcelain supports, interrupter –housing insulation shall be coordinated with that of Circuit Breaker. The puncture strength of the bushings shall be greater than the dry flashover value.

d) When operating at rated voltage, there shall not be any electrical discharge between live terminal and earth. No Radio disturbance shall be caused by the support insulators when operating up to the maximum System Voltage. It shall also be free from corona.

e) All iron parts shall be hot dip galvanized. The nuts, bolts, washers etc. shall also be hot dip galvanized steel or stainless steel.

f) Each Circuit Breaker shall be provided with Bi-metallic terminal stud/pad suitable for connection of pipe bus/ACSR Conductor.

8. AUXILIARY CONTACTS:

a) Breaker shall be provided with 9 NO & 9 NC spare auxiliary contacts in addition to the auxiliary contacts required for Breaker’s own operational requirements. These auxiliary contacts shall preferably be convertible type.

b) These contacts shall have continuous current rating of at least 10A. The breaking capacity shall be adequate for the circuits controlled, or at least 12A at 110 V DC with a circuit time constant of minimum 20 ms.

c) All these contacts shall be wired up to terminal block in the control cubicle. Auxiliary contacts which are to be installed on the frame of Circuit Breaker shall be suitably protected against accidental arcing from main circuit. Insulating materials of contacts shall be ceramics or other non-tracking materials.

9. GROUNDING:

Circuit Breaker shall be provided with two grounding pads with 2 nos. tapped holes for M10 bolts and spring washers for connection of the Employer's grounding conductor (50x6 mm G.I. strips).

10. PAINTING:

External surfaces shall be given a coat of high quality red oxide or other suitable primer and shall be finished with two coats of synthetic enamel paints. Such painting should be able to withstand tropical climate as stipulated in Sl.No.3 of this Specification.

11. EQUIPMENT FOUNDATION AND STEEL STRUCTURE:

a) The Circuit breaker etc. shall be furnished complete with base frame, anchor/foundation bolts and hardware. Details structure assembly drawing, mentioning part no. of each member and also indicating cross sectional area of member used with supporting calculations. The point of C.B. dynamic load and its amplitude, dead load etc. shall be mentioned.

b) Similar grounding pad as mentioned against Sl.No.8 are also to be provided.

c) If the Centre line of Control Cubicle is more than 1.50m above ground plate, one suitable platform with checker plate shall be fixed at a suitable height of support structure with ladder step arrangement, to access the control cubicle for Local operation & maintenance purpose.

12. CURRENT TRANSFORMER:

Current transformers, three per circuit breaker, shall be of outdoor, single phase, electromagnetic induction, oil immerged, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted on the bracket. The CT tank should be Hot Dip galvanized as per relevant IEC to prevent corrosion of all exposed metal parts.

12.1 Core

High grade non-ageing cold rolled grain oriented (CRGO M4 or better grade) silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.

12.2 Winding

The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften coze, shrink or collapse during service.

Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ration. Similar numbers shall be marked on terminal block arrangement and wiring diagram.

The continuous current rating of the primary winding shall be one hundred and twenty percent of the normal rated current. Secondary windings of current transformers shall be used for metering, instrumentation and protection and shall be rated for continuous current of one hundred and fifty percent of normal rated current of primary winding.

12.3 Construction

The current transformer enclosures shall be made of high quality steel and shall be not dip galvanized and shall be able to withstand and stresses occurring during transportation and the terminal and mechanical stresses resulting from maximum short circuit current in service. The primary winding and terminals shall be in a tank and supported by a hollow porcelain insulator. The secondary connection shall be conducted through the hollow insulator and terminated in a terminal box mounted on the base plate.

12.4 Insulation level

The current transformers shall be designed to withstand impulse test voltages and power frequency test voltage as specification.

13. POTENTIAL TRANSFORMER

The voltage transformer to be supplied under this specification shall be of outdoor, single phase dead tank double wound, oil immersed type for operation in hot and humid atmospheric conditions described in this document. To prevent corrosion of the exposed surfaces, the tank should be not dip galvanized. They shall have separate HV and LV windings and shall be suitable for use as bus VTs in 33 KV.

13.1 Duty requirement

33KV Voltage transformer for all the indicating instruments, measuring meters and protection on the 33 KV side.

13.2 Porcelain Insulator

External parts of the voltage transformers which are under continuous electrical stress shall be of hollow porcelain insulators. The creepage and flashover distance of the insulators

shall be dimensioned and the type and profile designed and shall be suitable for the worst environmental conditions for heavily polluted atmosphere and shall be not less than 25mm per KV of highest phase to phase system voltage with protected creepage distance minimum 50 percent of the total. Internal surfaces of hollow insulators shall also be glazed.

The insulators shall be withstand in high mechanical, tensile and breaking strength. All porcelain used on the voltage transformers shall have the following properties high strength, homogeneity, uniform glaze, free from cavities and other flaws and a high quality uniform finish porcelain components shall withstand the maximum expected static and dynamic loads to which the voltage transformers may be subjected during their service life. The insulation of the hollow porcelain insulators shall be coordinated with that of the voltage transformers to ensure that any flash over occurs only externally.

13.3 Core

High grade non-ageing cold rolled grain oriented silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and or over Voltage. The flux density shall be limited to 1.6 Tesla at normal voltage and frequency. There shall be no saturation at any stage during operation.

The instrument security factor of the core shall be low enough so as to cause damage to the instruments in the event of maximum short circuit current or over voltage.

13.4 Windings

The primary and secondary windings shall be electrolytic copper of high purity and conductivity and covered with double paper insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

The insulation of windings and connections shall be free from composition liable to soften, ooze, shrink or collapse during service. The secondary windings of the voltage transformers shall be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitable reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage. The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

Both primary and secondary winding terminals shall be clearly and indelible marked to show polarity. The connections required for different secondary windings in case of multi-winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

13.5 Secondary Terminal Box

A dust vermin and weather proof terminal box shall be provided at the lower end of each voltage transformer for terminating the secondary windings. The box shall have a bolted removable cover plate complete with gaskets. The terminal box shall have cable gland plate and cable glads with shrouds suitable for entry of 4 core □2.5mm2 PVC insulated control cables. The terminal box enclosure shall have protection of class IP 55.

13.6 Circuit diagram

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the terminal box cover. Labels shall be provided inside the cover to describe the functions of various items of equipments.

13.7 Earthing Termination

Two earthing terminals complete with necessary hardware shall be provided on each voltage transformer for connecting to earth continuity conductors of the Employer. They shall be of electroplated brass and of adequate size to carry the earth fault current.

The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals.

14. DRAWING, MANUALS AND TYPE TEST CERTIFICATES:

The following drawings and manuals shall be furnished for information purpose with each copy of the bid.

14.1 General Arrangement Drawings indicating all dimensions,

14.2 Technical leaflets/manuals on each piece of Equipment explaining the function of various parts, principle of operation and special features. Technical leaflets/manuals for offered type of vacuum bottle etc.

14.3 Type Test Certificates as per IEC carried out on Similar Circuit Breaker from reputed/recognized laboratory shall be furnished with the bid.

14.4 Supplier also have to provide test reports of relays.

15. CONTRACT DRAWING AND CATALOGUE:

After placement of order, six (6) copies of various drawings data and manuals as mentioned below shall be submitted to the Project Manager/Employer.

15.1 Dimensional General Arrangement drawing showing all dimensions and disposition of fittings and space requirement and mounting arrangements.

15.2 Sectional views of contact assembly, operating mechanism and are extinguishing chamber.

15.3 Transport/shipping dimensions with weights.

15.4 Foundation and anchor details including dead-load and impact load with direction and also point of application.

15.5 Assembly drawing for erection at site with part numbers and schedule of materials.

15.6 Electrical schematic and wiring diagram with explanatory notes, if any.

15.7 Schematic diagram for spring charged operating mechanism schematic layout drawings.

15.8 Name plate drawing and any other relevant drawing and data necessary for erection, operation and maintenance.

15.9 Outline drawings of bushings, terminals and terminal connectors.

15.10 i) After approval, the Contractor shall submit Ten (10) sets of approval drawings and manuals to the Project Manager/Employer. Instruction manuals and data sheets for each rating of Equipment shall be submitted. The manuals shall clearly indicate the installation methods, checkups and tests to be carried out for testing the Equipment and maintenance procedure.

ii) In all drawings, manuals etc., reference no. of purchase order no. shall be indicated.

iii) Two sets complete in all respects with required bindings should be sent directly to the Project Manager/ Employer.

16. TEST REPORTS AND INSPECTION:

The test reports are to be submitted along with the bid and Inspections shall be carried out during Pre Shipment and Post Landing Inspection.

16.1 Type test

The Bidder shall submit along with the bid, detailed as well as complete test reports of all tests (including Type Test) as stipulated in relevant IEC with Complete identification, date and serial no., carried out in a Government recognized Test House or Laboratory/ CPRI/ NABL accredited lab/ on Circuit Breakers of identical design.

For Breaker:

a) Short time withstand and peak withstand current test
b) Lightning impulse voltage withstand test
c) Temperature rise Test
d) Mechanical Endurance Test
e) Measurement of the resistance of the main circuit
f) Short circuit current making and breaking tests
g) Tightness tests.

For CT:

a) Lightning impulse voltage(Chopped impulse and full impulse);
b) Power frequency wet withstand voltage;
c) Temperature rise;
d) Short circuit withstand capability test;
e) Current error and phase displacement
f) Switching impulse.

For PT:

a) Lightning impulse voltage test;
b) High voltage power frequency wet withstand voltage;
c) Temperature rise test;
d) Short circuit withstand capability test;
e) Switching impulse;
f) Determinations of error;

16.2 Routine test

For Breaker:

a) Dielectric test on main, auxiliary and control circuit
b) Measurement of the resistance of the main circuit
c) Tightness test
d) Mechanical operation tests
e) Design and visual checks

For CT:

a) Verification of terminal marking and polarity;
b) Power frequency dry withstand test on both windings;
c) Power frequency dry withstand test between sections;
d) Over voltage inter-turn test;
e) Turn ratio;
f) Instrument security factor test;
g) Determinations of error;
h) Secondary winding resistance and Accuracy test ;
i) Current error and phase displacement;
j) Knee point voltage and magnetizing current test ;
k) Insulation Resistance Test;

For PT:

a) Verification of terminal marking and polarity;
b) Power frequency dry withstand tests on both winding;
c) Power frequency withstand tests between sections;
d) Determination of limits of voltage errors and phase displacement;
e) Partial discharge measurement;
f) Insulating Resistance measurement;

16.3 Special tests

For CT:

a) Multiple chopped impulse test on primary winding;
b) Measurement of capacitance and dielectric dissipation test.
c) Mechanical tests.

For PT:

a) Chopped impulse test on primary winding;
b) Measurement of capacitance and dielectric dissipation test.
c) Mechanical tests.
d) Transmitted over-voltage measurement.

17. SPECIFIC LIMIT OF AUXILIARY SUPPLY VOLTAGE:

a) The auxiliary supply voltage shall be 80% to 110% of the rated 110 V in supply for closing coil and the same shall be 70% to 110% for tripping coil.
b) The operating voltage for motor operated spring charged mechanism shall be 415V A.C., 3 phase, 50 Hz or 230V. 1-phase, 50 Hz. The motor shall operate at a voltage variation of 85% to 110% of the supply voltage.

18. NAME PLATE:

i. Rated voltage/Maximum voltage
ii. Rated insulation level
iii. Type /Model No./Sl. No./Year of manufacture.
iv. Rated current
v. Rated frequency.
vi. Rated short Circuit Breaking Current.
vii. Rated transient recovery voltage for terminal fault.
viii. Rated short circuit making current.
ix. Rated operating sequence.
x. Rated short time current.
xi. Rated line charging/breaking current
xii. Rated Cable charging current.
xiii. Rated single capacitor bank charging/breaking current.
xiv. Rated small inductive breaking current.
xv. Rated Supply Voltage of auxiliary circuits.
xvi. Applicable standard.

19. RECOMMENDED SPARES:

Instructions to Bidders: The Bidder shall quote item-wise price of recommended spares for 5 (five) years normal operation. The Employer will decide the actual quality of spare to be procured on the basis of the List.

20. ACCESSORIES:

Each Breaker shall be furnished complete with fittings and accessories as listed below (The list is illustrative & not exhaustive).

i. Clamp-type terminal connectors for ACSR Conductor
ii. Base frame and foundation/anchor bolts.
iii. Operating mechanism, trip and close coils.
iv. Set of valves required for gas filling.
v. Auxiliary Contacts and Relays/Contacts.
vi. Local/Remote selector Switch and Close/Trip Control Switch.
vii. Manual close and trip devices.
viii. Mechanical ON/OFF indicators.
ix. Operation counters.
x. Weatherproof Control cubicle and operating mechanism boxes, with locking arrangement.
xi. Set of Switch-Fuse/MCB/MCCB units for A.C. & D.C. Supply.
xii. Space heaters with thermostat and switch. Two units will be provided with the option to operate separately.
xiii. Cubicle illumination Lamp with Switch.
xiv. Terminal blocks and internal wiring.

xv. Necessary all Main Control cables & Auxiliary Control cables.

xvi. G.I. conduits and accessories for connection between Central Control Cubicle and operating mechanism boxes where applicable.

xvii. Other standard accessories which are not specified, but are necessary for efficient and trouble free operation shall be supplied.

21. TEST AT FACTORY AND TEST CERTIFICATES

21.1 All Acceptance tests shall be carried out at manufacturer's works in presence of the Employer's and Contractor's representatives. In addition to above, all routine tests are also to be carried on the breakers as per relevant IEC. The entire cost of acceptance and routine test that to be carried out as per relevant IEC' shall be treated as included in the quoted price of breakers. The Contractor shall give at least 21(twenty one) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out from the date when the tests will be carried out.

21.2 Routine tests on all breakers, CTs and PTs shall be carried out as per IEC-62271-100, IEC 60044-1, IEC 60044-2 and test reports shall be submitted along offer.

22. WARRANTY

The Contractor shall warrant that the VCB furnished have conformed to this specification. The warranty shall state that if, within three (3) years from the date of delivery in case of EXW contracts & from the date of arrival at the designated port of entry in case of CIP Contracts, a VCB is found to have defects in workmanship or material (or fails in service due to such defects) the Contractor shall repair or replace such defective parts (and other parts damaged as a result) within 15 days, free of charge.

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR 33 KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER (VCB)

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

Sl. No.	Description	Unit	REB Requirements	Tenderers Guaranteed Values
1	System voltage	KV	33	
2	Rated voltage	KV	36	
3	Rated frequency	HZ	50	
4	Rated normal current			
	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	80	
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 □s 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 stored energy.	
15	Operating particulars			
	a) Breaking time	ms	<60ms	
	b) Closing time	ms	70±10ms	
16	Is the circuit breaker trip free with anti-pumping feature?	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 Contact			
	NO	Nos	9	
	NC	Nos	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	

Sl. No.	Description	Unit	REB Requirements	Tenderers Guaranteed Values
26	Creep age Distance	mm/kv	25	
27	Closing Coil	Nos.	01	
28	Contact Resistance	μ	≤ 40	
29	Is the lockout facility fitted?		Yes	
30	Length of stroke	mm	To be mentioned	
31	All current carrying parts of VCB shall be made of		Copper	
32	Tripping Coil	Nos.	02	
33	No of operation a) At rated short circuit current b) At rated current	 Nos. Nos.	 100 30000	
34	Standard		IEC 62271-100	
35	Manufacturer's name & Country		To be mentioned	
36	Manufacturer of vacuum bottle		Siemens/ABB or/ALSTOM	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE FOR 33 KV
CONTROL AND ENERGY METERING PANEL

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)
Failure to provide all of the information requested may lead to the rejection of the tender.

SL. No.	Description	Unit	REB Requirements	Tenderers Guaranteed Values
1	Manufacturer's name & Country		To be mentioned	
2	Model Number		To be mentioned	
3	Overall dimensions	mm	To be mentioned	
4	Weight of panel	Kg	To be mentioned	
PROTECTION				
A. DIFFERENTIAL RELAY				
1	Manufacturer's name & Country		Siemens, Germany /ABB, Sweden/Schneider (UK/France)/ GE, USA	
2	Model Number	-	To be mentioned	
3	Type of relay	-	Numerical Programmable	
4	Range setting a) Phase element of current b) Earth fault element of current c) Range of time setting	% of CT rating	To be mentioned	
5	Shall have event record option		Yes	
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 time CT rated current for a) Phase element (100%) b) E/F element (40%)	Sec Sec	To be mentioned To be mentioned	
9	The relays should be 61850 protocol type.		Yes	
B. IDMT OVER CURRENT & EARTH FAULT RELAY				
1	Manufacturer's name & Country		Siemens, Germany /ABB, Sweden/Schneider (UK/France)/ GE, USA	
2	Model Number	-	To be mentioned	
3	Type of relay	-	Numerical Programmable	
4	Range setting a) Phase element of current b) Earth fault element of current c) Range of time setting	% of CT rating	5% to 2500% 1% to 1000% 2.5% to 1000%	
5	Ranges of timing at DMT	ms	0-100000	

SL. No.	Description	Unit	REB Requirements	Tenderers Guaranteed Values
6	Shall have event record option		Yes	
7	Burden of relay at 10 time CT rating	VA	To be mentioned	
8	Percentage of current setting at which relay will reset	%	To be mentioned	
9	Reset time after removal of 10 time CT rated current for a) Phase element (100%) b) E/F element (40%)	 Sec Sec	 To be mentioned To be mentioned	
10	Annunciator for the Transformer Panel		To be provided	
11	The relays should be 61850 protocol type.		Yes	
12	Over Current Relay Type		Directional	
KWh METER			Separate Panel for Energy Metering	
1	Manufacturer's name & Country		Siemens (Germany/ Switzerland)/Alstom (UK)/ ABB (Sweden)/AEG (Germany)/ Schlumberger (USA)/ Landys+Gyr (Switzerland/Greece) /CEWE (UK)	
2	Model Number	-	To be mentioned	
3	Number of KWh Meters		01	
4	Type of the meter		Numerical Programmable, Multifunction with accuracy Class 0.2s, Load profile , instrumentation profile for minimum 6 months with a interval of 30 min, software for protection and optical probe for data download as per IEC with provision of communication port automatic meter reading (AMR)	
5	Class of accuracy		0.2 s	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR INDICATION METER (VOLT, AMPERE, KW, KVAR, POWER FACTOR, FREQUENCY)

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)
Failure to provide all of the information requested may lead to the rejection of the tender.

SL. No.	Description	Unit	REB Requirements	Tenderers Guaranteed Values
1	Manufacturer's name & Country		Siemens (Germany/ Switzerland)/ Alstom (UK)/ ABB (Switzerland/Romania/ Finland)/AEG (Germany)/ Schlumberger (USA) /CEWE (UK)	
2	Model Number		To be mentioned	
3	Number of Meters		3 nos Ammeter, 3 nos voltmeter, 1nos KW meter,1nos KVAR meter, 1nos Pf meter,1	
4	Type of meter		Digital	
5	Class of accuracy		1	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE FOR 33KV CURRENT TRANSFORMER (CT)

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)
Failure to provide all of the information requested may lead to the rejection of the tender.

SL. No.	Description	Unit	REB Requirement	Tenderers Guaranteed Values
1	Type		Electromagnetic induction, single phase, oil immersed outdoor	
2	Rated primary current	Ams	800-400/5-5-5A	
3	Rated secondary current	Ams	5-5-5A	
4.1	Rated secondary accuracy and burden (33 kV Feeder& Grid			
	a) Protection (core 1)		5P20, 30VA	
	b) Metering (core 2- dedicated for energy metering)		0.2, 30VA	
	c) Metering(core 3- for indicating meters)		0.2, 30VA	
4.2	Rated secondary accuracy and burden (10/14 MVA Incomer)			
	a) Metering(core 1- for metering)		0.2, 30VA	
	b) Protection (core 2)		5P20, 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	Basic insulation level on 1.2 / 50 micro-sec wave	KV	170	
11	Power frequency withstand voltage (1 min, 50 Hz)	KV	70	
12	Creep age distance	mm/Kv	25	
13	Bushing		Porcelain outdoor	
14	System earthing		Effectively earthed	
15	Insulation class		A	
16	Standard		IEC60044-1	
17	Knee point voltage for protection (at both ratio):		The value should be sufficient to meet 5P20 at rated burden and measured	
18	Knee point voltage for metering (at both ratio):		The value should be sufficient to meet	
19	Security factor, (FS for the metering core)		<5	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR 33 KV VOLTAGE TRANSFORMER (VT FOR BUS & FEEDERS)

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

SL. No.	Description	Unit	REB Requirement	Tenderers Guaranteed Values
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 /	
4	Rated secondary burden and accuracy			
	Secondary winding Core 1	VA Class	50VA 0.2	
	Secondary winding Core 2	VA Class	30VA 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	
12	Rated voltage factor		1.2 continuous 1.9 at 30	
13	Standard		IEC 60044-2	
14	Short time current rating for 3 sec.	KA	31.5	

PUBLICATION NO: 1002-1999
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)
TECHNICAL SPECIFICATION FOR 11 KV INDOOR TYPE VACUUM CIRCUIT BREAKER/SWITCHGEAR

1. 11 KV Indoor Switchgear

1.1 General

The 11 kV switchgear shall consist of a single bus-bar, metal clad, indoor type, floor mounted, single tier integrated unit, incorporating enclosures for the circuit breaker units, bus-bars, current transformers and auxiliary wiring.

Each 11 kV CB shall be provided with a combined relay & control panel forming an integral part of the circuit breaker equipment. All in door 11 kV feeders/ bus CTs and bus PTs shall be dry/ cast resin type.

The panels shall be equipped with the necessary protection control devices, indicating instruments and alarming devices, MCBs, etc. All the relays should be 61850 protocol type for automation network of the 33/11.55 kV Sub-station.

The switchgear shall be of robust construction designed for maximum reliability of service in the tropical climate specified.

Cable boxes shall be supplied complete with glands and terminal lugs.

1.2 Clearances

Maximum insulator lengths and clearances in air shall be not less than those specified for 11 kV switchgear having 75 KVp Basic Impulse Level.

1.3 Current Ratings

All parts of the switchgear, including current transformers, shall be capable of withstanding, without thermal of mechanical damage, the instantaneous peak and the three second short time current corresponding to the rated making and breaking capacity of the circuit breakers.

All normal current specified are the minimum continuous values required under the service conditions appertaining to Bangladesh.

1.4 Circuit Breaker making and Breaking capacities

Each circuit breaker shall be capable of making and breaking short circuit faults in accordance with the requirements of IEC 56 - Circuit Breaker, at 3 phase symmetrical circuit ratings at 11 kV service voltages as stated in the schedules.

1.5 Circuit Breakers

1.5.1 Type

The 11 kV circuit breakers shall be vacuum type in accordance with IEC 56 as appropriate.

All types shall incorporate horizontal isolation facilities and be mounted on horizontal draw-out type.

1.5.2 Interchangeability of Circuit Breakers

Circuit breaker of the same type and current rating shall be interchangeable, both electrically and mechanically, but it must be impossible to interchange equipment of different current ratings.

1.5.3 Circuit Breaker Operation Mechanism

Circuit breaker closing mechanisms shall be 230-volt a.c motor wound preferably spring operated type such that the closing speed is independent of the operator.

11kV switchgear tripping shall be effected by means of 02 nos. of 110 volt dc shunt trip coil.

Each equipment shall be provided with a visual, mechanized, indicating device, which shall be positively driven in both directions to show whether the circuit breaker is “Open” or “Closed”. It shall be operative when the circuit breaker is in the “Service” and “Test” locations. Lamp indication in place of a mechanical indicator will not be accepted. Operation counters shall be provided on each mechanism.

Means shall be provided for coupling the secondary circuits on the fixed portion to those on the movable portion when the circuit breaker is isolated in order to permit closing, tripping and interlock circuits to be checked for operation test purposes.

Means shall be provided for local manual mechanical tripping of circuit breakers, preferably by push buttons, shrouded to prevent inadvertent operation.

Locking facilities shall be provided so that with the circuit breaker in any location it can be prevented from being closed when it is open and from being mechanical tripped when it is closed. This requirement shall be met by the fitting of a single padlock and shall not entail the fitting of any loose components prior to the insertion of the padlock.

It shall not be possible, without the use of tools, to gain access to the tripping toggle or any part of the mechanism which would permit defeat of the locking of the mechanical tripping feature.

It shall not be possible to render the electrical tripping feature inoperative by any mechanical locking device.

1.5.4 Circuit Breaker Isolating Features

Irrespective of the operating type of unit the following shall apply.

Each circuit breaker shall be connected to the bus bars and feeder circuit through plug and socket type isolating devices. The devices shall be of the “Off Load Type” but shall be suitable for operation whilst the bus bars and/or feeder circuits are alive.

Isolating devices shall be interlocked with their respective circuit breakers to prevent their making or breaking load, but arrangements whereby attempted isolation of a closed circuit breaker trips the circuit breaker are not permitted.

The main circuit isolating devices and also all secondary circuit isolating contacts shall be of the self-aligning type, mounted in accessible positions to permit maintenance.

The number of auxiliary circuit isolating switches shall be sufficient to meet the facilities.

1.5.5 Interlocks

All mechanical interlocks shall be of the preventive type and shall be arranged to prevent mal operation as close as possible to the point at which mechanical force is applied, in order to prevent defeat of the interlocks by distortion of linkages Electrical interlocks shall also function so as to prevent the closing of the circuit breaker.

Clearly labeled mechanical interlocks shall be provided which are designed to prevent:

a) A closed circuit breaker from being withdrawn or inserted into the isolating contacts.
b) Tripping by attempted isolation.
c) The closing of a circuit breaker except when correctly located in Service or Test positions.
d) A circuit breaker from being plugged into the isolation contacts if the tank is not in position
e) A circuit breaker being closed in the service position when the secondary circuits between the fixed and moving portions are not completed.

In addition electrical interlocks may be utilized to ensure safe operation of the plant; i.e. on 11 kV transformer incoming circuits the circuit earth position shall not be operative unless the 33 kV circuit is de-energized and isolated etc.

1.5.6 Safety Shutter Devices

A set metal shutters shall be provided to cover each 3 phase group of stationary isolating contacts.

The shutters shall open automatically by a positive drive initiated by the movement of the circuit breaker. The closing operation shall also be automatic by positive drive
When padlocked closed, the shutters shall completely shroud the stationary contacts and it shall not be possible to force the shutters or part of the shutters to gain access to the stationary contacts.

To facilitate testing, means other than locking shall be provided for securing the shutters in the open position. However, such means shall be automatically cancelled when the automatic operation of the shutters restored upon reconnection of the circuit breaker.

Bus-bar shutters shall be painted signal red, colour 537 in BS 381 C, and shall be clearly and indelibly labeled “BUSBARS” in large white letter in English. The Contractor may offer works which comply with different standards or codes only if, and when requested by the Project Manager Circuit shutters shall be painted yellow, colour 355 in BS 381 C, but shall not be lettered, except that on incoming feeders the circuit shutters shall be clearly and indelibly labeled “DANGER LIVE CABLES” in large red letters.

Voltage transformer spout shutters shall be painted yellow, colour 355 in BS 381 C. Durable phase colour identification shall be provided in a prominent position. Provision or access shall be made for lubricating the mechanical linkages.

All shutters shall be effectively earthed

Shutters shall not operate towards the fixed isolating contacts.

1.5.7 Bus-bars and Connections

The equipment shall be of single bus-bar type. Bus-bars and connection shall comply with applicable clauses of IEC 298 and shall be fully insulated.

The equipment shall be of single bus-bar type. The bus-bar assemblies shall be of a type which shall not rely only on air for insulation purpose.

Any earthed screen applied to the exterior of the insulation shall be securely earthed in each bus-bar compartments.

The insulation of the bus-bars and their connections shall be capable of withstanding, without damage, the thermal and mechanical effect of a through fault current equivalent to the short-time rating of the switchgear.

Access to bus-bars and the connections directly thereto shall be gained only by the removal of covers secured by bolts or screws. Such covers shall be marked clearly and indelibly "BUSBARS"

Bus-bars shall extensible at both ends; such extension shall entail the minimum possible disturbance to the bus-bar chambers. Compound filled bus-bar chambers are not acceptable.

1.5.8 Earthing of Metal Parts of Switchgear

All metal parts, other than those forming part of an electrical circuit, shall be connected to a hard-drawn, high conductivity, copper earth conductor on each unit, of adequate sectional area.

The frame of draw-out circuit breakers shall be connected to the earth bar through a substantial plug type contact and the plug shall be long enough to allow the bus-bar and feeder shutters to close before breaking contact.

Interlocking (both mechanical & electrical) must be provided to avoid accidental earthing circuit breaker in "service position".

1.5.9 Earthing of Insulations

Earthing of the switchgear and ancillary panels and auxiliary equipment shall be carried out in accordance with IEEE Standard 80 & 142 where applicable.

1.5.10 Insulators

Porcelain insulators shall be best quality electrical porcelain. The clamping surfaces of all porcelain insulators shall be accurately ground and shall be free of glaze.
Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index.

1.5.11 Auxiliary switch

Each circuit breaker shall be provided with adequate no. auxiliary switches to interrupt the supply to the closing mechanism and to complete the trip circuit, when the circuit breaker is in the "Closed" position and to cover all the necessary indication, interlocking and control facilities with spare contacts.

Each circuit breaker shall be provided with clean auxiliary contacts for the purpose of providing remote switch and alarm indication at the remote grid supervisory centre. In addition each circuit breaker shall be provided with the necessary 50 volt dc interposing relays required to achieve remote control of the circuit breaker via a future remote grid supervisory system. All auxiliary switches shall be wired down whether in use or not to the appropriate marshaling kiosk.

1.5.12 Special Tools

One complete set, of all special tools that are necessary for the overhauling maintenance and adjustment of the whole equipment shall be provided with each switchboard. The tools provided shall be in a new condition and shall not be used for the erection of the equipment on Site.

1.5.13 Indoor Breaker Specification

The 11 kV switchgear unit indoor vacuum CB will be draw out type along with CT,11 kV bus, 11 kV PT (3 × single phase unit – draw out type). The C.B shall have spring operating mechanism suitable for charging by motor (A.C 230 V, 1 phase) with provision of hand charging. Sufficient auxiliary contacts shall be provided for position indication, interlocks and other purposes. Two sets of independently operative trip coils shall be there. Provision for signaling of low gas pressure and ultimate lock out for very low pressure shall be provided. Anti pumping features should be introduced with the Breaker. All the current carrying parts should be copper.

Technical Particulars of 11 kV Circuit Breakers:

Phase	3-phase
Service (Rated) Voltage	11.55 KV
Maximum system Voltage	12.62 KV
Continuous rating current of Bus-bar	2000 Amps.
Continuous rating current	2000 A (Incomer for 20/28 MVA), 2000 A (Incomer for 10/14 MVA), 2000 A (Bus Section), 630A (Feeder).
Basic Impulse Level (BIL)	75 kV,
Power frequency withstand voltage	28 kV.

Bus Shall be 3 phase, 50Hz ,2000A, air insulated capable of withstanding **31.5** KA for 3 sec.

Vacuum Interrupter

The vacuum interrupter, consisting of fixed contact and moving contact, shall be interchangeable among the same type interrupter. Short circuit capacity of vacuum bottle should be 31.5 KA and design life should be 100 nos. Operation at rated short circuit level. The operation of the interrupter will be 30000 nos. at rated current.

Vacuum Bottle shall be from Siemens/ABB or/ALSTOM and of reputed indigenous make. Offered bottle shall be identical with Type tested one. Brochures/leaflet on technical data sheet for vacuum bottle shall be enclosed with technical bid.

1.5.14 Current Transformers (CTs).

The current transformer rated current ratio shall match the connected load circuit and secondary circuit requirements.

Current transformers shall be capable of withstanding without damage the full load, peak and rated short time currents of their associated equipment.

Where space within a current transformer chamber permits dedicated current transformers shall be used for protection, instrumentation and metering. All the indoor 11 kV CTs shall be dry/ cast resin type.

Current transformers used for energizing indicating instruments and metering shall be of Class 0.2 accuracy in accordance with IEC 185Current 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 the switchgear breaking capacity unless otherwise approved by the Project Manager.

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 Project Manager.

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.

Current transformers for combined purposes (e.g. protection relays and indicating meters) shall have a dual Class 5p/Class 0.2 performance, and the secondary circuit shall have an approved means (saturating reactor or saturating interposing C.T.) of protecting the meters and reducing their burden under system fault conditions.

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 dc 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 Project Manager informed.

Metal clad switchgear current transformers shall be located on the non-bus-bar side of the circuit breaker except where current transformers are provided on both sides of the circuit breaker for protection zone overlap. The primary conductors shall be accessible for primary current injection treating on site.

1.5.15 Voltage Transformers (VTs)

Voltage transformers shall comply with the requirements of IEC 186 with amendments and supplements and shall be of:-

- Class 3P accuracy for protection/indicating instruments

- Class 0.2 accuracy for tariff metering or acceptance efficiency testing.

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 the indoor 11 kV VTs shall be dry/ cast resin type.

All voltage transformers in the system at a given voltage level shall be earthed in the same manner.

Where it is required to earth the primary neutral of a metal clad three- phase voltage transformer, the neutral earthing connection shall be insulated and brought out separately from the tan earthing connection. Means shall be provided to maintain the tank earthing connection while the voltage transformer is being withdrawn.

Where three single-phase voltage transformers are supplied for protection purposes, star connected secondary windings shall have the star point formed by insulated connections and shall be earthed at a common point.

Where necessary for earth fault protection, voltage transformers shall be of five- limbed core construction.

Where possible primary windings shall be connected through fuses with current limiting features.

Secondary MCB's shall be provided as close as possible to each voltage transformer and labeled to show their function and phase colour. The secondary circuits shall be monitored individually to detect and alarm individual fuse failure or MCB trip and to block protection operation if required.

Voltage transformers shall be designed that saturation of their cores does not occur when 1.732 times normal voltage is applied to each winding.

Magnetization curves shall be submitted for approval for each type of voltage transformer.

The standard secondary voltage between phases shall be 110 volts unless special circumstances dictate otherwise, and are approved by the Project Manager.

Secondary circuits from different voltage transformers, or separate windings of the same transformer, shall not be connected in parallel.

Voltage transformers shall be connected on the non-bus-bar side of circuit breakers unless otherwise approved by the Project Manager.

1.6 TEST CERTIFICATE OF 11 KV INDOOR TYPE CIRCUIT BREAKER.

Instructions to Bidders: Bidders shall submit with their offer the test certificates along with the test results of 11 KV Panel board including Circuit Breaker for the following tests carried out in accordance with IEC-56 and other international standard or latest revision thereof from an internationally recognized independent and reputable testing authority like KEMA- Holland/CESI Italy/UL-USA etc.

A. <u>Type Tests:</u>

For Breaker:

a) Short time withstand and peak withstand current test
b) Lightning impulse voltage withstand test
c) Temperature rise Test
d) Mechanical Endurance Test
e) Measurement of the resistance of the main circuit
f) Short circuit current making and breaking tests

For CT

a) Lightning impulse voltage(Chopped impulse and full impulse);
b) Power frequency wet withstand voltage;
c) Temperature rise;
d) Short circuit withstand capability test;
e) Current error and phase displacement
f) Switching impulse.

For PT:

a) Lightning impulse voltage test;
b) High voltage power frequency wet withstand voltage;
c) Temperature rise test;
d) Short circuit withstand capability test;
e) Switching impulse;
f) Determinations of error;

For Control Panel & Relays:

Required tests as per relevant IEC 62271-111 Standard.

B. <u>Routine test</u>

For Breaker:

a) Dielectric test on main, auxiliary and control circuit
b) Measurement of the resistance of the main circuit
c) Tightness test
d) Mechanical operation tests
e) Design and visual checks

For CT:

a) Verification of terminal marking and polarity;
b) Power frequency dry withstand test on both windings;
c) Power frequency dry withstand test between sections;
d) Over voltage inter-turn test;
e) Turn ratio;
f) Instrument security factor test;
g) Determinations of error;
h) Secondary winding resistance and Accuracy test ;
i) Current error and phase displacement;
j) Knee point voltage and magnetizing current test ;
k) Insulation Resistance Test;

For PT:

a) Verification of terminal marking and polarity;
b) Power frequency dry withstand tests on both winding;
c) Power frequency withstand tests between sections;
d) Determination of limits of voltage errors and phase displacement;
e) Partial discharge measurement;
f) Insulating Resistance measurement;

Note: The test certificate for 3 phases, 50 Hz, 11 KV circuit breaker of rated current offered for the type (Manufacturer's designed type) shall be submitted. However, the test certificates for circuit breakers of the offered manufacturer's designated type and voltage class as per requirement of the bidding document but having higher rated current shall also be accepted. All the aforesaid tests shall be carried out in one random selected circuit breaker. Parts of the tests carried out on different circuit breakers shall not be accepted. The bid will be considered non responsive in absence of test certificates and the supply records.

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR 11 KV SWITCHGEAR AND CONTROL EQUIPMENT

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

	Description	Unit	BREB/PBS Requirement	Tenderer's Guaranteed Values
INCOMING SWITCHGEAR UNITS:				
1.	Manufacturer's Name & Address		Siemens/ABB	
	Vacuum bottle manufacturer		or/ALSTOM	----------

2.	Applied standard			----------
3.	Rated nominal voltage	KV	11	----------
4.	Rated Voltage	KV	12	----------
5.	Rated current for bus	A	2000	----------
6.	Rated short time current	KA	31.5	----------
7.	Short time current rated duration	Sec.	3	----------
8.	**Circuit Breaker:**			
	Type		VCB	----------
	Rated Voltage	KV	12	----------
	Rated Current	A	2000 for20/28MVA and 10/14 MVA substations	----------
	Rated short Ckt. breaking current, 3 Sec.	KA	31.5	----------
	Rated short Ckt. making current	-KA	80	----------
	Rated breaking time	--Cycle	3	----------
	Opening time	--Sec.		----------
	Closing time	--Sec.		----------
	Rated operating sequence		--0-0.3 sec-CO 3 min-CO	----------
	Control voltage	V	DC 110	----------
	Motor voltage for spring charge	V	AC 180~240	----------
	No. of Trip coil	No.	02	----------
9.	**Current Transformer:**			
	Rated Voltage	KV	12	----------
	Accuracy class, Metering		-0.2	----------
	Accuracy class, Protection		5P20	----------
	Accuracy class, Protection		5P20	----------
	Rated current ratio	A	800-400:5- 5-5 (for 10 MVA) 1600-800:5-5-5 (for 20 MVA)	----------
	Burden (At both ratio)	VA	20	----------
10.	Rated frequency	Hz	50	----------
11.	**Insulation level:**			
	AC withstand voltage 1 min. dry	KV	28	----------
	Impulse withstand, full wave	KV	75	---------- -
12.	**Degree of Protection:**			
	Enclosure		IP3X	----------
	HV Compartment		IP65	----------
	LV Compartment		IP40	----------
13.	**Earthing Switch:**			
Type				----------
Short Time Current, 3Secs.		kA		----------

14.	**Bus bar:**			
	Material	Copper		----------
	Cross Section	mm^2		----------
15.	**Dimension and Weight**			
	Height	mm		----------
	Width	mm		----------
	Depth	mm		----------
	Weight including Circuit Breaker	Kg.		----------
BUS SECTIONALIZER SWITCHGEAR UNIT:				
16.	Manufacturer's Name & Address			----------
17.	Applied standard			----------
18.	Rated nominal voltage	KV	11	----------
19.	Rated Voltage	KV	12	----------
20.	Rated current for bus	A	2000	----------
21.	Rated short time current	KA	31.5	----------
22.	Short time current rated duration	Sec.	3	----------
23.	**Circuit Breaker:**			
	Type		VCB	----------
	Rated Voltage	KV	12	----------
	Rated Current	A	2000	----------
	Rated short Ckt. breaking current, 3 Sec.	KA	31.5	----------
	Rated short Ckt. making current	KA	80	----------
	Rated breaking time	Cycle	3	----------
	Opening time	Sec.		----------
	Closing time	Sec.		----------
	Rated operating sequence		0-0.3sec-CO-3min-CO	----------
	Control voltage	V	DC 110	----------
	Motor voltage for spring charge	V	AC 180~240	----------
	No. of Trip coil	No.	02	----------
24.	**Current Transformer:**			
	Rated Voltage	kV	11	----------
	Accuracy class, Protection		5P20	----------
	Accuracy class, Metering		0.2	
	Rated current ratio	A	2000-1000:5-5	---------- ----------
	Burden (At both ratio)	VA	15	----------
25.	Rated frequency	Hz	50	----------
26.	**Insulation level:**			
	AC withstand voltage 1 min. dry	KV	28	----------
	Impulse withstand, full wave	KV	75	----------
27.	**Degree of Protection:**			
	Enclosure		IP3X	----------
	HV Compartment		IP65	----------
	LV Compartment		IP40	

28.	**Earthing Switch:** Type			
	Short Time Current, 3 Secs.	KA		
29.	**Busbar:**			
	Material	Copper Cross Section	mm^2	
	Short Time Current, 3 Secs.	KA		----------
30.	**Dimension and Weight**			
	Height	mm		----------
	Width	mm		----------
	Depth	mm		----------
	Weight including Circuit Breaker	Kg.		----------

LINE FEEDER SWITCHGEAR UNITS:

31.	Manufacturer's Name & Address			----------
32.	Applied standard			----------
33.	Rated nominal voltage	KV	11	----------
34.	Rated Voltage	KV	12	----------
35.	Rated current	A	2000	----------
36.	Rated short time current	KA	31.5	----------
37.	Short time current rated duration	Sec.	3	----------
38.	**Circuit Breaker:**			
	Type		VCB	----------
	Rated Voltage	KV	12	----------
	Rated Current	A	630	----------
	Rated short Ckt. breaking current, 3 Sec	KA	31.5	----------
	Rated short Ckt. making current	KA	80	----------
	Rated breaking time	Cycle	3	----------
	Opening time	Sec.		----------
	Closing time	Sec.		----------
	Rated operating sequence		0-0.3sec-CO-3min-CO	----------
	Control voltage	V	DC 110	----------
	Motor voltage for spring charge	V	AC 180~240	----------
	No. of Trip coil	No.	02	----------
39.	**Current Transformer:**			
	Rated Voltage	KV	12	----------
	Accuracy class, Metering		0.2	----------
	Accuracy class, Protection		5P20	----------
	Rated current ratio	A	600-300:5-5	----------
	Rated short time current, 3 Sec	KA	31.5	----------
	Burden (At both ratio)	VA	20	----------
	Knee point voltage for protection (at both ratio):		Sufficient to meet 5P20 at rated burden and measured CT secondary resistance	----------
40.	Rated frequency	Hz	50	----------
41.	**Insulation level:**			
	AC withstand voltage 1 min. dry	KV	28	----------
	Impulse withstand, full wave	KV	-75	---------- --
42.	**Degree of Protection:**			
	Enclosure		IP3X	----------
	HV Compartment		IP65	----------
	LV Compartment		IP40	----------

43. **Earthing Switch:**

Type ----------

Short Time Current, 3 Secs.KA ----------

44. **Busbar:**

Material		Copper	----------
Cross section	mm^2		----------

45. **Dimension and weight:**

	Height	mm	----------
Width	mm		----------
Depth	mm		----------
Weight including circuit breaker	Kg.		----------

VOLTAGE TRANSFORMER SWITCHGEAR UNITS

46. Type ----------

47. **Busbar:**

Material		Copper	----------
Cross section	mm^2		----------
48. Rated nominal voltage	KV	11	----------
49. Rated Voltage	KV	12	----------
50. Rated current for bus	A	2000	----------
51. Rated short time current	KA	31.5	----------
52. Short time current rated duration	Sec.	3	----------

53. **Voltage Transformer:**

Number of phase			----------
Rated primary voltage	KV	11/□3	----------
Rated secondary voltage	V	110/□3	----------
Rated tertiary voltage	V	-110/□3	----------
Rated burden, Secondary	VA	--50	----------
Rated burden, Tertiary	VA	30	----------
Accuracy class for metering		0.2	----------
for protection		3p	----------

54. **Power Fuse:**

Rated voltage	kV	12	----------
Rated current	A	10	----------
Rated short Ckt. breaking current	kA	31.5	----------

-

55. **Dimension and Weight:**

Height	mm		----------
Width	mm		----------
Depth	mm		----------
Wt. including voltage transformer	Kg.		----------

56. **Degree of Protection**

Enclosure		IP3X	----------
HV Compartment		IP65	----------
LV Compartment		IP40	----------

57. Insulation Level KV ----------

58. All current carrying path of the breaker should be copper

11 KV CONTROL AND ENERGY METERING PANEL

A. **PROTECTION**

IDMT OVER CURRENT & EARTH FAULT RELAY

1	Manufacturer's name & Country		Schneider, UK or France/ Siemens, Germany /ABB, Sweden/ GE,USA	----------
2.	Model Number		To be mentioned	----------
3	Type of relay		Numerical Programmable	----------
4	Range setting a) Phase element of current b) Earth fault element of current c) Range of time setting (IDMT)	 % of CT rating % of CT rating 	 5% to 2500% 1% to 1000% 2.5% to 1000%	----------
5	Ranges of timing at DMT	Sec	0-100(with 1ms interval)	----------
6	Shall have event record option		Yes	----------
7	Burden of relay at 10 time CT rating	VA	To be mentioned	----------
8	Percentage of current setting at which relay will reset	%	To be mentioned	----------
9	Reset time after removal of 10 time CT rated current for a) Phase element (100%) b) E/F element (40%)	 Sec Sec	 To be mentioned To be mentioned	----------
10	The relays should be 61850 protocol type.		Yes	----------
11	The transformer 11 KV breaker protection relay should have directional protection facility.		Yes	----------

B. KWh Meter

1	Manufacturer's name & Country		Siemens (Germany/ Switzerland)/Alstom (UK)/ ABB (Sweden)/ AEG (Germany)/ Schlumberger (USA) /Landis Gyr (Switzerland/Greece)	----------
2	Model Number		To be mentioned	----------
3	Number of KWh Meters		01	
4	Type of the meter		Numerical Programmable, Multifunction with accuracy Class 0.2s , Load profile , ----------	----------

		instrumentation profile for minimum 6 months with a interval of 30 min, software for protection and optical probe for data download as per IEC with provision of communication port automatic meter reading (AMR)	
5	Class of accuracy	0.2s	----------
C.	**Indication meter (Volt, Ampere, KW, KVAR, Power factor, Frequency)**		
1	Manufacturer's name & Country	Siemens (Germany/ Switzerland)/Alstom (UK)/ ABB (Switzerland)/AEG (Germany)/ Schlumberger (USA)	----------
2	Model Number	To be mentioned	----------
3	Number of Meters	3 nos Ammeter, 3 nos voltmeter, 1nos KW meter,1nos KVAR meter, 1nos Pf meter,1 nos frequency meter.	----------
4	Type of meter	Digital	----------
5	Class of accuracy	1	----------

PUBLICATION 266-1999
RURAL ELECTRIFICATION BOARD (REB
PEOPLES REPUBLIC OF BANGLADESH
STANDARD FOR
36 KV UNDERGROUND POWER CABLE

1. GENERAL

This standard establishes the physical and electrical requirements for 36 KV, 1-Core, copper conductor, cross-linked polyethylene (XLPE) insulated power cable shall comply with IEC-60502. The cable shall be suitable in all respect for use in 33 KV system, 50 hertz, underground distribution system.

2. REFERENCE DATA:

REB 36 KV, 1- core underground cable shall be comprised of the following :

2.1 CONDUCTOR.

The conductor shall be stranded, circular and compacted copper wire in accordance with IEC-228 or ASTM B3.

2.2 CONDUCTOR SCREEN

The conductor screen shall comprise of a layer of extruded semi-conducting compound, compatible in all respects with the conductor and insulation material. Conductor screen shall be bonded to the insulation such a way that no voids or discontinuities are present. The bond shall be adequate to withstand normal electrical and mechanical stresses in service without degradation or separation.

Lapped semi-conducting tape shall not be used for conductor screens.

2.3 INSULATION

The insulation shall be cross-linked polyethylene (XLPE). The cable insulation shall be extruded in one operation with conductor & insulation screens. The highest possible purity of insulation material is required. The Bidder shall demonstrate that adequate precautions are taken to remove contaminants and to eliminate the introduction of particles of contaminate during material handling or the extrusion process.

The insulation material shall consist of cross-linked polyethylene tightly extruded over the conductor screen. A cross-linking process using steam curing will not be permitted. Dry process insulation shall be offered, without which the tender will not considered.

2.4 INSULATION THICKNESS

The insulation thickness of the cables shall not be less than the values tabulated in IEC publication 60502. Insulation thickness shall not depart from the specified nominal value by an amount exceeding the tolerance specified in IEC publication-60502.

The thickness of the semi conducting screens on the conductors and over the insulation shall not be included in the measurement of insulation thickness.

2.5 INSULATION SCREEN

The insulation screen shall comprise of a non-metallic semi-conducting polyethylene part in combination with a metallic part.

The non-metallic semi-conducting part shall be applied directly upon the insulation of each core and shall comprise of a layer of extruded semi-conducting polyethylene compound.

The conductor screen, Insulation and semi-conducting part of Insulation screen layer shall be applied to the conductor in common extrusion process with dry curing system.

The metallic part shall be stranded copper applied directly over the semi-conducting part. It shall comprise of a single layer of copper wires equally spaced apart.

2.6 ARMOUR

The armour shall consist of a single layer of non-magnetic wires in accordance with IEC-60502.

The non-magnetic wire joints are brazed or welded and any wire shall be not less than 1 mm from nearest joints in any other armour wire in the complete cable.

2.7 OVER SHEATH

The cable shall be sheathed overall with a PVC (polyvinyl chloride) outer sheath. The outer sheath shall be of smooth and uniform composition and free of holes. Cracks blisters and imperfection.

As a protection against termite attack, the outer covering shall contain termite repellent substance of Pb nephtanate.

The outer sheath shall be of adequate strength and thickness to withstand the test voltages and mechanical tests and shall be suitable for the ambient conditions at site.

The outer sheath material shall be capable of withstanding without damage or deformation the highest temperature achieved with the cable at its rated current and at the site ambient conditions.

2.8 MANUFACTURER'S IDENTIFICATION.

The manufacturer's identification shall be printed with black colour on the identifying tape. It shall show the rated voltage, conductor size, year of manufacturing and name of the manufacturer at an interval of not more than 1000 mm throughout the length of the cable. The designation of voltage and cable marking shall also be embossed on the outer PVC covering. The gap between the end of one set of embossed characters and the beginning of the next shall be not greater than 150 mm throughout the length of cable with character approximately 10 mm high.
Name of the purchaser shall be embossed in the title- RURAL ELECTRIFICATION BOARD at every 1000 mm gap.

2.9 CONTINUOUS CURRENT RATING :

The continuous rating of the cables that the bidder proposes to supply shall be calculated by means of the procedure described in IEC publication 287based on the site ambient conditions including solar radiation, with the installation parameters as specified.

The maximum conductor temperature shall not exceed 90^0 C when carrying the rated current under the most onerous site conditions.

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The bidder shall base his ratings on the site ambient conditions, with the methods of installation and bonding as specified. Due account shall be taken of the heating due to other cables or other sources of heat where these can be identified. The bidder shall state all the parameters including any assumptions that he has made in the calculation of continuous current ratings.

2.10 SHORT CIRCUIT RATING :

All cables shall be capable of with standing without damage or permanent distortion the specified maximum short circuit currents for the specified times as under: -

The temperature of the conductors during the passage of the specified maximum fault current for the specified time of one second shall not exceed 250° C for XLPE cables.

The cable design including the design of external Clamps or other restraining devices shall be adequate to contain the mechanical forces arising from two or three phase short circuit currents and longitudinal forces whether arising from magnetic effects or from thermal expansion of conductors.

The cable metallic screen sheath and armor shall be capable of passing the specified maximum earth fault current for the specified time of one second without damage, permanent distortion or deterioration in the cable. The insulation screen shall be capable of carrying an earth fault current of 25 KA for 1 second without damage.

If in order to comply with the requirement for carrying prospective earth fault current it is necessary to rely on the armor and/ or sheath conductivity in addition to metallic core screen tapes, the bedding material or materials shall be of the semi-conducting type.

3. TESTS:

3.1 GENERAL

The following tests shall be carried out to demonstrate the integrity of the cable.
The frequency of the alternating current supply is between 48 Hz and 62 Hz.

3.2 TESTS AT MANUFACTURER'S WORKS

Tests shall be carried out in accordance with the relevant British standards IEC publication and the following type tests and routine tests shall be carried out at the Manufacturer's works.

a) TYPE TESTS

Type test for 36 KV cables shall be carried out in accordance with the IEC publication 540 and 60502 for suitable length of cable.

i) ELECTRICAL TESTS

1. Partial Discharge test (s).
2. Bending test.
3. Heat cycle test.
4. Impulse Voltage withstand test
5. High voltage Alternating current test

II) NON-ELECTRICAL TEST

1. Measurement of Insulation thickness
2. Measurement of thickness of non-metalic sheath.
3. Determination of mechanical properties of insulation and sheaths before and after aging.
4. Ageing test on pieces of complete cables.
5. Pressure test at high temperature on insulation & sheaths.
6. Hot set test.
7. Water absorption test on insulations.
8. Shrinkage test on XLPE insulation.
9. Electrical test after installation.
10. Water penetration test.

b) ROUTINE TESTS:

The manufacturer shall carry out routine tests on all finished cables to demonstrate their individual integrity as per IEC pub. 60502

1. Measurement of Electrical Resistance of conductors.
2. High voltage test
3. Partial discharge test

3.3 SPECIAL TEST

Additional samples of cable shall be selected for special tests. The number and frequency of special tests shall be in accordance with the procedures specified in IEC publication 60502.

The cable shall be subjected to the following special tests.

1. Conductor examination
2. Check of dimensions
3. Electrical test for cables
4. Hot set test..

4. PACKING

Cable shall be shipped on standard non-returnable steel drum, each drum having stenciled on its side ; Size, Type, and length of cable, gross & net weight and contract number. The complete cable drum shall be covered by steel sheet to protect from external thrust and the kits are to be export-packed and properly protected for shipment, rough transportation and storage.

The maximum length of cable on a drum shall be 500 meters with a variation of + / - 10 %(ten percent) and it shall be only one length of conductor on a reel.

Each kits cartoon shall be sealed in water proof polyethylene bag having a silicagel packet placed inside the unit and then packed in polystyrene foam gasket closed by self adhesive tape. Size of the items shall be marked by label on the foam for easy identification. Maximum 10 (ten) sets kits are allowed to pack into separate wooden packing box lined with heavy gauge polyethylene.

5. DOCUMENTATION

The following test reports and the attached data schedule filled in completely shall be included with offer, without which the offer shall not be considered for evaluation.

a) All Routine Test, Type Test and Special Test reports as per clause 3.2a, 3.2b & 3.3 of the specification and ISO-9001 Certificate of the identical 36KV cables from an internationally recognized independent laboratory.

b) Supply record with documentary evidence of the identical 33KV cables for last 5 (five) years mentioning purchaser's name, quantity, and year of supply.

c) Printed catalogue/Leaflet for the offered type of cables.

6. GENERAL REQUIREMENT OF 33 KV XLPE UNDERGROUND CABLE

Table-1

SL. No.	Particulars	Specified
1.	Installation	Direct burial
2.	Type	XLPE insulated, 1-core, armoured, under ground cable.
3.	Voltage:	
	a. Voltage between phases	33 KV
	b. Maximum system voltage	36 KV
4.	CORES:	
	Number of cores	Single core, stranded copper, round concentric.
5.	CONDUCTOR:	
	a. Material	copper
	b. Design (stranded sectional etc.)	round, compacted
	c. Strand	As per table-2
	d. Cross sectional area of conductor core	As per table-2 or specified as per material & price schedule
	e. Maximum DC resistance of conductor at 20^0 C	As per table-2
6.	CONDUCTOR SCREEN:	
	a. Material	Extruded Semi-conducting PE
7.	INSULATION:	
	a. Thickness (Nom)	8.00 mm
	b.Type of curing	Dry curing
8.	INSULATION SHIELD	Extruded Semi-conducting PE
9.	ARMOUR:	A single layer of non-magnetic wires in accordance with IEC 60502.
10.	OVER SHEATH	PVC
11.	STANDARDS	Design, Manufacture, Testing & Performance shall be in accordance to latest revision of IEC-60502,540 or Equivalent International Standard.

Table-2

Item No.	Conductor		XLPE Insulation Thickness (mm)	Max^m D. C Resistance of Conductor at 20°C (Ω/km)	Stand. Packing Length (m)
	Nominal Cross Sectional Area (mm^2)	Minimum number of wires in the conductor			
F-7	400	53	8.0	0.0470	500
F-8	500	53	8.0	0.0366	500
F-9	600	53	8.0	0.0283	500
F-10	800	53	8.0	0.0221	500

7. TECHNICAL SPECIFICATION OF JOINTING KITS FOR 33 KV XLPE,1-CORE, COPPER CABLE

7.1. TERMINATION KITS (OUTDOOR)

Sl. No.	Name of Item	Termination jointing kits for 36 KV XLPE cable single-core, (Outdoor)
1.	Application	For 33 KV, 1 core, XLPE, copper conductor armored cable
2.	Installation	Outdoor, mounted on Poles/Structure
3.	System	33 KV, effectively grounded system
4.	Cable Conductor	As per Table**-2 &** material & price schedule.
5.	Kit content	Heat shrinkable high voltage insulating and non-tracking tubing
		Heat shrinkable stress control tubing
		Stress relieving mastic strip
		Truck resistant sealant tape
		Heat shrinkable track resistant rain skirt
		Support Insulator
		Cable preparation kit
		Solderless earth connection kit
		Compression lugs
		Support Insulators Tee brackets
		Installation Instructions

7.2 TERMINATION KITS (INDOOR)

Sl. No.	Name of Item	Termination jointing kits for 36 KV XLPE cable single-core (Indoor)
1.	Application	For 33 KV, 1 core, XLPE, copper conductor armored cable
2.	Installation	For indoor switchgear terminations
3.	System	33 KV, effectively grounded system
4.	Cable Conductor	As per Table**-2 &** material & price schedule.
5.	Kit content	Heat shrinkable high voltage insulating and non-tracking tubing
		Heat shrinkable stress control tubing
		Stress relieving mastic strip
		Truck resistant sealant tape
		Heat shrinkable track resistant rain skirt
		Cable preparation kit
		Solderless earth connection kit
		Compression lugs
		Installation Instructions

7.3 STRAIGHT THROUGH JOINT BOX

Sl. No.	Name of Item	Straight through joint box for 36 KV XLPE cable, single-core copper conductor.
1.	Application	For 33 KV, 1 core, XLPE, copper conductor armored cable
2.	Installation	For underground horizontal mounting
3.	System	33 KV, effectively grounded system
4.	Cable Conductor	As per Table**-2 &** material & price schedule.
5.	Construction	The joint shall be proof against ingress of moisture and water.
6.	Kit content	Compression ferrules
		Valid filling tape
		Heat shrinkable stress control tubing
		Truck resistant sealant tape
		Heat shrinkable high voltage insulating tape
		Heat shrinkable black/red dual wall
		Estomeric tube
		Roll spring
		Heat shrinkable outer jacket tube
		Heat shrinkable truck resistant rain skirt.
		Cable preparation kit
		Solder less earth connection kit
		Misc. other material
		Installation instructions

Note : The size & quantity of the termination kits and straight through joint splices shall be as per material & price schedule.

PUBLICATION 262-1988
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)
PEOPLES REPUBLIC OF BANGLADESH
STANDARD FOR
15 KV UNDERGROUND POWER CABLE

1. GENERAL

This standard establishes the physical and electrical requirements for 15 KV, 3-Core, copper conductor, cross-linked polyethylene insulated power cable shall comply with IEC-60502. The cable shall be suitable in all respect for use in 11 KV system, 50 hertz, underground distribution system.

2. CLIMATE CONDITIONS

The cable subject to this specification shall be used to convey power from a 11kV overhead line via fresh or tidal submarine route to another overhead line under the following conditions:

- Altitude above sea level up to 1000 meters
- Maximum outdoor temperature: 45^0C
- Minimum outdoor temperature: 0^0C
- Maximum daily average temperature: 35^0C
- Relative Humidity: up to 100%
- Water conditions: high turbidity, heavy scouring by sandy bed load, brackish water conditions, up to 30m depth of installation
- Frequency: 50 Hz.
- System type: 11kV Unigrounded three phase (neutral earthed at the substation)
- Installation: Three core copper conductors in a single cable.
- Average isokeraunic: 80 days/year
- Earthing and bonding: Sheaths and armour bonded and earthed at both ends.

3. REFERENCE DATA:

REB 15 KV, 3- core underground cable shall be comprised of the following:

3.1 CONDUCTOR.

The conductor shall be uncoated, class B stranded, circular and compacted copper wire in accordance with IEC-228 or ASTM B3. The copper conducted cables shall be constructed with three cores in size of as per **table-2** or specified in material schedule. The cores in any one cable shall be of equal cross-sectional areas.

3.2 CONDUCTOR SCREEN

The conductor screen shall comprise of a layer of extruded semi-conducting polyethylene compound, compatible in all respects with the conductor and insulation material. Conductor screen shall be bonded to the insulation such a way that no voids or discontinuities are present. The bond shall be adequate to withstand normal electrical and mechanical stresses in service without degradation or separation.

Lapped semi-conducting tape shall not be used for conductor screens.

3.3 INSULATION

The insulation shall be cross-linked polyethylene (XLPE). The cable insulation shall be extruded in one operation with conductor & insulation screens. The highest possible purity of insulation material is required. The Bidder shall demonstrate that adequate precautions are taken to remove contaminants and to eliminate the introduction of particles of contaminate during material handling or the extrusion process.

The insulation material shall consist of cross-linked polyethylene tightly extruded over the conductor screen. A cross-linking process using steam curing will not be permitted. Dry process using the Catenary Continuous Vulcanization or the Vertical Continuous Vulcanization insulation shall be offered, without which the tender will not considered.

3.4 INSULATION THICKNESS

The minimum thickness of insulation shall be (4.50 mm) for 15 KV under ground cable. The thickness at any point may, be less than the specified value, provided the difference does not exceed 10 percent plus 0.1 mm.

The thickness of the semi conducting screens on the conductors and over the insulation shall not be included in the measurement of insulation thickness.

3.5 INSULATION SCREEN

The insulation screen shall comprise of a non-metallic semi-conducting polyethylene part in combination with a metallic part by triple tandem process.

The non-metallic semi-conducting part shall be applied directly upon the insulation of each core and shall comprise of a layer of extruded semi-conducting polyethylene compound.

The conductor screen, Insulation and semi-conducting part of Insulation screen layer shall be applied to the conductor in common extrusion process with dry curing system.

The metallic part shall be stranded copper applied directly over the semi-conducting part.

3.6 Metallic Shield

A minimum 0.2mm thick copper tape or copper wire applied over the outer screen of the each core. Shield shall provide the circuit neutral and withstand a fault current as per table-2 with initial sheath temperature of 90 degree C, and final sheath temperature of 250 degree C for each core.

3.7 INNER SHEATH

The cable shall be sheathed overall with a PVC inner sheath. The inner sheath shall be of smooth and uniform composition and free of holes, Cracks and blisters and imperfection.

As a protection against termite attack, the inner covering shall contain termite repellent substance of Pb nephtanate.

The inner sheath shall be of adequate strength and thickness to withstand the test voltages and mechanical tests and shall be suitable for the ambient conditions at site.

The inner sheath material shall be capable of withstanding without damage or deformation the highest temperature achieved with the cable at its rated current and at the site ambient conditions.

3.8 Jacket

The cable shall be jacketed overall with a medium density polyethylene (MDPE) outer jacket. The outer jacket shall be of smooth and uniform composition and free of holes, cracks blisters and imperfection. The jacket shall fully embed & encapsulate the armour wires.

The external jacket shall be loaded with 2.5% carbon black for UV resistance.

The outer jacket shall be of adequate strength and thickness to withstand the test voltages and mechanical tests and shall be suitable for the ambient conditions at site.

The outer jacket material shall be capable of withstanding without damage or deformation the highest temperature achieved with the cable at its rated current and at the site ambient conditions.

3.9 ARMOUR

The armour shall consist of a single layer of Aluminum Alloy Wire. The armour shall cover the whole diameter of the cable.

The wire joints are brazed or welded and any wire shall be not less than 1 mm from nearest joints in any other armour wire in the complete cable.

3.10 MANUFACTURER'S IDENTIFICATION.

The manufacturer's identification shall be printed with black colour on the identifying tape. It shall show the rated voltage, conductor size, year of manufacturing and name of the manufacturer at an interval of not more than 1000 mm throughout the length of the cable.

The designation of voltage and cable marking shall also be embossed on the outer PVC covering.

The gap between the end of one set of embossed characters and the beginning of the next shall be not greater than 150 mm throughout the length of cable with character approximately 10 mm high. Each conductor shall be coded for phase identification.

Name of the purchaser shall be embossed in the title- "BANGLADESH RURAL ELECTRIFICATION BOARD" at every 1000 mm gap.

3.11 CONTINUOUS CURRENT RATING:

The continuous rating of the cables that the bidder proposes to supply shall be calculated by means of the procedure described in IEC publication 287 based on the site ambient conditions including solar radiation, with the installation parameters as specified.

The maximum conductor temperature shall not exceed 90^0 C when carrying the rated current under the most onerous site conditions.

The bidder shall base his ratings on the site ambient conditions, with the methods of installation and bonding as specified. Due account shall be taken of the heating due to other

cables or other sources of heat where these can be identified. The bidder shall state all the parameters including any assumptions that he has made in the calculation of continuous current ratings.

Temperature ratings the cable are given below:

Normal operation	:90^0C
Emergency overload	:130^0C
Short circuit	:250^0C

3.12 SHORT CIRCUIT RATING:

All cables shall be capable of with standing without damage or permanent distortion the specified maximum short circuit currents for the specified times as under: -

The temperature of the conductors during the passage of the specified maximum fault current for the specified time of one second shall not exceed 250° C for XLPE cables.

The cable design including the design of external Clamps or other restraining devices shall be adequate to contain the mechanical forces arising from two or three phase short circuit currents and longitudinal forces whether arising from magnetic effects or from thermal expansion of conductors.

The cable is suitable in all respect for use on an 11 KV system with a nominal 3-phase fault level described in table-2.

The cable metallic screen sheath and armor shall be capable of passing the specified maximum earth fault current for the specified time of one second without damage, permanent distortion or deterioration in the cable where the cable must have the short circuit capability of it's metallic screen as per table-2.

4.0 TESTS:

4.1 GENERAL

The following tests shall be carried out to demonstrate the integrity of the cable.
The frequency of the alternating current supply is between 48 Hz and 62 Hz.

4.2 TESTS AT MANUFACTURER'S WORKS

Tests shall be carried out in accordance with the relevant IEC publication and the following type tests and routine tests shall be carried out at the Manufacturer's works.

a) TYPE TESTS

Type test for 15 KV cables shall be carried out in accordance with the IEC publication 60502 for suitable length of cable.

i) ELECTRICAL TESTS

1. Partial Discharge test (s).
2. Bending test.
3. Heat cycle test.
4. Impulse Voltage withstand test
5. High voltage Alternating current test

II) NON-ELECTRICAL TEST

1. Measurement of Insulation thickness
2. Measurement of thickness of non-metalic sheath.
3. Determination of mechanical properties of insulation and sheaths before and after aging.
4. Ageing test on pieces of complete cables.
5. Pressure test at high temperature on insulation & sheaths.
6. Hot set test.
7. Water absorption test on insulations.
8. Shrinkage test on XLPE insulation.
9. Electrical test after installation.
10. Water penetration test.

b) ROUTINE TESTS:

The manufacturer shall carry out routine tests on all finished cables to demonstrate their individual integrity as per IEC pub. 60502 .

1. Measurement of Electrical Resistance of conductors.
2. High voltage test
3. Partial discharge test

4.3 SPECIAL TEST

Additional samples of cable shall be selected for special tests. The number and frequency of special tests shall be in accordance with the procedures specified in IEC publication 60502.

The cable shall be subjected to the following special tests.
1. Conductor examination
2. Check of dimensions
3. Electrical test for cables
4. Hot set test.

5. PACKING

Cable shall be shipped on standard non-returnable steel drum, each drum having stenciled on its side ; Size, Type, and length of cable, gross & net weight and contract number. The complete cable drum shall be covered by steel sheet to protect from external thrust and the kits are to be export-packed and properly protected for shipment, rough transportation and storage.

The maximum length of cable on a drum shall be **as per table-2** with a variation of + / - 10 %(ten percent) and it shall be only one length of conductor on a reel.

Each kits cartoon shall be sealed in water proof polyethylene bag having a silicagel packet placed inside the unit and then packed in polystyrene foam gasket closed by self adhesive tape. Size of the items shall be marked by label on the foam for easy identification. Maximum 10 (ten) sets kits are allowed to pack into separate wooden packing box lined with heavy gauge polyethylene.

6. DOCUMENTATION

The following test reports and the attached data schedule filled in completely shall be included with offer, without which the offer shall not be considered for evaluation.

a) All Routine Test, Type Test and Special Test reports as per clause 4.2a, 4.2b, 4.3 of the specification and ISO-9001 Certificate of the identical offer type 15KV cables from an internationally recognized independent laboratory.

b) Printed catalogue/Leaflet for the offered type of cables.

7. DRAWINGS & APPROVAL PROCEDURE

a) Within 30 days of contract commencement the Supplier shall submit, for approval by the Purchaser, a schedule of the drawings to be produced detailing which are to be submitted for "Approval" and which are to be submitted "For Information Only". The schedule shall also provide a program of drawing submission, for approval by the Purchaser that ensures that all drawings and calculations are submitted within the period specified above.

b) The Supplier shall submit all drawings, documents and type test reports for approval in sufficient time to permit modifications to be made if such are deemed necessary and resubmit them for approval without delaying the initial deliveries or completion of the contract work. If the Purchaser is satisfied with the drawing, one copy will be turned to the Supplier marked with "Approved" stamp. If the Purchaser is partially satisfied with the drawing, then Approved Subject to Comment" status will be given to it and a comment sheet will be sent to the Supplier. If the drawing submitted does not comply with the requirements of the specification then it will be given "Not Approved" status and a comment sheet will be sent to the Supplier. In both these cases the Supplier will have to modify the drawing, update the revision column and resubmit for final Approval.

Table-2

Item No.	Conductor		XLPE Insulation Thickness (mm)	Max^{m} D. C Resistance of Conductor at 20°C (Ω/km)	Short Circuit Withstand Capacity For 1 Second(min)		Stand. Packing Length (km) (will be finalize during drawing approval)
	Nominal Cross Sectional Area (mm^2)	Minimum number of wires in the conductor			Phase conductor (KA)	Metallic Screen for (KA)	
F-1	95	15	4.50	0.193	12.5	3	375-800
F-2	120	18	4.50	0.153	17	4	350-800
F-3	150	18	4.50	0.124	20	5	300-800
F-4	185	30	4.50	0.0991	25	6	300-800

7. GENERAL REQUIREMENT OF 11 KV XLPE UNDERGROUND CABLE

SL. No.	Particulars	BREB Required
1.	INSTALLATION	Direct burial
2.	TYPE	XLPE insulated, 3-core, armoured, under ground cable.
3.	VOLTAGE:	
	a. Voltage between phases	11 KV
	b. Maximum system voltage	15 KV
	c. Rated voltage of cable U_0/U	8.7/15 KV
4.	CORES:	
	Number of cores	Three core, stranded copper, round concentric.
5.	CONDUCTOR:	
	a. Material	copper
	b. Design (stranded sectional etc.)	round, compacted
	c. Strand	As per table-2
	d. Cross sectional area of each conductor core	As per table-2 or specified in material schedule
	e. Maximum DC resistance of conductor at 20^0 C	As per table-2
6.	CONDUCTOR SCREEN:	
	a. Material	Extruded Semi-conducting PE
7.	INSULATION:	
	a. Thickness (Nom)	4.50 mm
	b.Type of curing	Dry curing
8.	INSULATION SHIELD	Extruded Semi-conducting PE
9.	METAL SHIELD	Copper wire
10.	INNET SHEATH	Polyvinyl Chloride (PVC)
11.	ARMOUR	Aluminum Alloy Wire.
12.	OUTER SHEATH	Medium Density Polyethylene (MDPE)
13.	Short Circuit Withstand Capability	As per table-2
14.	STANDARDS	Design, Manufacture, Testing & Performance shall be in accordance to latest revision of IEC-60502-2 or Equivalent International standard.

8. TECHNICAL SPECIFICATION OF JOINTING KITS FOR 11 KV XLPE,3-CORE, COPPER CABLE

8.1. TERMINATION KITS (OUTDOOR)

Sl. No.	Name of Item	Termination jointing kits for 15 KV XLPE cable 3-core, (Outdoor)
1.	Application	For 11 KV, 3- core, XLPE, copper conductor armored cable
2.	Installation	Outdoor, mounted on Poles/Structure
3.	System	11 KV, effectively grounded system
4.	Cable Conductor	185 mm^2 copper conductor

5.	Kit content	Heat shrinkable high voltage insulating and non-tracking tubing
		Heat shrinkable stress control tubing
		Stress relieving mastic strip
		Truck resistant sealant tape
		Heat shrinkable track resistant rain skirt
		Support Insulator
		Cable preparation kit
		Solderless earth connection kit
		Compression lugs
		Support Insulators Tee brackets
		Installation Instructions

8.2 TERMINATION KITS (INDOOR)

Sl. No.	Name of Item	Termination jointing kits for 15 KV XLPE cable 3-core (Indoor)
1.	Application	For 11 KV, 3- core, XLPE, copper conductor armored cable
2.	Installation	For indoor switchgear terminations
3.	System	11 KV, effectively grounded system
4.	Cable Conductor	185 mm^2 copper conductor
5.	Kit content	Heat shrinkable high voltage insulating and non-tracking tubing
		Heat shrinkable stress control tubing
		Stress relieving mastic strip
		Truck resistant sealant tape
		Heat shrinkable track resistant rain skirt
		Cable preparation kit
		Solderless earth connection kit
		Compression lugs
		Installation Instructions

8.3 STRAIGHT THROUGH JOINT BOX

Sl. No.	Name of Item	Straight through joint box for 15 KV XLPE cable, 3-core copper conductor.
1.	Application	For 11 KV, 3- core, XLPE, copper conductor armored cable
2.	Installation	For underground horizontal mounting
3.	System	11 KV, effectively grounded system
4.	Cable Conductor	185 mm^2 copper conductor
5.	Construction	1. The joint shall be proof against ingress of moisture and water.
6.	Kit content	2. Compression ferrules
		Valid filling tape
		Heat shrinkable stress control tubing
		Truck resistant sealant tape
		Heat shrinkable high voltage insulating tape
		Heat shrinkable black/red dual wall
		Estomeric tube
		Roll spring
		Heat shrinkable outer jacket tube
		Heat shrinkable truck resistant rain skirt.

		Cable preparation kit
		Solder less earth connection kit
		Misc. other material
		Installation instructions

Note: The size & quantity of the termination kits and straight through joint splices shall be as per material & price schedule.

500 mm^2 11 KV XLPE CABLE

Cross Link Polyethylene (XLPE) cables shall be suitable for operation at voltage of 11KV between phases at continuous maximum conductor temperatures of 90 degree C. the cable shall be suitable in all respect for use on 11KV system with a nominal three phase fault level of 31.5 KA. The cables and associated fittings, joints and termination shall be so designed to prevent damage to the cable or fittings, except in the immediate vicinity of the fault, in the event of an installation failure at any point which results in a fault current to earth of 31.5KA for 3 sec.

Each core of Power cable shall comprise 500sq.mm. Copper Conductor XLPE Insulated, Copper Screen and shall comply with IEC 60502, except as modified or extended by the requirement of the specification. The length of cable on a drum shall be 500M continuous or as specified by the Purchaser and it shall be shipped on standard non-returnable steel drum, each drum having stencilled on its side; size, type and length of cable, together with its gross weight, net weight and contract number.

1.1 CONDUCTORS

All conductor shall be stranded, circular and compacted and comply with IEC 228. Cables shall be constructed with single core sizes of 500 mm^2.

1.2 CONDUCTOR SCREENING

The conductor shall be screened with an extruded layer of semi-conducting material of 0.5mm thickness for both the cables.

1.3 INSULATION

The insulation shall consist of cross-linked polyethylene tightly extruded over the conductor screen. The insulation shall generally comply with IEC 502.

The highest possible purity of insulation material is required. The Bidder shall confirm that adequate precautions are taken to remove contaminants and to eliminate the introduction of particles of contaminants during material handling or extrusion process.

The Cable shall be manufactured through VCV/CCV.

The insulation material shall be cross-linked by a dry process. A cross-linking process using steam curing will not be permitted.

1.4 INSULATION THICKNESS

The thickness of insulation shall be determined by taking the average of number of measurements and shall be not less than the values tabulated in IEC Publication 502.

Insulation thickness shall not depart from the specified nominal value by an amount exceeding the tolerances specified in IEC Publication 502.

The thickness at any point, if less than the specified value, provided the difference does not exceed 10 percent plus 0.1mm, may be acceptable.

The thickness of the semi conducting screens on the conductors and over the insulation shall not be included in the measurement of insulation thickness.

1.5 INSULATION SCREENING

The insulation screen shall comprise a non-metalic semi-conducting polyethylene part in combination with a metallic part.

The non-metalic semi-conducting part shall be applied directly upon insulation of the core and shall comprise a layer of extruded semi-conducting polyethylene compound.

The conductor screen, insulation and semi-conducting part of insulation screen layer shall be applied to the conductor in common extrusion process with dry curing system.

The metallic part shall be stranded copper applied over the layer of semi conducting compound.

There shall be a single layer of copper wires adequately spaced apart on each core of Power Cable.

The non-metallic part shall be applied directly upon the insulation and shall be a layer of extruded semi-conducting compound. This screen shall be formed in such a way that it is readily removed for jointing.

The insulation screen shall be capable of withstanding a fault current of 31.5KA for 3 sec. without damage.

5.6 OVER SHEATH

The cable shall be sheathed overall with a Medium Density Polyethylene (MDPE) outer sheath. The outer sheath shall be of smooth and uniform composition and free of holes, cracks, and bisectors.

As a protection against termite attack, the outer covering shall contain the termite repellent substance of Pb napthanate.

The outer sheath shall have adequate strength and thickness to withstand the test voltage and mechanical tests and suitable for ambient conditions at site.

The outer sheath material shall be capable of withstanding the highest temperature achieved with the cable at its rated current without damage or deformation at site ambient conditions.

The outer surface of the polyethylene outer sheath shall be as specified in IEC 60502.

1.7 ARMOUR

The armour shall consist of a single layer of Alluminium alloy wires in accordance with IEC 502.

The joints are brazed or welded and any wire shall be not less than 01 mm from the nearest joints in any other armour wire in the complete cable.

1.8 CONTINUOUS CURRENT RATING

The continuous current rating of the cable shall be calculated in accordance with the procedure described in IEC 60287 based on the site ambient condition, with the insulation parameters as specified.

The cable current rating shall base on site ambient conditions, with the general methods of installation and bonding.

The maximum conductor temperature shall not exceed 90 deg. C when carrying the rated current under the most onerous site conditions.

1.9 SHORT CIRCUIT RATING

The cable shall be capable of withstanding the specified maximum short circuit current for the specified times without damage or permanent distortion.

The temperature of the conductor at maximum fault current for the specified time shall not exceed 250°C as specified in IEC 60502.

1.10 MANUFACTURER IDENTIFICATION

The external surface of the cable shall be marked by the following at an interval of 1000 mm with 10mm high character throughout the length of the cable:

(i) "11KV, XLPE, 1-Core, 500 sq.mm Cu"
(ii) "BREB", "Manufacturers Name"

2.0 GENERAL TECHNICAL REQUIREMENT OF 11KV XLPE 5000 MM2 COPPER CABLE

Item No.	Description of Items	Unit	Particulars
1	System Voltage	KV	11
2	Rated Voltage	KV	6/10(12)
3	Cross sectional Area of Conductors	mm^2	500
4	Insulation thickness	mm	Average thickness shall not be less than 3.40 mm nominal value as per IEC 502. However, thickness at any point may be less than nominal value provided that the difference does not exceed 0.1mm + 10% of nominal value.
5	Manufacturing process		Manufactured through VCV/CCV.
6	Conductor Material		Copper
7	Shape of Conductor		Compact Circular
8	Type of Conductor Screen		Semi-conducting XLPE
9	Conductor Temperature at end of short Circuit	°C	250

2.1 STRAIGHT-THROUGH JOINT BOX FOR 11KV XLPE, 1-CORE, 500 MM2 COPPER CABLE

Item No.	Description of Items	Particulars
1	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors
2	Installation	For underground horizontal mounting
3	System	11KV, effectively earthed system
4	Cable conductor	500 mm^2 1-core, Copper Conductors
5	Construction	The joint shall be proof against ingress of moisture and water
6	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

2.2 INDOOR TERMINATION KITS FOR 11KV, XLPE, 1-CORE,500 MM2 COPPER CABLE

Item No.	Description of Items	Particulars
1	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors
2	Installation	For Indoor switchgear terminations
3	System	11KV, effectively earthed system
4	Cable conductor	500 mm^2 1-core, Copper Conductors
5	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solder less earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Installation instructions

2.3 OUTDOOR TERMINATION KITS FOR 11KV, XLPE, 1-CORE, 500 MM2 COPPER CABLE

Item No.	Description of Items	Particulars
1	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors
2	Installation	For outdoor installation on poles/structures
3	System	11KV, effectively earthed system
4	Cable conductor	500 mm^2 1-core Copper Conductors
5	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solder less earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR 11KV, 1-CORE X 500 SQ. MM U/G XLPE COPPER CABLE

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

Sl. No.	Description of Items	Unit	Required Specification	Supplier's / Manufacturer's Particulars
1	Name & address of the Manufacturer			
2	Type/Model of the offered Cable			
3	System Voltage	KV	11	
4	Rated Voltage of Cable	KV	6/10 (12)	
5	Process of manufacturing		VCV/CCV.	
6	Number of core and Cross sectional area of conductor cores	Sq.mm	1X500	
7	Conductor materials		Copper	
8	Shape of conductor		Round	
9	Type of conductor screen		Semi-conducting	
10	Thickness of semi-conducting screen	mm	0.6	
11	Average thickness of insulation	mm	4.5	
12	Process of curing		Dry process	
13	Material of Insulation		Cross Linked Polyethylene (XLPE)	
14	Type of non-metallic insulating screen		Semi-conducting	
15	Thickness of semi-conducting insulation screen	mm	1.0	
16	Number and diameter of copper screen strands	No./mm	Based on design calculation	
17	Composition of filler		PVC	
18	Composition of bedding		Extruded PVC	
19	Thickness of bedding	mm	Based on design calculation	
20	Number and diameter of armour wire	No./mm	As per IEC 60502	
21	Average thickness of PVC over sheath	mm	Based on design calculation	
22	Nominal diameter of complete cable	mm	Based on design calculation	
23	Nominal weight per meter of complete cable	Kg/m	Based on design calculation	
24	Minimum radius of bend round which cable can be laid	mm	Based on design calculation	
25	Maximum D.C. resistance of conductor per meter at 20°C	Ohm/m	Based on design calculation	

Sl. No.	Description of Items	Unit	Required Specification	Supplier's / Manufacturer's Particulars
26	Maximum A.C. resistance of conductor per meter at a maximum conductor temperature	Ohm/m	Based on design calculation	
27	Star reactance per meter of cable at 50Hz	Ohm/m	Based on design calculation	
28	Star capacitance per meter of cable at 50Hz	pF/m	Based on design calculation	
29	Charging current per conductor per meter at 6300/11000 Volts, 50Hz	mA	Based on design calculation	
30	Maximum current carrying capacity of conductor in ground	A	Based on design calculation	
31	Maximum conductor temperature under continuous loading	°C	Based on design calculation	
32	Short circuit capacity of the cable for 1sec. duration	KA	70	
33	Conductor temperature at the end of short circuit	°C	≤250	
35	Screen short circuit withstand capacity for 1sec.	KA	25	
36	Armour short circuit capacity	KA	Based on design calculation	
37	Cable resistance, reactance:			
	a) for positive sequence	Ohm/km	Based on design calculation	
	b) negative sequence	Ohm/km	Based on design calculation	
	c) zero sequence	Ohm/km	Based on design calculation	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE

FOR JOINING KITS FOR 11 KV XLPE, 1-CORE, 500 MM^2 COPPER CABLE

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

Item Sl. No.	Description of Items	Required Particulars	Manufacturers Particulars
Indoor Termination Kits for 11KV XLPE, 1-Core, 500 mm^2 Copper cable			
1	Name and address of the manufacturer	Shall be furnished	
2	Type/model of the kits	Shall be furnished	
3	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors	
4	Installation	For Indoor installation in switchgear terminations	
5	System	11KV, effectively earthed system	
6	Cable conductor	500 mm^2 1-core Copper Conductors	
7	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solder less earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Installation instructions	
Outdoor Termination Kits for 11KV XLPE, 1-Core, 500 mm^2 Copper cable			
1	Name and address of the manufacturer	Shall be furnished	
2	Type/model of the kits	Shall be furnished	
3	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors	
4	Installation	For Outdoor installation on poles/structures	
5	System	11KV, effectively earthed system	
6	Cable conductor	500 mm^2 1-core Copper Conductors	

7	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator	

Item Sl. No.	Description of Items	Required Particulars	Manufacturers Particulars
		- Cable preparation kit - Solder less earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions	
Straight-through joint box for 11KV XLPE, 1-Core, 500 mm^2 Copper cable			
1	Name and address of the manufacturer	Shall be furnished	
2	Type/model of the kits	Shall be furnished	
3	Application	For 11KV, 1-core, XLPE 500 mm^2 Copper Conductors	
4	Installation	For underground horizontal mounting	
5	System	11KV, effectively earthed system	
6	Cable conductor	500 mm^2 1-core Copper Conductors	
7	Construction	The joint shall be proof against ingress of moisture and water	
8	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solder less earth connection kit - Misc. other material - Installation instructions	

CONDUCTORS AND CONNECTIONS

Overhead conductors carried by the switchyard structures shall be erected with such sags and tensions that when the conductors are subjected to load combinations, the factor of safety will not be less than 3.5.

Materials used for connections shall be stressed to not more than forty percent of their elastic limit. Provision shall be made for expansion and contraction with variation in conductor temperature and bus bars shall be arranged so they may be readily extended in length with a minimum of disturbance to existing equipment. The design of joints and connections shall be such as to permit ready dismantling.

Connectors shall be of an approved type. Connections dependent upon site welding techniques will not be permitted.

All bus connections and joints for aluminum conductor where applicable shall be of crimp and bolted palm types in accordance with the design parameters and the general technical requirements of this specification and the relevant standards.

Suspension and tension conductor clamps shall be of approved types and shall be as light as possible. Suspension and tension clamps shall be designed to avoid any possibility of deforming the stranded conductor and separating the individual strands.

Tension conductor clamps shall not permit slipping of, or damage to, or failure of the complete conductor or any part thereof at a load less than 95 percent of the ultimate strength of the conductor as stated in the schedule of particulars and guarantees.

All clamps and fittings and their components shall be electro-chemically compatible with the conductor material and those made of steel or malleable iron shall be hot dip galvanized. All bolts and nuts shall be locked in an approved manner.

Unless otherwise approved, connections shall be so arranged and supported that under no circumstances, including short circuit conditions, can the clearances between live metal and earth of earthed metal work or between other conductors be less than the specified distances.

Where dissimilar metals are in contact, approved means shall be provided to prevent electro-chemical action and corrosion. Unless otherwise approved, joints and surfaces of copper or copper alloy fittings shall be tinned.

Cleaning down and preparation of contact surfaces of connectors and clamps shall be to the approval of the Project Manager.

DISCONNECTORS AND EARTHING SWITCHES

1. GENERAL

Disconnecting and earthing devices shall be in accordance with IEC 60129 and IEC 60265 (Part 2). Transformer disconnectors in transformer circuits without circuit breakers on the High Voltage side shall be in accordance with IEC 60265 and shall be capable of breaking the transformer magnetizing current. All shall be complete with supporting steel work and installed to permit maintenance of any section of the substation plant when the remainder is alive and shall be so locate that the minimum safety clearances stated in BS 7354 are always maintained.

In outdoor substations, disconnectors shall preferably be of the single throw double air break, centre rotating post type or the double rotating post type with single air break and shall be to the approval of the Project Manager. Pantograph designs, or other alternatives, if applicable will be considered.

Disconnectors shall comply with the requirement of BS 5253 in respect of lighting impulse voltage tests. The contact resistance should be $\leq 30\mu\Omega$

Circuit isolating switches shall be rated not less than specified. Bus section/coupler isolating switches shall be rated not less than the associated bus bars.

Isolating switches shall generally be designed of live operations and will not require switching current other than the charging current of open bus bars and connections or load currents shunted by parallel circuits. Main contacts shall be of the high pressures line type and arcing contacts, if provided, shall be to the Project Manager approval.

Service conditions require that isolating switches shall remain alive and in continuous service for periods of up to 2 (Two) years in the climatic conditions specified and without operation or maintenance. The contacts shall carry their rated load and short circuit currents without overheating or welding and at the end of the two year period the maximum torque required at the operating handle to open a 3-phase disconnector shall not exceed 340 Nm.

All feeder disconnectors and high level disconnectors where specified shall be fitted with approved three phase line earthing devices, mechanically coupled or interlocked with the main isolator, so that the earthing device and main isolator cannot be closed at the same time.

The earthing switch, when in the closed position, shall be capable of carrying the rated short time current for three seconds without the contacts burning or welding.

Isolating devices shall be interlocked with circuit breakers and as necessary to prevent the possibility of making or breaking load current. Except where electrical interlocking is provided each mechanism box shall accommodate the relevant Castell type key interlocks.

Disconnector operation mechanisms shall be robust construction, carefully fitted to ensure free action and action and shall be unaffected by the climatic conditions at site. Mechanisms shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearing which are not of the self lubrication type. The mechanisms shall be housed in a weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts, including the supporting steelwork shall be hot dip galvanized.

2. 33 KV ISOLATOR, EARTH SWITCH AND FUSE SWITCH

(a) 33 KV Isolator, Off Load Type (Outdoor)

The 33 KV Isolator, shall be a gang operated type, horizontal mounted and horizontal break, 3-phase, outdoor mounted, manual operating type along with the following feature:

(a) Auxiliary contact operative through the operating mechanism of the isolator blade (6 normally ON and 6 normally OFF contacts).
(b) Terminal connecting clamp suitable for being connected with AAAC/ ACSR conductor.
(c) Earth pad for safety of the operating person. The operating lever shall be provided with locking device. Necessary grounding points shall be provided with connector suitable for being connected with 100 mm^2 stranded Cu wire.
(d) Gland for multi core control cable.
(e) 33 KV structure beam, complete operating mechanism for easy manual operation from the ground and grounding points with connection clamps for connecting with str. Cu wire.
(f) All ferrous parts to be hot dip galvanized as per BS 729.
(g) All electrical auxiliaries to be housed in a fully weather proof housing.

All other features as stated in the table of guaranteed data schedule should be applicable also.

(b) 33 KV Isolator with Earth Switch of the Line Side (Outdoor)

Same as in specification of 33 KV isolator but with the added feature of earthing blade with will also hand operable from the switchyard by another handle and the operation of this earth blade with be mechanically interlocked with that of the main blade. The earth blade will be of same current rating as the main blades and shall be earthed through a 100 mm sq. (cu) earthing conductor. Necessary aux. contracts for position indication and to provide electrical inter locking should be there.

(c) 33KV Fuse Switch with Holder and Fuse (Outdoor) for By-passing VCB and CT

The 33 KV Fuse Switch, shall be 3 pole double-break gang operated type, outdoor vertical mounted, manual operating type which shall have a removable fuse in series. The switch shall be suitable for mounting on a pole (wooden, concrete or metal). A suitable structure shall be constructed by the Contractor with proper phase & ground clearances.

The circuit breaker/by-pass switch combination shall be designed in such a way that the circuit breaker primary circuits can be isolated by bolted links or switchable single phase links or similar disconnect devices to enable maintenance of the CB with the by-pass switch closed supplying the substation, without encroaching on any safety clearances.

The purpose of the fused bypass switch is to enable the substation to be supplied while the circuit breaker/current transformer combination is being maintained or replaced. The Contractor shall design and install 2 sets of disconnect links in the circuit breaker/current transformer branch of the circuit so that the complete breaker/current transformer can be safely maintained with the bypass switch closed and providing 33 KV supply to the power transformer.

3. 11 KV ISOLATOR

The 11KV Isolator, shall be of gang operated type, horizontal mounted and horizontal break, 3 phase, outdoor mounded, manual operated type.

INSULATORS

1. DESIGN

For open terminal type insulator, transformer terminal bushings and cable sealing ends the minimum specified creepage distance measured from the insulator metal cap to the base over the insulation cells shall not be less than 25mm per KV of rated voltage between phases.

All types of insulator shall satisfactorily withstand the specified climatic and service conditions. The strength of insulators as given by the electro-mechanical test load shall be such that the factor of safety, when supporting their maximum working loads, shall be not less than 2.5.

Designs shall be such that stresses due to expansion and contraction in any part of the insulators and fittings do not lead to development of defects.

All insulators shall be manufactured in one piece. Jointing of solid or hollow porcelains in not permitted except by use of metal fittings.

Damaged insulators may not be repaired without the written consent of the Project Manager.

Arcing horns are not required on post type and string insulators.

All insulators shall be porcelain construction type in accordance with IEC 60305. Post insulators shall comply with IEC 60273. Porcelain shall be sound, free from defects and thoroughly vitrified and the glaze shall not be depended upon for insulation.

The minimum specific creepage distances of outdoor insulators shall be as stated in the schedule of requirements. The shed shape, spacing and inclination shall be such as to with stand moderate pollution and the extremely heavy rainfall encountered at Site.

Glaze shall be smooth, hard of a uniform shade of brown and shall completely cover all exposed parts of the insulators. Outdoor insulator fittings shall remain unaffected by atmospheric conditions producing weathering, acids alkalis, dust and rapid changes in temperature that may be experienced under working conditions.

Porcelain insulators shall be secured in an approved manner, preferably by means of bolts or metal clamping plates with suitable packing material interposed.

Porcelain shall not engage directly with hard metal and where necessary, approved water and oil resistant yielding material shall be interposed between the porcelain and fittings. All porcelain clamping surfaces shall be approved quality applied in an approved manner and shall not be chemically active with the metal parts or cause fracture by expansion in service. Where cement is used as a fixing medium, the cement thickness shall be as small and as even as possible and care shall be taken to correctly centre and locate the individual parts during cementing.

Suspension and tension insulators shall comprise porcelain units with ball and socket fittings. Each tension insulator shall consist of a string of insulator units and the ball socket joints of the units and of the associated fittings shall be in accordance with IEC 60305 (BS 137 Part 2) and IEC 60383 (BS Part 1).

Retaining pins or locking devices for cap and pin insulators shall be in accordance with BS 137.

Unless otherwise approved, the individual units of both the suspension and tension insulators sets shall be identical and interchangeable.

2. IDENTIFICATION

Each insulator shall have marked on it the manufacture's name or trademark, the year of manufacture and the insulator reference. Tension and suspension insulators shall also be marked with the guaranteed electro-mechanical strength. Marks shall be visible after assembly of fittings and shall be imprinted and not impressed. For porcelain insulators, the marks shall be imprinted before firing and shall be clearly legible after firing and glazing.

When a batch of insulators has been rejected, no further insulators from this batch shall be submitted and the Contractor shall take adequate steps to mark or segregate the insulators constituting the rejected batch in such a way there is no possibility of the insulators being subsequently resubmitted for tests or supplied for the Employer's use.

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
FOR 33 KV ISOLATOR/EARTH SWITCH

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

Description		Unit	BREB/PBS Requirement	Tenderer's Guaranteed Values
1.	Name of the manufacturer		Required	
2.	Switch Type & Model		Required	
3.	Rated Voltage & Frequency	KV/Hz	33,50	
4.	Maximum Continuous voltage	KV	36	
5.	Rated Current	A	630	
6.	Rated Short time current (3 sec)	KA	31.5	
7.	Impulse withstand voltage	KV	170	
8.	Power Frequency withstand voltage (1 min)	KV	70	
9.	Creepage Distance	mm	Required	
10.	Dimension of the supporting steel structure		Required	
	Height	mm	Required	
	Width	Mm	Required	
	Length		Required	
11.	Weight of the phase units	Kg	Required	
12.	Phase center distance	Mm	Required	
13.	Period of time, equipment has been in service	Years	2	
14.	Period of time, equipment has been in manufacture	Years	5	
15.	Earth Switch		Required	
16.	Manufacturer		Required	
17.	Country of Manufacture		Required	
18.	Manufacturer type designation		Required	
19.	Reference Standard		Required	
20.	Number of years disconnector type in service		Required	
21.	Nominal system Voltage	KV	33	
22.	Highest system voltage	KV	36	
23.	Frequency	Hz	50	
24.	Rated Current	A	1250	
25.	Type of operating mechanism		Hand	
26.	Contact resistance	μ	≤ 30	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE FOR 11 KV ISOLATOR

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected)

Failure to provide all of the information requested may lead to the rejection of the tender.

Description	**Unit**	**BREB/PBS Requirement**	**Tenderer's Guaranteed Values**
1. Name of the manufacturer		Required	
2. Switch Type & Model		Required	
3. Rated Voltage & Frequency	KV/Hz	11, 50	
4. Maximum Continuous voltage	Kv	12	
5. Rated Current	A	1250	
6. Rated Short time current (3 sec)	KA	31.5	
7. Impulse withstand voltage	KV	75	
8. Power Frequency withstand voltage (1 min)	KV	28	
9. Creepage Distance	mm	Required	
10. Dimension of the supporting steel structure		Required	
Height	mm	Required	
Width	mm	Required	
Length		Required	
11. Weight of the phase units	Kg	Required	
12. Phase center distance	mm	Required	
13. Period of time, equipment has been in service	Years	2	
14. Period of time, equipment has been in manufacture	Years	5	
15. Contact resistance	μ	≤ 30	

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
For 33KV, DOUBLE BREAK SWITCHED FUSE

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

Description	Unit	REB Requiremen	Tenderers guaranteed values
1. Name of the manufacturer		Required	
2. Switch Type & Model	Dual Break	Required	
3. Rated Voltage & Frequency	KV/Hz	33,50	
4. Maximum Continuous voltage	Kv	36	
5. Rated Current	A	630	
6. Rated Short time current (3 sec)	KA	31.5	
7. Impulse withstand voltage	KV	170	
8. Power Frequency withstand voltage (1 min)	KV	70	
9. Fuse Type		Required	
10. Fuse Rating	A	630	
11. Creepage Distance	mm	Required	
12. Dimension of the supporting steel structure		Required	
Height	mm	Required	
Width	mm	Required	
Length	mm	Required	
13. Weight of the phase units	Kg	Required	
14. Phase center distance	mm	Required	
15. Period of time, equipment has been in service	Years	2	
16. Period of time, equipment has been in manufacture	Years	5	

SUBSTATION EARTHING SYSTEM

1. GENERAL

Circuit breakers, power transformers, voltage transformers, auxiliary transformers, earthing switches and other electrical apparatus shall each be connected to the main earth bus by means of a separate subsidiary connection. Gradient control mats shall be installed adjacent to each circuit breaker and disconnect switch mechanism box. Each mat shall be connected directly to the earth grid and the equipment.

Isolating supports, bus bar supports and cable sheaths may be earthed in groups by a separate branch connection from each item of equipment in the group the branch connections being connected by a single subsidiary connection to the main earth. Isolating and earth switch mechanism boxes shall be earthed by a connection separate from that effecting the earthing of the associated switch.

The main members of the steel structures shall be earthed by continuous copper connections bonded to the steelwork and these connections shall be connected separately at each column to the main or subsidiary earth. There shall be 2 connections to each structure and 1 to each piece of high voltage apparatus.

Connections to apparatus and structures shall be made clear of ground level, preferably to a vertical face and protected against electrolytic corrosion.

Current transformer and voltage transformer secondary circuits shall be complete and shall be earthed at one point only (at the control building) through links situated in an accessible position. Each separate circuit shall be earthed through a separate link, suitably labelled. The links shall be of the bolted type, having necessary provision for attaching test leads.

The earth system shall be designed so as to include all overhead line terminal Poles, by bonding the overhead earth wire to the earth grid by means of a link which shall be capable of being removed for testing purposes.

The terminal pole shall also be included within the boundary of the earth grid by extending the grid if necessary.

Structures and masts for lighting and security surveillance equipment shall also be within the perimeter of the earth grid. No fixed low voltage equipment, with the exception of a warning or alarm button and intruder alarms, which shall be of the double insulation type, shall be erected outside the perimeter of the earth grid.

All control and relay panels shall have a continuous earth bus run of sectional area approved by the Project Manager along the bottom of the panels, each end being connected to the main earthing system. Metal cases of instruments and metal bases of relays on the panels shall be connected to this bar by conductors of sectional area approved by the Project Manager.

Loops shall be provided on the earthing system in positions approved by the Project Manage, for the attachment of portable earth connectors during maintenance. These will normally be in the earth bar run between the equipment and the base of the structure. They shall be formed separately from the bar and soldered or thermo-welded thereto. Where necessary, rods shall be provided at the tops of bushings or insulators for the attachment of portable earth clips.

Earthing for any high frequency coupling equipment , if applicable, and surge diverters shall be via a copper rod driven directly into the ground at a position immediately adjacent to the equipment being earthed in addition to the normal earth connection.

2. EARTHING SYSTEM DESIGN

The earthing system shall be designed to meet the requirements of this specification and shall be in accordance with "The Guide for Safety in Alternating Current Substation Grounding" as published by the Institute of Electrical and Electronic Engineers Incorporated, Publication IEEE 80 and 142. The Contractor shall present calculations to show the earthing system meets these requirements and can be shown to be safe in terms of touch, step and transferred potentials. The earth resistance should be kept below or equal to 0.2 Ω.

Electrical measurements of the subsoil at various depths, up to 20 metres shall be made at the site of the substation in order to determine the layered effects of the ground from which the effective ground resistivity and hence the expected resistance of the proposed earth grid system may be predicted.

Soil composition may be highly corrosive and special consideration shall be given to this problem. The earth grid shall be effectively protected against corrosion. Cathodic protection, if considered, may adversely affect other equipment and shall be subject to approval by the Project Manager.

In actual design, the earthing system shall take the form of a combination of grids of buried conductors and earth rods driven vertically into the ground. Within the grid, conductors shall be laid in parallel lines at reasonably uniform spacing. They shall be located along rows of structures or equipment to facilitate the making of earth connections, where practical.

The main earth and each subsidiary earth shall have a sectional area, as required for 31.5 kA for 3 sec, in any case not less than 120 mm^2 in any part of its length. Each branch connection shall have a sectional area of not less than 70 mm^2.

Connections to the grid of all non-current carrying metallic parts, which might become energised by chance, such as metal structures, building earth, equipment, earth rods, water pipes, etc. shall not be less than 70 mm^2 and shall be of adequate size, current-carrying capacity and mechanical ruggedness.

The spacing between conductors forming the mesh system shall be such as to limit the grid potential rise to a value that limits the touch voltage to a value not greater than the maximum tolerable touch potential assuming a fault clearance time equal to that of the main protection equipment being provided.

Each group of earth conductor shall be connected to the main earth grid through connections having a sectional area of not less than 120 mm^2 which shall be protected from corrosion.
The grid shall be subdivided into a number of sections, interconnected with test links. These links shall be accessible from above-ground.

Areas of the grid, where high concentrations of fault currents can appear, as at neutral earthing connections, shall have reinforced conductor sizes where necessary, to handle adequately the highest fault current and its duration.
In case the equipment is widely spaced in the station, individual local grids may be established at the various equipment locations and the local grids shall be interconnected and connected to the

overall earth grid. Interconnecting conductors shall not be less than the size of the conductor for main grid.

Metal parts of all equipment, other than those forming part of an electrical circuit shall be connected directly to the main earth system via a single conductor. The arrangement of the mesh earth system shall be such as to minimise the length of these single connections.
Earth bars installed directly into the ground should normally be laid bare and the trench back-filled with fine topsoil. Where the soil is of a corrosive nature, precautions must be taken to protect the earth bar.

All trenches shall be backfilled in compacted 100 mm layers. All stones and other sharp objects shall be removed from the backfill by a suitable sieve.

Copper to copper joints on strip conductor shall be brazed, using zinc-free brazing material with a melting point of not less than 600°C, or by approved exothermic welding. All exposed joints shall be at a minimum height of 150 mm above floor or ground level. Earth conductor joints that are required to be broken for testing or maintenance shall have mating surfaces tinned.

After installation of the earth system the Contractor shall measure the resistance of the substation. The method used shall preferably be the "fall of potential" method, requiring the availability of a local low voltage supply but other methods using an earth resistance megger will be acceptable in the event of a local supply being unavailable.

In the case of surge (lightning) arrestors a local earth connection shall be made by driving electrodes into the earth near the arrestors and the lightning arrester earth conductor shall be connected to both the rod and to the common earthing grid of the station. The connection from arrester to earth shall be as short and as straight as possible. The conductor shall not be less than 120 mm^2.

The measured earth resistance shall not exceed 0.5 ohm. A value higher than 0.5 ohm shall be subject to the approval of the Project Manager. The resistance shall be measured with all transmission line earth wires connected to the earthing grid.

In the event of the substation resistance obtained with the foregoing installation being of a magnitude unacceptable to the Project Manager, then where practicable, the ground area enclosed by the earth system shall be increased by installing directly in the ground an additional copper conductor in the form of a ring around the site, or by additional conductors within the site. Alternatively earth conductors can be directly buried radially outside the substation perimeter fence. The use of earth plates as current carrying electrodes is not acceptable. Any additional conductors shall be as directed by the Project Manager.

From the point of view of the possible damage to apparatus, the earthing system shall be such as to limit voltage appearing between the substation equipment and the main body of earth, so that insulation breakdown or burning does not occur on apparatus. For the same reason, voltage rise between earthed points in the substation shall be kept to a minimum. In addition, the effectiveness of any surge protection devices shall be fully realized by providing an adequate earth path. In this case, the earthing system shall not only be of low resistance, but of as low reactance as practicable.

N.B: For the earthing system design copper conductor shall be considered instead of copper earth electrode.

3. STEP AND TOUCH VOLTAGE

The earthing systems shall be so designed as to keep the "step" and "touch" potentials within acceptable limits, thereby ensuring safety to the personnel. The aim shall be to ensure that under either normal or abnormal conditions no dangerous voltages can appear on the equipment or accessories to which a person has legitimate access.

The step and touch potential voltages obtained inside the site and at selected locations around the fence/gate shall also be measured by a suitable method acceptable to the Project Manager. Appropriate measures shall be taken to rectify the causes of any deviations from allowable values.

4. FENCE AND PERIMETER EARTHING

The fence surrounding the substation shall be earthed to its own earth grid and the fence earth grid shall be connected to the main station earth grid at frequent intervals as approved by the Project Manager.

A continuous conductor shall be laid outside the periphery of the substation site at a distance of 1.0 metre from the boundary fence and at a depth of 0.6 metres below the surface. This shall be welded to earth rods installed at adequate intervals and at points adjacent to each corner and immediately below any overhead line entering or leaving the site. The location of the mesh conductors shall be such as to enable all items of equipment to be connected to the earth system via the shortest possible route. All corner fence posts and posts adjacent to earth rods shall be effectively connected to the earth conductor.

Gateposts forming part of the substation fence shall be bonded together with below ground connections and the gates themselves shall be electrically bonded to the posts.

The alternative approach of independently earthing the fence and placing it outside the earth grid area shall only be adopted if the above mentioned procedures prove insufficient or impracticable. The Contractor shall provide calculations to show that this approach produces safe touch voltages at the fence and shall ensure that the fence is isolated from all other buried metalwork.

5. TESTS

All relevant type and routine tests shall be carried out.

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 Project Manager 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.

SUBSTATION BATTERY AND BATTERY CHARGER

The following battery size is the minimum expected and is provided as a guide only. The Contractor shall provide the detailed calculations of the loads and the expected loadings and the sizing of the battery for approval before implementation. The number of cells required in the battery shall be determined by the Contractor in accordance with the design of the DC requirements.

A. BATTERY

i	Application	: Supply for remote control, operation, indication, protective and regulation apparatus, emergency light etc.
ii	Installation	: Indoor (self supporting unit).
iii	Type/Model	: Nickel Cadmium Alkaline
iv	Operating Voltage	: 110 V, DC
v	Continuous discharge	: 20 A during 5 hour
vi	Capacity (at the 5 hr rate)	: 100 A hour
vii	No. of cell	: 90
viii	Discharging voltage	: 1.3 - 1.5 volt per cell
ix	Charging voltage (normal)	: 1.45 - 1.55 volt per cell
x	Charging voltage (max)	: 1.65 volts per cell
xi	Type of container	: Transparent plastic
xii	Mounting	: Cabinet
xiii	Construction	: Closed top
xiv	Standard	: 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 shall be connected together to form a leak proof bond against seepage of electrolyte.

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 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 alkali resisting units, 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 a few step structural steel and shall be printed 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 syringe.
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.

B. BATTERY CHARGER

Charger type	:	Constant voltage with current limiting
Nominal output voltage	:	110 D.C
Input voltage	:	433 V (50 Hz) three phases.
Charging operating control	:	Boost and floating charge, automatic with manual operation
Maximum charging current	:	As Required
Provision constant current 15A - 40A	:	Shall be provided
Provision of constant voltage charge 90V - 130V	:	Shall be provided

All interconnections, nuts and bolts shall be non-corrosive type.

Battery charger shall come with a voltmeter (0 to 250V DC scale) and suitably scaled ammeters 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 other miscellaneous items as well as appropriate tamper proof sheet steel housing for battery charger shall be provided.

The housing shall have storage space for accessories and provision for locking.

Necessary interconnections between battery and battery charger, DC output terminals, AC input terminals and AC disconnect switch shall be supplied.

OVERHEAD EARTHING SCREEN

Earthed screens shall be provided at all substations to protect the substation equipment from direct lightning strikes. The screens shall be of aluminum clad steel wires of not less than 50 sq. mm total section, and connected to provide low impedance paths to earth.

In accordance with international standards, the 'Rolling Sphere' method shall be used to determine the required protection. The layout of the earth wires shall be such that equipment to be protected generally lies within areas bounded by two or more conductors.

The earth screens shall be suitable for extension to protect the substation equipment to be installed in future stages of development.

Connections to the main underground earth grid shall be made of suitably rated copper strap at each support unless the galvanized steel support structure has sufficient area and current carrying capacity. Earth wires shall be held in clamps with free pin type joints between clamps and supports.

Connections shall be provided for the terminations of the earth wires of the overhead lines, including bimetal connectors where necessary.

The design of all structures shall comply with the requirements of the standards and specifications with consider the layout of the 33/11 kV sub-station. In particular the design shall ensure that in the event of the breakage of one earth wire, the Factor of Safety is not less than 1.5.

A. ELECTRICAL

3.0 TESTING AND COMMISSIONING

TABLE OF CONTENTS

Clause No.	Description
3.0	Testing and Commissioning
3.1	Motors
3.2	Relays
3.3	Instrument Transformers
3.4	Electrical Instruments and Meters
3.5	AC Switchboards/ Contacts/L.V Equipment
3.6	PVC Cable
3.7	Metal Clad Switchgear
3.8	Disconnectors and Earth Switches
3.9	Bushings and Insulators
3.10	Current and Voltage Transformers
3.11	Structures of Electrical Equipment
3.12	Surge Arresters
3.13	Batteries and Battery Chargers
3.14	Control Panels
3.15	Metal Clad Switchgear Busbars
3.16	Instruments
3.17	Power Transformers
3.18	Station service Transformer
3.19	Prior to Shipment
3.20	Inspection and Testing During Site Erection and Commissioning
3.21	Commissioning Tests
3.22	Commissioning of Electrical Equipment
3.23	Plant Performance
3.24	Manufacturer’s Standard Tests

3.0 Testing and Commissioning

The Contractor shall include comprehensive Inspection and Test Plans in its Quality Plan. Factory testing shall include all type tests and routine tests set out in the relevant IEC standards and in the Particular Technical Requirements.

If satisfactory type tests have been carried out on identical equipment the Contractor shall submit copies of the test certificates to the Employer. The Employer may waive the requirement for any of the type tests if it approves these test certificates.

The Employer will witness all factory inspections and testing. The Contractor shall notify the Employer of its intention to conduct factory inspection and testing for each lot of equipment at least one month in advance, and shall not perform such testing unless the Employer witnesses the test or a waiver has been provided by the Employer.

The notification shall include full details of the equipment, manufacturers and proposed tests, including:

Contract identification
Full details of equipment to be tested
Manufacturer's name, address and contact information
Contractor or manufacturer's staff responsible for the testing
Location and date of tests
Schedule of tests to be performed and standard to be applied
List of relevant drawings and documents

In the following sections, various relevant standards and tests are listed. These are not intended to be exhaustive. If other standards and/or tests are relevant, they shall also apply.

3.1 Motors

One motor of each type and rating shall be type tested and all motors shall be routine tested in accordance with the tests specified in IEC 60034, NEMA MG 1, IEEE 112, 114, 115 and 85.

3.2 Relays

3.2.1 Type Tests

Type test results shall be submitted for approval for each type and rating of relay.

Type tests may be waived at the Project Manager’s discretion if adequate type tests have already been performed and copies of the type test reports are supplied.

3.2.2 Routine Tests

All relays and associated equipment shall be routine tested as required by the standards to prove the quality and accuracy. Routine tests shall be in accordance with relevant IEC recommendations and BS 142.

All relays shall be subjected to the appropriate routine tests as listed below, the individual tests being as detailed in IEC 60255 or as otherwise agreed with theProject Manager.

- Accuracy of calibrated pick-up and drop-off levels over the effective range of settings
- Insulation tests
- Accuracy of timing elements
- Correct operation of flag (or other) indicators
- Mechanical requirements, integrity/safety of draw-out units, check of contact pressure and alignment.

3.3 Instrument Transformers

All required tests shall be carried out as per relevant IEC standards.

3.4 Electrical Instruments and Meters

One instrument and meter of each type and rating shall be subjected to the test as specified in IEC 60051.

3.5 AC Switchboards/ Contacts/L.V Equipment

Routine tests shall include general inspection and electrical operation tests.

3.6 PVC Cable

Each size and rating of PVC cable shall be subjected to type tests as specified in BS 6346. Routine tests are detailed in this document.

3.7 Metal Clad Switchgear

One circuit breaker, disconnector, earthing device and other switchgear equipment of each rating and type shall be subjected to the type tests laid down in IEC 60056, ANSI C37, IEC 62271-100 and other relevant IEC standards. In cases where documentary evidence is produced that a circuit breaker of exactly similar design has been type tested by an approved and independent testing station, the type test requirement may be waived.

The circuit breakers of each type shall be either 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 major insulation components.

Routine tests in accordance with IEC 60056, IEC 62271-100 or ANSI C37 shall be carried out on all circuit breakers. These shall include operation tests, millivolt drop tests and power frequency voltage tests. Routine tests in accordance with the relevant IEC standards, including operation tests and power frequency voltage tests, shall be carried out on all switchgear.

3.8 Disconnectors and Earth Switches

Tests shall be carried out as required according to the following standards:

- Type and routine tests to IEC 60129 (BS 5253).
- Type and routine tests to IEC 60265 for switch disconnection.
- Routine high voltage and mechanical test of insulators.
- Sample and type tests of insulators

3.9 Bushings and Insulators

Routine, sample and type tests shall be carried out in accordance with the specified standards. Type tests shall also be carried out unless approved type test evidence is submitted. These tests shall include temperature cycle and porosity tests.

The following standards shall apply:-

- IEC 60233 (BS 4963) for hollow porcelains.
- IEC 60137 for bushings.
- IEC 60148 and 60273 (BS 3297) for high voltage post insulators.
- IEC 60383 and 60305 (BS 137 Part 1 and Part 2) for cap and pin string insulators.

3.10 Current and Voltage Transformers

Type and routine tests shall be carried out according to IEC 60185 (BS 3938), IEC 60186 (BS 3941), IEC 60044-1 and IEC 60044-2.

3.11 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.

3.12 Surge Arresters

Routine tests and type tests shall be carried out to the specified standards.

The following routine tests shall be carried out on all arrester units in accordance with clause 8.1 of IEC 60099-4.

- Measurement of reference voltage
- Residual voltage test
- Partial discharge test
- Housing leakage test
- Current distribution test for multi-column arrester

3.13 Batteries and Battery Chargers

All relevant type and routine tests shall be carried out.

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 Project Manager 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.

3.14 Control Panels

Routine operation tests and insulation resistance tests shall be carried out.

3.15 Metal Clad Switchgear Busbars

Routine tests including millivolt drop tests shall be carried out in accordance with the specified standard. Type tests shall also be carried out on each busbar design unless approved type test evidence is submitted.

3.16 Instruments

Calibration tests shall be carried out on all important pressure gauges and other instruments as required by the relevant standards. Site tests shall also be carried out to prove compliance.

3.17 Power Transformers

Testing shall include all routine electrical, mechanical and hydraulic tests in accordance with the relevant IEC or British Standard, except where departures there from and modifications thereto are embodied in this specification. For plant not covered by any IEC or British Standard or specifically mentioned in this specification, such tests as are relevant shall be agreed with the Project Manager.

Should the plant, or any portion thereof, fail under test to give the required performance, further tests which are considered necessary by the Project Manager shall be carried out by the Contractor and the whole costs of the repeated tests borne by the Contractor. This also applies to tests carried out at the Sub- contractors' works.

After satisfactory completion of the witnessed tests at the works, the Plant shall be submitted for the Project Manager's approval during dismantling preparatory to shipment. No item of Plant is to be despatched to site until the Project Manager has given his approval in writing.

Routine Tests

All transformers shall be subject to the routine tests and routine test sequence (mentioned in Section VI Part 2 Electrical Transformer Specification (Clause 5)) in accordance with IEC 60076 and the requirements of this Specification.

The test shall be in accordance with IEC 60076, Part 2, and shall be carried out on one transformer of each size and type. Temperature-rise tests shall be conducted on the tapping corresponding to the maximum losses.

All relevant type tests shall be carried out or documentary evidence of tests on similar designs presented.

Temperature Rise Test:

This shall be carried out in accordance with IEC 60076 Part 2.

Noise Level Tests:

A noise level test according to IEC 60075 shall be carried out on one transformer of each type specified under items 1 and 2 in accordance with IEC 60551.

Special Tests

As mentioned in Section VI Part 2 Electrical Transformer Specification (Clause 5).

3.17.1 Voltage Control Equipment

The following tests shall be carried out:

Routine Tests

Each finished tap changer shall be subjected to the routine tests specified in IEC 60214.

Type Tests

Type tests shall be carried out entirely in accordance with IEC 60214 except that evidence of the service duty type test shall be in excess of 100,000 operations.

3.17.2 Magnetic Circuit

The following tests shall be carried out:

Routine Tests

Each core completely assembled shall be tested for one minute at 2,000V AC between core bolts, side plates, structural steelwork and core at the core and coil stage. After the transformer is tanked and completely assembled, a further test shall be applied between the core and the earthed structural steelwork to prove that the core is earthed through the removable link, at one point only.

3.17.3 Outdoor Bushing Assemblies with Porcelain Insulators

The following tests shall be carried out:
Hollow insulators tested in accordance with IEC 60233.

Complete bushings tested in accordance with IEC 60137.

All relevant type and routine tests shall be carried out.

3.17.4 Tanks

The following tests shall be carried out:

Routine Tests shall include:

Oil Leakage:

All tanks, conservators and oil filled compartments, which are subjected in service or during maintenance to oil pressure, shall withstand without leakage a hydraulic pressure test equal to 69 kN/m^2 or the normal pressure plus 34 N/m^2 whichever is the greater, for 24 hours during which time no leakage or oil ingress into normally oil free spaces shall occur.

Type Tests:

Unless type test certificates can be produced for tests carried out on similar equipment, the following tests shall be included for tanks and conservators.

i) Vacuum Test:

The equipment shall withstand a full vacuum when empty of oil. The permanent deflection of plates or stiffeners on removal of vacuum shall not exceed the following values:

Length of Plate	Permanent deflection
Less than 1300 mm	3.17 mm
1300 to 2500 mm	9.5 mm
Greater than 2500 mm	12.7 mm

3.17.5 Cooling Plant

The following tests shall be carried out:

Routine Tests

- Cooler: Pressure test to be as specified above.
- Motors and control Gear: as required by the standard

3.17.6 Gas and Oil – Actuated Relays

The following tests shall be carried out:

Routine Tests:

- Oil Leakage, when subject to an internal oil pressure of 207kN/m2 for fifteen minutes.
- Gas Collection
- Oil Surge
- Performance test under service conditions
- Voltage:2kV for one minute between electrical circuits and casing.

3.17.7 Galvanizing

Routine Tests shall be carried out to the requirements of BS 443 or BS 729 whichever is applicable

3.18 Station Service Transformer

The following tests shall be carried out:

Routine Tests

- Measurement of Winding Resistance
- Ratio, polarity and phase relationships
- Measurement of impedance voltage

- Measurement of loss
- Short duration power frequency voltage-withstand test
- Induced over voltage withstand test
- Insulation resistance of each winding

Type Tests

All relevant type tests including a temperature rise test shall be carried out.

Unless acceptable type test certificates cab be submitted in respect of a transformer similar in design to that specified, a temperature rise test shall be carried out and the costs shall be included in the contract Price. This test shall take into account temperature rise due to both the specified earth fault current and continuous operation at CMR of the auxiliary winding.

3.19 Prior to Shipment

After the satisfactory completion of all tests at the factory, the plant shall be submitted for the Project Manager's approval during dismantling preparatory to shipping. No item of plant shall be despatched to site until the Project Manager has given approval in writing.

3.20 Inspection and Testing During Site Erection and Commissioning

3.20.1 General

The Contractor shall be responsible for the inspection and testing during site erection, to ensure correct erection and compliance with the specification. Tests carried out during testing and commissioning shall includes those tests listed in this section but shall not be limited to them.

During the course of erection, the Contractor shall provide access as required by the Project Manager for inspecting the progress of the works and checking its accuracy to any extent that may be required.

The Contractor shall provide, at its own cost, all labor, materials, stores, and apparatus as may be required and as may be reasonable demanded to carry out all tests during erection, whether or not the tests are specifically referred to in this specification. All power supplies (including 50Hz AC) shall be provided by the Contractor.

A full site test program shall be submitted for approval. This shall include a brief description of all tests and testing procedures and shall be provided before tests commence and the method of testing, unless otherwise specified, shall be agreed with the Project Manager.

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 arrangements to be made in conformity with the testing program.

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 test during the working life of the equipment. The required number of site test result records shall be provided by the Contractor to the Project Manager 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 Project Manager 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 detailed under this specification may be subject to some variation upon the instruction or agreement of the Project Manager where necessitated by change conditions at site of by differing design, manufacture, or construction techniques.

The Contractor shall be responsible for the safe and efficient setting to work of the whole of the plant and equipment. The methods adopted shall be in accordance with any safety and permit regulations in force by the Employer on the site.

3.20.2 Mechanical Equipment

The extent of testing during erection shall include, but not be limited to, the following.

- Checking the accuracy and alignment of plant erected. The accuracy shall comply with the relevant standards, the specification or the plant manufacturer's requirements as may be applicable or where no requirements exist, to a standard to be agreed between the Project Manager and the Contractor.
- Checking the alignment of rotating equipment to the manufacturer's requirements.
- Non-destructive testing of site welds as required by the relevant standard and as detailed in this specification.

3.21 Commissioning Tests

At least two months before commencing the commissioning of any plant or equipment, the Contractor shall submit for approval fully comprehensive schedules of pre-commissioning checks as applicable to each item of the plant and equipment provided. These schedules shall then be used during pre-commissioning as a guide to the methods to be followed and to record the actual activities carried out with the appropriate date, together with details of all work yet to be completed, variations and modifications to design conditions.

In addition the Contractor is to submit with the schedules to the Project Manager proforma test sheets (to be used by the Contractor during testing and commissioning) for all tests he proposes to carry out and those required by the Project Manager.

Each activity on the schedules, when completed to the satisfaction of the Project Manager, shall be signed and dated by the Contractor. The schedules shall be countersigned by the Project Manager as necessary. If during the performance of the pre-commissioning checks the Project Manager considers that additional tests are necessary to prove the system or plant the Contractor shall perform such additional tests to the Project Manager's satisfaction.

Each activity on the commissioning procedure schedules when completed to the satisfaction of the Project Manager, shall be signed and dated by the Contractor and shall be countersigned by the Project Manager as necessary.

The commissioning procedures shall ensure that the commissioning of any section of the Works does not interrupt the normal commercial operation of any previously commissioned section(s).

At least 14 days prior to commencing commissioning checks, the Contractor is to agree with the Project Manager, the method and sequence of performing the commissioning tests. Following agreement the Contractor shall submit a detailed program indicating the testing sequence to permit advance notice to be given to the Employer in order that the Employer's representatives may also witness testing.

For the purposes of this Contract, the provisions of this section will apply to plant supplied from nominated sub-contractors.

3.21.1 Contractor's Site Supervisory Staff

During the commissioning and subsequent testing of any item of plant the Contractor shall provide the services of any special supervisory staff necessary for the purpose of ensuring proper commissioning and the satisfactory completion of all tests. The cost of any such specialized services is deemed to be part of the bid price for erection of plant.

3.21.2 Commissioning of Modified Circuits

Where the scope of works has included the diversion, relocation or variation of any existing circuit the Contractor is deemed to have included for all pre-commissioning checks on existing equipment. Where this work includes overhead line or cable circuits the Contractor is responsible for carrying out full pre-commissioning and on-load checks at the remote end of the circuit including the injection testing and re-setting of relays if required.

All and any such work associated with the re-commissioning of existing equipment is deemed to be included in the contract price.

3.21.3 Test Equipment

The Contractor is responsible for providing all equipment, power, etc. necessary to carry out all tests on site. Following award of contract, at the appropriate time, the successful Contractor shall submit a detailed schedule of the test equipment etc., he intends to provide for carrying out this portion of the works. Should the Project Manager require additional or alternative test equipment to be provided to enable full site testing to be performed in accordance with the requirements of the specification, the Contractor shall supply such equipment at no extra cost.

3.21.4 Owner Participation

The Contractor shall plan for Employer staff participation either continuously or on a regularly recurring basis in the commissioning work with the primary intent of:

a) Staff becoming familiar with the operating and maintenance aspects of the new equipment.
b) Staff maintaining a continuing assessment of the precautions required in, or possible consequences of, initial energization of equipment.

These two objectives must be allowed for in the preparation of schedules.

3.22 Commissioning of Electrical Equipment

3.22.1 General

A general check of all the main switchgear and ancillary equipment shall be made and shall include a cheek of the completeness, correctness and condition of earth connections, labeling, arcing ring and horn gaps, clearances, painted surfaces, cables, wiring, pipe work, valves, blanking plates and all other auxiliary and ancillary items. Checks shall be made for oil and gas leaks and that the 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 e.g. blanking plates, tools, spares, are in order and are correctly stored.

The following general tests are to be carried out on electrical equipment after erection at site:-

Routine high voltage tests to the appropriate IEC standard. Where no relevant standard exists, tests shall be agreed with the Project Manager.

- Insulation resistance tests on all electrical equipment.
- Continuity and conductivity resistance tests.
- Test operation of alarm and tripping, devices to local and remote.
- Rotational tests on all motors.
- Polarity tests on CTs and VTs.
- Oil tests.
- Grounding system and electrode tests.
- Ratio, vector grouping and magnetizing current tests on each transformer.
- Calibration of winding and oil temperature devices.
- Vector group and phasing tests on VT circuits.
- Magnetization current/voltage tests, knee voltage, accuracy and winding resistance tests on all current transformers.
- Primary and secondary injection tests on relays, protection devices and equipment.

3.22.2 Transformers

The site tests, full details of which are to be submitted by the Contractor after the Contract has been placed, shall include those tests described in outline below.

(a) Insulation resistance of core and windings.
(b) Dielectric strength of oil samples.
(c) Ratio and no-load current at low voltage (e.g. 400 V) on all tappings.
(d) Vector notation check.
(e) Calibration check of temperature instruments, including secondary current injection and proving contact settings.
(f) Air injection tests of gas/oil-actuated relays.
(g) Setting check of oil-level and oil-flow devices.
(h) Complete functional tests of cooling equipment and tap-change equipment, including manual/automatic sequences, indications, alarms and interlocks, measurement of motor currents, adoption of suitable motor protection settings and proof of protection for stalled or single-phasing conditions.
(i) Operational tests of breathers.
(j) Insulation resistance of all secondary circuits.
(k) Carry out “footprint” tests to confirm that no damage to the windings has taken place during transit and installation.

(l) Final checks before energizing:-

Venting, position and locking of valves, earthing of star-point(s) and of tank, state of breathers and of pressure-relief devices, oil levels, absence of oil leakage, operation of kiosk heaters, tap-change counter readings, resetting of maximum temperature indicators, final proving of alarms and trips.

(m) Dissolved Gas Analysis of transformer oil after final processing

(n) Tests when energized:

On-load tap-changer operation throughout range (subject to not exceeding 1.1 pu volts on any windings).
Maintenance of 1.1 pu volts on untapped windings for 15 minutes (but not exceeding this value on tapped winding).

(o) Tests on load:
Temperature instrument readings
Measurement of WTI CT secondary currents
Repeat Dissolved Gas Analysis of transformer oil after energisation tests completed

(p) Oil:
Samples of oil from each consignment shall be tested in accordance with IEC 60296 before dispatch.

Subject to the agreement of the Project Manager a test certificate, confirming that the oil from which the consignment was drawn has been tested in accordance with IEC 60296, may be accepted. Before commissioning any transformer, the electric strength of its oil shall be check-tested and results approved by the Project Manager.

3.22.3 Circuit-Breakers

Circuit-breakers shall be given a visual inspection.

In the case of gas type circuit-breakers testing will be required on the gas system to prove the gas pressure, quantity, dryness and dielectric strength.

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.

Local air components associated with pneumatic operation, including air compressors, shall be tested and air loss measurements and pressure and alarm settings checked. Tests shall be made also on mechanical and hydraulic operation systems.

3.22.4 Disconnectors and Earth Switches

Manual operation of disconnectors and earth switches shall be subject to operational tests to confirm contact pressures, contact resistances, simultaneous operation of all phases and the ease of operation.

Motorised operation of disconnectors and earth switches shall be tested to prove the motor operation, including local and remote operation, and timing tests shall also be carried out. Motor protection shall be tested.

Checks shall be made on interlocks, local and remote indications and operation of auxiliary contacts.

Earth switches shall be tested to confirm the opening and closing sequences and checks shall be made on interlocks, indications and manual locking devices.

3.22.5 Busbars and Connections

Flexible busbars 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 stress to other equipment. If dynamometers are used to check the sags and tensions, they shall be checked both before and after use.

Rigid busbars and connections shall be tested to ensure that the busbars 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.

3.22.6 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 on precautions taken 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 test testing procedures.

The earth resistance shall be measured during the installation and on completion as follows:-

- of each earth rod after driving
- of the earth grid after completion and back-filling of the trenches
- of each group of earth rods or earth point after completion of the connection from the test link terminal.
- Of the completed installation without any connections outside the substation

The tests shall be carried out by a method and with equipment approved by theProject Manager. 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.

3.22.7 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 used.

The operation and resetting level (current and/or voltage) and timing of all relays shall be measured over an agreed range of settings for all relays.

Other relays shall be fully tested in accordance with the manufacturer's recommendations.

All DC elements of protection relays shall be tested for operation at 70% rated voltage.

All d/c 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:

- Establish that the equipment has not suffered damage during transit.Establish that the correct equipment has been supplied and installed.
- Confirm that the various items of equipment have been correctly interconnected.
- Confirm performance of schemes designed on the bases of calculation e.g. differential protection.
- To provide a set of figures for comparison 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 polar characteristic of all distance protections shall be recorded at a minimum of 30 degree intervals.

For circulating current protection employing high impedance voltage operated relays, the points of injection for relay voltage setting tests shall be across the relay and stabilizing resistance.

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 with all associated relays, setting resistors, and CT's connected.

(e) 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.

The stability of all differential schemes shall be checked by injection of primary current.

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 Project Manager.

Tests are to be carried out as follows:

- Local primary injection to establish the ratio and polarity of current transformers as a group, care being taken to prove the identity of current transformers of similar ratio.
- Overall primary injection to prove correct interconnection between current transformer groups and associated relays.
- 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 theProject Manager.

All tripping, control, alarm and interlocking circuits shall be functionally tested to prove satisfactory and full proof 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 burdens 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 not 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.

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.

The insulation to earth of the complete DC installation shall be tested.

Power Cables

Each completed circuit shall be tested for continuity and insulation resistance.

Current Transformers

A magnetization curve shall be obtained for each current transformer in order to:-

- Detect damage in transit or installation
- Prove that the correct cores have been wired out to the relevant terminals
- 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 also the transformers and connection leads, each item being recorded separately.
- The insulation resistance of all secondary circuits shall be measured at 1000 volt and recorded.

Primary current injection tests shall be conducted on all current transformers using adequate primary current to prove correct ratio, polarity and, for differential protection schemes, to prove the correct relative polarities of all current transformers of each scheme.

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 energizing each primary winding produces an output from only the correct phase secondary winding. The residual voltage of any open delta or broken delta winding shall be measured with rated primary voltage applied.

Control and Instrumentation Equipment

The following general tests shall be performed on control and instrumentation equipment at site:

- Insulation resistance testing of all circuits.
- Functional tests for all tripping, control, alarm and interlocking circuits.

The testing of all equipment in accordance with the manufacturer’s instructions or as advised by the Project Manager.

Transformers and Ancillary Equipment

The following tests shall be performed.

- Insulation resistance tests on bushings.
- Insulation resistance test at 500V between core and core clamping structure.
- Voltage withstand tests on insulation oil to BS 148.

- Ratio test.
- Phase relationship
- Magnetization characteristics of current transformers of winding temperature devices.
- Calibration of winding temperature devices.
- Tap Selector and Diverter Switch alignment.
- Calibration of automatic voltage control equipment.
- Proving tests as necessary on control schemes.
- Measurement of winding resistance on all taps and phases.

3.22.8 Inspection Plan and Procedures

3.22.9 Measuring and Testing Equipments

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 nationally recognized standards. Where no national standards exist, the basis employed for calibration shall be approved by the Project Manager.

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.

Each piece of equipment shall be labeled with its identification and current calibration status.

Calibration records for each piece of equipment shall be maintained at least for life of that piece of equipment and shall be available for examination by the Project Manager.

3.22.10 Re-inspection Following Non-Conformance

If a non-conformance report is issued as specified in this clause and the clause below, the Contractor shall reimburse the Project Manager for all costs incurred by its staff (including time costs, travel, accommodation etc.) for both attending discussions on remedial matters and any re-inspection that the incurred by its staff may deem to be necessary.

3.23 Plant Performance

3.23.1 Guarantees

Bidders shall state and guarantee the technical particulars listed in the Schedules of Technical Particulars and Guarantees. These guarantees and particulars shall be binding and shall not be deviated from without the written permission of the Project Manager.
The tolerances permitted in the IEC or other standard shall apply unless otherwise stated.

3.23.2 Rejection

If the guarantees are not met and/or if any items fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or during the maintenance period, the Project Manager may reject the item, or defective component thereof, whichever he considers necessary, and after adjustment or modification as directed by the Project Manager, the Contractor shall submit the item for further inspection and/or test. The repair procedure shall be to the Project Manager’s approval. In the event of a defect on any item being of

such a nature that the requirements of this Specification cannot be fulfilled by adjustment or modification, such item shall be replaced by the Contractor, at his own expense to the entire satisfaction of the Project Manager. Any item of plant repaired to an approved procedure shall not be accepted as a part of the Works as a permanent solution or replacement unless the Contractor guarantees in writing that the repaired plant or component shall have the same service life and efficiency as the component originally manufactured.

3.24 Manufacturer's Standard Tests

3.24.1 General

Where no specific test is specified then the various items of plant, materials and equipment shall be tested in accordance with the appropriate IEC standard. Where no appropriate standard is available, tests shall be carried out in accordance with the maker's standard practice, subject to the prior approval of the Project Manager. In all cases, works tests shall include electrical mechanical and hydraulic tests in addition to any tests called for by the Project Manager to ensure that the plant being supplied fulfills the requirements of the Specification.
If considered necessary by the Project Manager any multi-part assemblies shall be fully erected in the Works prior to packing and dispatch to Site.

All tests to be performed during manufacture, fabrication and inspection shall be agreed with the Project Manager prior to commencement of the work. The inspection schedule included in the Schedules of Miscellany shall be used for this purpose. The Contractor shall prepare the details of the schedule and submit these to the Project Manager for approval.
It must be ensured that adequate relevant information on the design, code/standard employed, the manufacture/fabrication/assembly procedure and the attendant quality control steps proposed are made available to the Project Manager. The Project Manager will mark in the appropriate spaces his intention to attend or waive the invited tests, or inspections.

A minimum of 14 days notice in writing, of the readiness of plant for test or inspection shall be provided to the Project Manager by the Contractor in accordance with the following:

The Contractor shall submit to the Project Manager sequentially numbered applications for inspection which shall contain the following information.

- Contract number
- Contract title
- Contractors Name
- Inspection application number
- Manufacturers name, address, telephone and telex numbers, plus name of manufacturers staff responsible for the testing and manufacturer's works order number.
- Location of tests
- Date of tests
- Description in full of Plant offered for inspection (Contractors order references alone are insufficient and unacceptable)
- Section of the Works for which Plant is allocated.
- Schedule of tests to be performed and standard to be applied.
- List of the Employer's approved drawing numbers appropriate to the Plant offered
- Sub-order number

The subject items should remain available for the Project Manager inspection and test up to a minimum of 10 days beyond the agreed date of witnessing the test.

Every facility in respect of access, drawings, instruments, and manpower shall be provided by the Contractor and his Sub-contractor to enable the Project Manager or his designated representative to carry out the necessary inspection and testing of the plant.

No equipment shall be packed, prepared for shipment, or dismantled for the purpose of packing for shipment, unless it has been satisfactorily inspected, and approved for shipment, or alternatively inspection has been waived. The Contractor shall request permission to dispatch in writing.

Functional electrical, mechanical and hydraulic tests shall be carried out on the completed plant after assembly in the works. The extent of these tests and method of recording the results shall be submitted to, and agreed by, the Project Manager in sufficient time to enable the tests to be satisfactorily witnessed, or if necessary for any changes required to the proposed programme of tests to be agreed.

All instruments and apparatus used in the performance of the tests shall be to the approval of the Project Manager, and, if required by the Project Manager, shall be calibrated to an agreed standard at the National Physical Laboratories or equivalent centre and approved by the Project Manager.

The cost of carrying out such calibrations shall be borne by the Contractor in all cases.

The Project Manager reserves the right to visit the Contractor's works at any reasonable time during manufacture of the items of plant and to familiarize him with the progress made and the quality of the work to date.

3.24.2 Test Certificates

Within 30 days of the completion of any test, four sets of all principal test records, test certificates and correction and performance curves for the plant and its component parts shall be supplied to the Project Manager.

These test records, certificates and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Project Manager or his Representative. The information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificate refers and should also bear the contract reference title. It shall be possible to identify the item of plant to which a specific test certificate refers, including those of sub-components and the specific site for which the item is allocated.

Contractors order numbers or drawing reference numbers are not sufficient for this purpose without a description of the plant involved.

Test certificate shall provide full details of the measurements of their tolerances, and actual test values obtained. Certificates simply stating phrases such as 'Passed' or 'Tested in accordance with' are not acceptable.

When all equipment has been tested, the test certificates from all works and site tests shall be compiled by the Contractor into volumes and bound in an approved form, complete with index and included in the appropriate operation and maintenance manuals.

B. CIVIL

4.0 TECHNICAL REQUIREMENTS FOR SUBSTATION CIVIL AND BUILDING WORKS

TABLE OF CONTENTS

Clause No.	Description
4.1	Introduction
4.2	Design and Construction Standards
4.3	Units of Measurement
4.4	New 33/11 kV 10MVA or 20MVA Sub Stations
4.5	Site Analysis and Topographical Survey
4.6	Subsoil Investigations
4.7	Laboratory Testing
4.8	Bulk Earthworks
4.9	Building Foundations
4.10	Civil Work
4.11	Design and Construction Requirements and Interchangeability
4.11.1	General Requirements
4.11.2	Specific Requirements
4.12	Plant and Equipment Identification
4.12.1	Identification on Drawings
4.12.2	Labels and Nameplates
4.13	Safety and Security
4.13.1	Interlocks
4.13.2	Locks, Padlocks, and Key Cabinets
4.14	Commissioning Spares
4.15	Consumable Items
4.15.1	Chemicals and other Consumable
4.16	Painting and Cleaning
4.17	Galvanized Work
4.18	Steel Pipe Work
4.19	Bolts, Studs, Nuts and Washers
4.20	Architectural and Structural Requirements of Buildings
4.20.1	Architectural Planning and Design
4.20.2	Structural Design
4.21	Utility Services
4.22	Fire Detection and Protection Facilities
4.23	Grid Substation Sending End Bays for New Substations
4.24	Preparation of the Site
4.25	Temporary Buildings on Site
4.26	Access to the Site
4.27	Site Drainage
4.28	Site Maintenance during Construction

4.1 Introduction

This contract is being tendered as a turnkey contract, in which the selected contractor will be responsible for carrying out all civil works designs, including preparing working drawings and specifying materials to be used in all temporary and permanent works. This section describes the General Technical Requirements for all civil works, which include earthworks, the construction of foundations, structures, architectural features and all associated works required for REB 33/11 KV Indoor Rural Type Substations, fitting out structures, buildings and associated works, and erecting, installing and commissioning of all Substation plant. This section shall be read in conjunction with the Project Requirements, Schedules and Drawings.

The Contractor shall appoint a team of qualified and experienced engineers and other specialists to undertake the detailed design of all civil and associated works, and shall submit all completed designs, drawings and supporting calculations to the Project Manager for approval before site work commences.

4.2 Design and Construction Standards

The design and construction shall conform to the latest edition of the relevant codes of practice and standards listed below and in individual clauses in this document relating to specific materials or practice. Any proposed substitution for the listed standards by an equivalent standard shall be subject to approval by the Employer.

AASHTO	American Association of State Highway and Transportation codes for site access road design
ACI 318-89	Building Code Requirements for Reinforced Concrete
ASTM	American Society for Testing and Materials
BNBC	(Bangladesh National Building Code) with requirements for building works
BS 12	Portland Cement
BS EN 124	Gully and Manhole Tops for Vehicular and Pedestrian Areas
BS 812	Testing Aggregates
BS 882	Aggregates from Natural Sources for Concrete
BS 1387	Specification for Screwed and Socketed Steel Tubes
BS EN ISO 1461	Hot Dip Galvanized Coatings on Fabricated Iron and Steel Articles
BS 1881	Testing Concrete
BS EN 1992-1-1	Design of Concrete Structures (includes foundations)
BS EN 1997-1	Geotechnical Design
BS 2853	Design and Testing of Overhead Runway Beams
BS 3148	Methods of Testing for Water for Making Concrete
BS 3921	Clay bricks
BS 4449	Steel Bars for the Reinforcement of Concrete
BS 5262	External Renderings
BS 5395	Stairs, Ladders and Walkways
BS 5572	Sanitary Pipe Works
BS 5628	Code of Practice for use of Masonry
BS 5930	Code of Practice for Site Investigations
BS 6031	Code of Practice for Earthworks
BS 6367	Code of Practice for Drainage of Roofs and Paved Areas
BS 6399: Part1	Code of Practice for Dead and Imposed Loads
BS 6399: Part 2	Code of Practice for Wind Loads
BS 6465	Sanitary Installations
BS 6651	Code of Practice for Protection of Structures against Lightning
BS 6700	Design, Installation, Testing and Maintenance of Services Supplying Water for Domestic Use
BS 8004	Code of Practice for Foundations
BS 8005	Sewerage
BS 8100	Lattice Towers and Masts
BS 8102	Code of Practice for Protection of Structures Against Water
BS 8110	Structural Use of Concrete
BS 8206-2	Lighting for Buildings
BS 8215	Code of Practice for Design and Installation of Damp-proof Courses in Masonry
BS 8290	Suspended Ceilings
BS 8301	Code of Practice for Building Drainage

4.3 Units of Measurement

All designs and measurements in this Contract shall be provided in the International System of Units (SI) in accordance with the provisions of ISO 31 and ISO 1000.

4.4 New 33/11 kV 10 MVA or 20 MVA Sub Stations

Two storied buildings will be designed and constructed to establish a 33/11.55 kV, 10 MVA or 20 MVA Substations, with associated work including control room, complaint room, service road, fencing work, landscaping and beautification work and other related works.

The Contactor shall be responsible for the design and construction of the Substation and associated work, which will include the following:

- Topographical survey as part of site analysis
- Subsoil investigation, sampling and laboratory testing
- Master plan including services road, landscaping (beautification work) as per respective site condition
- Conceptual alternative studies of site plans shall be undertaken for individual sites, study and architectural planning of individual units. The site plan shall consider the building and other facilities/utilities like circulation roads, parking, utility networks, landscaping and boundaries.
- Foundation works
- Architectural plan, section, all side elevation including 3-D perspective of the building.
- Structural design as per present code of practices in Bangladesh (BNBC), detail drawings for construction works.
- All required temporary works.
- Earth works requirements as per site condition.
- Time schedule/work programme, BOQ including rates and all other document, Maintenance and Operation Manual as required for the process.

4.5 Site Analysis and Topographical Survey

The proposed substation sites are located as per drawing locations of Bangladesh. They are mainly in low lying areas and predominantly paddy land. The Contractor shall carry out a topographical survey of all substation sites prior to design work commencing, using the most modern survey equipment available in the country. The Contractor shall first establish a benchmark on or immediately adjacent to each site on a permanent structure, and establish its level relative to the nearest PWD benchmark. Detailed digital plans of each site shall be prepared using AutoCAD at a scale agreed by the Project Manager showing all existing physical features and other information as listed below and, to the extent necessary, the survey shall extend beyond the site boundaries to capture adjacent information:

(a) contours at intervals agreed by the Project Manager, extending into the immediate surroundings of the site;
(b) boundary line of the site;
(c) above ground physical features such as roads, including the nearest National or other main road, tracks, structures, utilities and plantations;
(d) the location of below ground utilities including piped water supply, gas, drainage, sewerage and tube wells;
(e) the highest flood level (HFL) at the site and its surrounding areas, related to the benchmark;
(f) the nearest points at which connections could be made to existing water, electricity and gas supplies, if available

4.6 Subsoil Investigations

Any previous soil test reports, if available, for each sub-station site will be provided by the Employer. However, the Contractor shall be fully responsible for all foundation design and must conduct his own subsoil investigations at every site, the main purpose of which is to determine, within practical limits, the stratification, ground water table and engineering properties of the soils underlying the sites of the proposed buildings. The principal properties of interest shall be the strength, bearing capacity and settlement characteristics of the underlying soils. Efficient, safe, economical design and construction can be achieved only through adequate evaluation of soil conditions of the proposed construction.

The Contractor may appoint a sub-contractor (if required) to carry out the site investigations but all work and all lab work shall be witnessed by one of his own staff who shall countersign all recorded data.
The record of all boring shall include but not limited to the following information:

(a) Size of the casing (if used)

(b) Number of blows per 300mm required to drive the sampling spoon and data should be recorded every 1.5 m intervals.

(c) The elevation of the ground surface referred to an established datum

(d) Location and depth of boring and its relation to the proposed construction

(e) Elevation at which samples are taken

(f) Elevation of the boundaries of soil strata

(g) Description of soil strata encountered and any particular unusual or special condition such as loss of water in the earth and rock strata, boulders, cavities and obstructions, use of

special type of samplers, traps etc.

(h) The level of ground water together with a description of how and when ground water level was observed

A minimum of five boreholes or augurs shall be drilled at each Substation site and if the results vary across the site, the Project Manager shall determine whether and how many additional boreholes shall be drilled.

4.7 Laboratory Testing

The following soil tests shall be performed in a laboratory approved by the Project Manager for evaluation of soil parameters:

(a) Grain size analysis

(b) Specific gravity

(c) Unit weight (wet & dry)

(d) Natural moisture content

(e) Unconfined compression strength

(f) Direct shear

(g) Consolidation test

The Contractor's Soil Investigation Reports for each site shall propose full details of foundations and loading thereon and shall provide estimates of total settlements and differential settlements of the underlying soil deposits and substantiate the recommendations regarding type of foundation. The site investigations and analysis of the data in the Reports shall contain but not be limited to the following:

(a) Location of ground water level

(b) Bearing capacity of the soil

(c) Comparison of alternative types and/or depths of foundation

(d) Data on soil parameters and properties

(e) Settlement predictions

(f) Risks if any to property adjacent to the site.

(g) End bearing value and skin friction for pile design

4.8 Bulk Earthworks

The existing level of all sites are below the HFL, in some cases by up to 5 m, and filling is required to raise the site level above HFL. The raised ground level of all sites shall be either 600 mm above the HFL or equal to the level of the nearest main road to the site, whichever is the higher, and also determined such that water shall not drain from the approach road or main road to the site. It is the Contractor's responsibility to determine the fill height required from the topographical survey data in accordance with the above criteria.

Slope protection works shall also be designed and carried out. This protection should be mainly by the construction of reinforced concrete retaining walls, pre-cast concrete piles or seasoned wooden piles, which shall be dependent on the height of filling required as well as existing sub-soil. The

Contractor may select and design the type of retaining wall considering the Soil Investigation Reports and the following:

(a) RCC retaining wall shall be selected where the filling height is above 3.0 m. The foundation of the wall shall be dependent on the sub soil report.

(b) Pre-cast pile shall be considered where the filling height between 2.0 m to 3.0 m. The spacing of the pile shall depend on the filling height and size of pile. A rectangular RCC pre-cast slab of size 1.0 m × 0.5 m shall be used and is to be fixed with the pile by proper bolting to retain the soil.

(c) Seasoned wooden pile shall be considered where the filling height is below 2.0 m. A metal sheet with proper treatment shall be fixed with the pile by proper bolting to retain the soil. The spacing of the pile depends on the filling height and diameter of pile

The fill materials shall be deposited and spread in successive uniform horizontal layers of about 150rnrn thick and compacted by use of mechanical 1.5 ton "Vibro" compactor or other approved devices to a 98% standard dry density in road and pavement sub-base and 95% standard dry density for other areas. In filling /back filling against a newly constructed structure precaution must be taken so that the structure is well matured to take the thrust of filling and when filling against a wall, the filling shall be carried out from both sides simultaneously.

Tests shall be carried out at a recognized laboratory to ascertain the nature of the fill material and the degree of compaction obtained for the filled material for which samples shall be taken and transported to the recognized laboratory by the Contractor at his cost and as directed by theProject Manager.

4.9 Building Foundations

The type of foundations required will be selected and designed by the Contractor based on the results of the subsoil investigation and testing program at each new Substation site. The foundations may be either shallow (spread footings or mat) foundations or deep (pile) foundations according to subsoil conditions. The Contractor shall submit his foundation design with full supporting calculation for the approval of the Project Manager. Design shall be according to BS EN 1992-1-1 and BS EN 1997-1. If deep piles are required, the submission shall include full details of the type of pile (bored or driven) and the proposed construction sequence.

4.10 Civil Work

Each Substation shall be designed with a two storied control room building (with a foundation suitable for three stories) with an approximate floor area of 140 sq. m. per story.

- Ground Floor (Ceiling Height 3 m): Complaint Centre, Office Room, Rest Room and Toilet (02 Nos.).
- First Floor (Ceiling Height 3 – 3.7 m): 33 kV & 11 kV Switchgear, Control Room, Battery Room, Toilet (01 No.).
- Stair with four flights (run width = 25 cm, riser height = 15 cm and railing with SS/MS angle).
- Great beam height of control room building to be 60 cm above finished ground level.
- The outside wall of the control room building shall be covered with Ceramic Bricks and the floor of the control room shall be Mosaic finishing.

- One no. opening with shutter (20 cm wide and full first floor height) at the outer wall of the first floor of the control room building at a suitable position as per instruction of the Project Manager (for materials to be carried on the first floor or carried out from the first floor).
- Oil Containment bund walls – for oil drain out one tank to be provided along/beside the transformer pad.
- Cable Trench, Duct and Sump Pits: Cable Trench depth should be provided above flood level of that area i.e. we should be able to avoid water logging in the cable trench.
- RCC Retaining wall along the property line and matching main and personnel gates: RCC Retaining wall to be constructed along the property line of Substation area including matching main and personal gates. Structure and foundations for line landing gantries, plant and equipment. All foundations (including future provisional equipment foundations), ducts/ drainage, fencing and gates.
- 33/11 kV Transformer Foundation: Solid power transformer foundation may be considered in that case rail provision to be provided above x-former pad.
- FGL of substation yard should be 60 cm above the highest flood level.
- Substation yard surface finishing should be with 25 – 30 mm washed stone gravelling of 7-10 cm depth.
- Construction of internal roads (as required).
- Substation yard surface finishing should be with 1" – 1.25" washed stone gravelling of 4" depth.
- Supply and installation of Air Conditioning System for Control Room including all other accessories/ components required for fitting & fixing up to commissioning.
- Supply and installation of submersible water pump motor set for safe drinking water including borehole drilling, pipes and all other accessories/ components required for fitting & fixing up to commissioning.
- All necessary furniture for the Control Room.
- Supply and installation of security lights.
- Material test results used in construction works.

4.11 Design and Construction Requirements and Interchangeability

4.11.1 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 violation from the Specification shall be made subsequent to the Contract without the written approval of the Project Manager.

Each of the several parts of the Plant to be provided shall be of the manufacturer's standard design, provided that this design shall be in accordance with an international code of practice and generally in accordance with this Specification.

The design, dimensions and materials of all parts shall be such that they shall 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 performing 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.

4.11.2 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 in the existing Substation.

(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 and loads.

(c) The plant and installation shall be designed for a minimum service life of 25 years.

(d) All plant is to have a minimum of 2 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 shall be provided by the Contractor if requested by the Project Manager.

Each sub-station is to be designed such that the failure or removal of any one item of plant for maintenance or repair shall not damage or hamper the operational integrity of the sub-station. The design and layout of the sub-stations shall ensure the safety of personnel concerned with the operation and maintenance of the plant.

4.12 Plant and Equipment Identification

4.12.1 Identification on Drawings

The Contractor shall prepare comprehensive plant and equipment Identification Schedules. Each item in the Schedules shall include the drawing number of the related flow sheet, diagram or drawing showing that item.

4.12.2 Labels and Nameplates

The Contractor shall supply and install labels, nameplates, ratings, instructions and warning plates, necessary for the identification and safe operation of plant and equipment at Substations.

Nameplates and labels shall be non-hygroscopic material with engraved lettering of a contrasting colour or, alternatively in the case of indoor circuit-breakers and starters, of plastic material with suitably coloured lettering engraved thereon.

All nameplates and labels 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 shall not be permitted.

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.

The Contractor shall be responsible for the relocation, or replacement of all labels on existing plant, which becomes inaccurate as a consequence of the contract works.

The language of labels, plates and notices shall comply with the requirements of the Contract.

4.13 Safety and Security

4.13.1 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:

(a) Safety of personnel engaged on operational and maintenance work on the plant.

(b) Correct sequence of operation of the plant during starting up and shutting down periods.

(c) Safety of the plant when operating under normal or emergency conditions.

(d) 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 designing all interlocking schemes and presenting them for the Project Manager's approval. General descriptions of interlocking requirements are given in the Specifications but the Contractor shall include for any other interlocks he considers necessary.

4.13.2 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 Project Manager.

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 Project Manager for groups of equipment. All locks shall have individual high integrity locks and shall be provided with three (3) keys. Each key shall be provided with a label as specified.

The Contractor shall 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 shall 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.

4.14 Commissioning Spares

In addition to the spare parts being provided to the Employer, the Contractor is responsible for ensuring that he has access to a stock of commissioning spares. Spares provided to the Employer are not to be utilized as commissioning spares without written approval of the Project Manager, in which case the Contractor shall immediately replace the contract spares at his own expense.

All commissioning spares are considered as Contractors equipment.

4.15 Consumable Items

4.15.1 Chemicals and other Consumable

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.

4.16 Painting and Cleaning

Immediately following signing of the contract, the Contractor shall submit the names of the proposed paint supplier and applicator together with a quality assurance program for approval. All paints for a contract shall be provided by one manufacturer and preferably shall be manufactured in one country to ensure compatibility.

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 Project Manager.

The schedules 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 that 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 Project Manager will 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 does 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 completed, 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 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 planished and bright parts shall be coated with grease, oil or other approved rust preventive before dispatch 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 40° C) or above 90% relative humidity or during rain or fog, or when the surfaces are less than 30° C above dew point, except to the approval of the Project Manager 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 Project Manager 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 Project Manager.

On sheltered or unventilated horizontal surfaces on which dew may linger more protection is needed and to achieve this 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 Project Manager and the painting is finished at site to the Project Manager'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, sherardized 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 national standards.

4.17 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 form 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 EN ISO 1461or equivalent National standard. Structural steel items shall initially grit blasted to BS 4232, second quality (SA2.5). The minimum average coating weight on steel sections 5 mm thick and over shall be as specified in BS EN ISO 1461.

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 provided adequate ventilation to all surfaces to avoid wet storage staining (with rust).

Small areas of the galvanized coating damaged in any way shall be brought to the attention of the Project Manager who shall authorize repair by cleaning the area of any weld slug and though wire brushing to give a clean surface, and application of two coats of zinc rich paint or the application of low melting point zinc alloy repair rod or power to the damage area, which is heated to 300^0C.

After fixing, bolt heads, washes and nuts shall receive two coats zinc rich paint.

4.18 Steel Pipe Work

All steel piping shall be designed, manufactured and tested in accordance with British Standards or equivalent Nationals Standards approved by the Project Manager. In particular, the minimum wall thickness of steel pipe work shall comply with Table 2 of BS 1387.

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 Project Manager.

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.

4.19 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 shall be used.

4.20 Architectural and Structural Requirements of Buildings

4.20.1 Architectural Planning and Design

All new buildings and extension to existing buildings shall be designed to be architecturally pleasing in appearances to the satisfaction of the Employer and to withstand the tropical climate with minimal maintenance.

Architectural plan and elevations of all sides of buildings shall be agreed with the Project Manager before other details are finalized. All external walls shall be 230 mm first class brick work plus a 50 mm thick layer of Mirpur ceramics facing bricks or similar approved for 10 MVA new sub-station building as required by the architectural drawing. The internal walls shall be 105 mm thick first class brick work with plastered and painting of an approved color. For the 5 MVA substations building internal walls shall plastered with paint finishing.

Bath room floors, walls and stairs shall be tiled. A fixed ladder of galvanized steel shall be provided up to the roof considering the future provision. Window frames shall be aluminum with MS grill. Doors shall be wooden and water proofed. A rolling shutter door with a ramp shall be provided for 10 MVA Substation buildings.

The main entrance to all buildings shall be shaded, either by a projection of the roof over the entrance verandah or by a separate roof at a lower level. This area of roof shall also be lime terraced and drained by rainwater pipes.

The service facilities like electricity, water supply and sanitary works, sewerage, gas connection (if possible) etc. shall be provided as per requirements. Best quality fitting and fixture made in Bangladesh shall be provided in bathroom in kitchen room. Electrical fittings and fixtures shall be best quality and wiring provided in Substation buildings shall be internal. Samples shall be shown to and approved by the Project Manager.

4.20.2 Structural Design

Structural design of Substation buildings shall be according to the Bangladesh National Building Code (BNBC). Loads for reinforce concrete design shall be calculated as the sum of dead loads, live loads and environmental loads (wind and seismic) as explained in the BNBC. Ultimate Strength Design (USD) method (BNBC Chapter 6) shall be adopted for design of all reinforce concrete structural elements.

The roof shall be a cast in situ concrete slab designed for 2.5 kN/m^2 live load. The ground floor slab shall be cast as per cable trench layout which shall be considered as slab on grade (RBC floor).

4.21 Utility Services

Utilities shall be designed and installed comprising:

(a) Plumbing system including wastewater and surface water drainage system development including septic tank, soak well, and surface or buried drain.

(b) Water supply and sanitary work.

(c) Electrical works includes internal wiring, fitting, fixing all necessary items, internal lighting, street lighting, necessary earthing.

(d) Telephone if needed.

4.22 Fire Detection and Protection Facilities

The Contractor shall design, manufacture, deliver to the Site, install, test and commission the firefighting system to protect each Substation, all plant associated equipment and outdoor yard. In particular, the following shall be included:

(a) Fire Detection and Alarm system: fire detection shall be by means of smoke detectors and ultra violet flame detectors with a backup system utilizing rate-of-rise temperature detectors, along with an alarm system.

(b) Balancing, testing and commissioning of fire detection and alarm system for 16 zone.

(c) Dry chemical powder and carbon dioxide type fire extinguishers.

(d) Five wall mounted sand buckets outside the control room building at suitable place locations

A reinforced concrete fire wall is required between two transformers in future provision for 10 MVA substations. The wall size shall depend on the transformer size. The Contractor shall prepare proposed designs for approval of the Project Manager.

4.23 Grid Substation Sending End Bays for New Substations

Some of the new Substations shall have direct connections from grid substations. Bays and busbar must be available for facilitating this connection. Where existing bay and busbar space is not available, new bays shall have to be designed and constructed and the existing busbar extended.

The Contractor shall be responsible for designing and constructing the grid substation foundation for 33KV circuit breaker, CT, gantry extension to construct new feeder bays and bays extension including earth grid where required including installing bay equipment and associated works. The design and drawings shall be submitted for the Project Manager's approval before any work commences at site.

4.24 Preparation of the Site

Boundary pillars of standard designs shall be fixed on the ground to define the boundary of the site.

Refuse or superfluous earthon the site shall be removed before construction begins. Shrubs and stumps of treesshall be uprooted and removed off site. Any valuable material derived from the clearing of the site should be stored and disposed of according to the BNBC.

No tree shall be cut down or pruned unless prior approval is given by the Project Manager. A survey report must be submitted and sanctions obtained before the trees are disposed of. If white ants are found to exist in the trees, their nests shall be located and dug up and the queen ant be destroyed. Holes left after uprooting of the trees shall be backfilled with sand or earth, care being taken that the fill, on compaction, achieves the density of the surrounding soil.

The Contractor's Engineer himself shall set out all important levels for permanent works using the site benchmark established during the topographical survey. Areas for storage and stacking of materials should be set out and pegged, similarly the position of temporary buildings, the access road and site roads.

The Contractor shall not fell any tree outside the site boundary without the express written permission of the land possessor, even if such tree is an obstacle to execution of the work.

4.25 Temporary Buildings on Site

Locations of temporary offices, guard sheds, work sheds and accommodation on each site shall be selected such that they do not clash with the location of permanent work and do not interfere with

construction work. Prefabricated buildings that are simple to erect and dismantle, yet provide a pleasing look, are preferred.

4.26 Access to the Site

The access road to each site shall generally be of the shortest possible length from the nearest main road. While designing the road alignment, the Contractor shall maximize natural slopes as much as possible for drainage of rainwater and the facilities shall be secured effectively and economically. The design and drawings shall be prepared by the Contractor to current practices AASHTO codes of practice.

4.27 Site Drainage

The entire surface of each Substation site within its boundary walls shall slope at 1 in 150 minimum gradient to open channels around the entire perimeter. These channels shall be designed for a rainfall intensity of 60 mm per hour. Outside the boundary wall, the Contractor shall be responsible for drainage up to 20 meters, or to suit each sites requirements, from the wall and the drainage outlets at some sites may be need to be provided with suitable erosion protection down to paddy level.

The ground immediately adjacent to foundations shall be sloped away from them at a slope of not less than 1:12 for a minimum distance of 205 m measured perpendicular to the toe of the wall. Consideration shall be given to possible additional settlement of backfill when establishing the final ground level adjacent to foundation.

A 75 mm layer of crushed rock (average size 30 mm) shall be placed across the entire site, extending 1 m outside the fence.

The concrete wall of cable trenches shall project at least 70 mm above brick paving level to prevent run off entering the cable trench. The floors of all cable trenches or tunnels shall be sloped to soak aways.

The cable trenches shall be free from surface water drainage. If the cutoff area exceeds 30 m^2 it shall be drained by a concrete pipe sized to take the runoff to the boundary drain. The Contractor's drainage design shall avoid all ponded water to avoid forming a mosquito breeding ground.

All drainage pipe work except cable trenches within buildings shall be UPVC pipe of diameter as per design requirement. But cable trenches are RCC work as per design requirements.

The floor slab shall be constructed in reinforced brick concrete (RBC) floor125 mm thick and foundations for controlling equipment in RCC.

External pipe work shall be 150 mm minimum diameter concrete pipes at a minimum depth of invert of 600 mm. Where pipes, including existing pipes along with site, are less than 400 mm above adjacent foundations, they shall be surrounded in concrete. Where required, drainage pipes shall be kept below cables, allowing 1.1 m cover to the top of pipes.

Manholes shall be of brick construction with 500mm x 500mm clear openings and air tight ductile iron covers to BS EN 124. Manholes shall be located at all changes of pipeline direction. The minimum gradient for all pipelines shall be 1 in 80. Manholes shall not be located in roads.

The Contractor shall be responsible for all negotiations with local authority (WASA) where a connection to a public sewer is proposed. The Contractor shall provide all protection required to

existing sewers and shall deepen foundations, including boundary wall foundations, where required all foundations are below adjacent sewers.

Each control building shall be provided with a septic tank designed for 10 users and a soakaway of open brick construction 11 m deep by 2.2 m diameter filled with broken bricks. The septic tank shall be located at suitable place of the area. The inner surface of all manholes and septic tanks shall be painted with two coats of bitumastic paint to protect it against sulphate attack. The septic tank shall have access holes directly over the inlet pipes and outlet pipes. Where public sewers exist along the side of substation site, the Contractor shall connect directly to the sewerage line from the soakaway. Two vents of minimum height 2.2 m shall be provided on each septic tank.

4.28 Site Maintenance during Construction

a) The site shall be kept as clean as reasonably possible during construction. Materials shall not be stacked haphazardly but kept in a planned manner in proper stacks. Care shall be taken to maintain the site with proper drainage of rain and stagnant water.

b) The proposed roads should be laid out and used for carriage of materials to avoid vehicles travelling randomly over the site and spoiling it. The base of the road may also be laid and maintained during construction.

c) Any rejected materials, dismantled materials and other items not required in the construction shall be removed from the site immediately, so that there is no chance of it being used by the Contractor’s labour.

B. CIVIL

5.0 SUBSTATION BUILDINGS AND ANCILLARY FACILITIES

TABLE OF CONTENTS

Clause No.	Description
5.1	Civil Works-General
5.2	Mobilization and Preparation of the Site
5.3	352Dismantling & Removal of Existing Structures for Rehabilitation Sites
5.4	353 Site Office Facilities for the Engineer
5.5	354 Earth Work in Excavation For Structure
5.6	354 Brick Flat Soling (BFS)
5.7	355 Lean Cement Concrete (CC) Works
5.8	355 Cement Concrete In Floor
5.9	356 Damp Proof Course
5.10	356 Reinforced Cement Concrete Work (RCC)
5.11	356 RCC with Water Proofing Admixture
5.12	365 Reinforcing Steel In Concrete
5.13	365 Brick Work
5.14	368 Patent Stone Flooring
5.15	369 Ceramic Tiles
5.16	370 Plaster Work
5.17	371 Neat-Cement (Skirting/Dado)
5.18	372 Making Groove On Wall Surface
5.19	373 Painting Works
5.20	374 Timber Works
5.21	376 Metal Works
5.22	378 Aluminum Doors, Windows etc.
5.23	379 Water Proofing Polythene Sheet
5.24	382 Lime Terracing on Roof
5.25	382 Screeding on Roof
5.26	383 Surface Drain
5.27	383 Apron
5.28	383 Road Work
5.29	384 Clearing after Completion
5.30	387 As Built Drawings
5.31	Tests for Materials

5.1 Civil Works-General

This specification has been prepared with all possible care and diligence and every effort has been made to cover all types of materials and items of works necessary to complete the Project in all respect.

All workmanship and materials to be used in the Works shall be of the best quality of their respective kinds as specified herein. All materials used in the Works shall be new and obtained from the sources and suppliers approved by the Project Manager. Materials shall comply strictly with the requirements prescribed hereinafter or, where such requirements are not specified in this specification, the latest issues of the relevant Technical Standard shall be followed. All tests of materials shall be done by laboratory approved by the Project Manager. The accuracy and sufficiency of information furnished in this specification is not guaranteed. It is the responsibility of the Contractor to clear any confusion or ambiguity in this specification well ahead of submission of bid. In case of any missing item relevant standard specification shall be followed.

5.1.1 Materials

5.1.1.1 Cement

Cement shall be Ordinary Portland Cement conforming to the requirements of the Standard Specifications for Portland Cement Type -I, ASTM C-150 or BDS 232 (2nd Revision) unless otherwise specified.

Cement shall conform to the following standards as per BDS 232 (2nd Revision) and ASTM C109, C191, C204.

a) Water for normal consistency	:	26% to 33%
b) Fineness	:	Minimum 280 sq. m./kg (by air permeability method)
i) Initial setting time, ASTM C191	:	Not less than 45 min.
ii) Final setting time, ASTM C191	:	Not less than 375 min.
c) Minimum compressive strength		
i) 3rd. day	:	9.45 Mpa (1350 psi)
ii) 7th day	:	14.7 Mpa (2100 psi)
iii) 28th day	:	21.0 Mpa (3000 psi)

Cement shall be delivered in packages as packed by the Manufacturer with the brand name, type of cement and weight of each bag marked on the bag. Sample test of cement must be done by laboratory approved by the Project Manager: Two bags from each brand or each consignment of supply of 25 metric tons of cement shall be selected for testing. The Project Manager require the Contractor to have the cement tested or can take samples in the presence of Contractor from cement bags stored at work site and send them to an approved laboratory for testing.

Cement of doubtful quality shall not be used until satisfactory results are obtained. All cement not conforming to specifications and cement that has deteriorated, been damaged or has set shall not be used and shall be immediately removed from work site by the Contractor. The cost of all such cement shall be borne by the Contractor.

5.1.1.2 Brick

Common building clay bricks shall conform to BDS 208 (First Revision).

Bricks shall be manufactured from combination of clay mixed with silica sand and alumina and shall be uniformly burnt throughout. Bricks shall be kiln burnt.

First Class Bricks

First Class Bricks shall comply with the following requirements of BDS 208 (Common Building Clay Bricks –First Revision)

a) Bricks shall be of machine mould, uniform colour, shape and size having sharp square sides and edges and paralleled faces.
b) Bricks shall be sound, hard and well burnt homogeneous in texture and free from flaws and cracks.
c) Bricks shall emit a clear metallic sound when struck with a small hammer or another brick. A fractured surface shall show a uniform compact structure free from lumps, grits or holes.
d) A first class brick shall not absorb more than $1/5^{th}$ of its dry weight when immersed in water for 24hours.
e) A first class brick shall not break when struck against another brick or when dropped at T-position on hard ground from a height of about 1.2 meter.
f) Standard dimension of bricks shall be 240 x 115 x 70mm (9.5" x 4.5" x 2 .75")
g) Allowable variations in dimensions shall be:
    i) in length not more than 6 mm
    ii) in breadth not more than 5 mm
    iii) in height not more than 1.5 mm
h). Unit weight of bricks shall be minimum 1100 kg/cum
    i) Minimum compressive strength of bricks shall be for
    i) Halved bricks (mean of 12 bricks): 28 Mpa (4000 psi)
    ii) Individual brick: 21.1 Mpa (3000 psi)
j). Range of efflorescence for a first class brick shall be slight to nil.

Picked Jhama Bricks

Picked Jhama-Bricks shall be over-burnt First Class Bricks, uniformly vitrified throughout with good shape, hard slightly black in colour, and without cracks or spongy areas. Minimum compressive strength shall not be less than 28 N/mm2 (4000 psi)

All other requirements for First Class Bricks shall apply to Picked Jhama except for dimensions.

Perforated Bricks

Perforated bricks shall meet the following specifications:

a)	Minimum unit weight	:	3.00 kg/brick
b)	Minimum compressive strength on gross area:		
	i) Multi-core brick	:	70kg/sq.cm
	ii) 10-Hole engineering brick	:	210kg/sq.cm
	iii) Maximum size of perforation	:	25sq.mm
c)	Minimum number of perforation		
	i) Along width of brick	:	2

	ii) Along length of brick	:	6
d)	Minimum wall thickness:		
	i) Between brick edge and perforation	:	10mm
	ii) Between adjacent perforations	:	10mm
e)	Maximum water absorption		
	i) 5hrs, boiling	:	20% of dry wt.
	ii) Efflorescence	:	Nil

Dimensions (3mm) 24cm × 11cm × 7cm (9.5"× 4.5"× 2.75")

The perforations may be of any regular shape in cross section, In case of rectangular section the larger dimension shall be parallel to length of the brick. Dimension of perforation measured parallel to the plane of the shorter side shall not be more than 15cm except in case of circular shape of the perforation in which case it may be allowed up to 20 cm. Total area of perforation shall not exceed 45% of the total area of corresponding face of the brick.

Clinker Bricks

Clinker bricks or tiles shall meet the following requirement:

Minimum unit weight	:	2 kg/brick
Minimum compressive strength	:	560 kg/sq.cm (8000psi)
Minimum modulus of rupture	:	560 kg/sq.cm (600psi)
Water absorption 5 hrs. boiling	:	12%-15% of dry wt.
Efflorescence	:	Nil
Dimensions	:	200 mm x 100 mm x 5 mm (8" × 4" × 2")

Clinker bricks shall be manufactured by dry process and burnt to a higher temperature and shall uniformly vitrified to a dark copper tone. Edges shall be square, straight and sharply defined.

5.1.1.3 Sand (Fine Aggregate)

Sand shall conform to BDS 243, ASTM C 33

Sand shall be either natural sand, composed of clean, hard, durable uncoated particles resulting from the disintegration of siliceous and/or calcareous rocks; or manufactured sand resulting from the crushing of boulders or shingle.

The maximum size of the particles shall be 4.75 mm (3/l6 in) and shall be graded down.

Sand shall be clean and free of injurious amounts of organic impurities; deleterious substances shall not exceed the following percentages by weight:

Clay Lumps and friable particles-Maximum	3%
Coal and Lignite	0.25%
Material passing the 0.075mm (No. 200) sieve	1%
Shale, coal, soft or flacky fragments	1%
Sulfur compounds	0.3%
Organic material content	no organic material.

Sand shall be well graded from coarse to fine and shall conform to the following Fineness Modulus:

Concrete	:	2.5	(Two point five)
Concrete	:	1.5	(One point five)
Mortar	:	1.5	(One point five)
Filling sand	:	1.0	(One point zero)
	:	0.8	(Zero point eight)

Sand from different sources of supply shall not be mixed and stored in the same stock pile nor used alternately in the work without permission from the Project Manager.

5.1.1.4 Coarse Aggregate

Coarse aggregate shall conform to BDS 243 (Coarse and Fine Aggregates from Natural Sources for Concrete 1; ASTM C 33: Concrete Aggregates).
Nominal maximum size of coarse aggregate in concrete shall not be larger than:

a) One-fifth of the narrowest dimensions between sides of forms; or
b) One-third the depth of slabs; or
c) Three-fourth the minimum clear spacing between individual reinforcing bars or wires, bundles of bars.

The Boulder

The boulders to be used for coarse aggregate in concrete shall be composed of limestone, sandstone, granite, trap rock or rock of similar nature and shall have the following properties.

Compressive strength (minimum)	35Mpa (5000psi)
Specified gravity	2.2-2.6
Unit weights	22-25.1 kn./cum
Porosity	2.10%
Water absorption (maximum)	2.5% by wt

The boulder shall be of uniform light color as approved and shall be free of thin laminations, adherent coatings, and deleterious substances. The wear loss of coarse aggregate of all types shall not exceed 35% by weight when tested by the Los Angeles Abrasion Test.

5.1.1.5 Water

The water used in mixing and curing concrete shall be tested for chlorides and sulphates in a standard material-testing laboratory as directed by Project Manager. The maximum acceptable limits shall be as follows:
1000mg/I as S03 for sulphates
500mg/l as Cl ion for chloride

Water shall be clear and free from salt, oil or acid, vegetable or other substances injurious to the finished product. The pH values of water shall generally be not less than 6. Water used in construction work shall be potable.

5.1.1.6 Admixtures

Admixtures used for the purpose of modifying the normal plastic life of concrete mix or for influencing its rate of gaining hardness and strength or for the workability or concrete shall not be used except with the written approval of the Project Manager.

Admixture if specified or permitted shall conform to the requirements of AASHTO Standard Specification M-194/ASTM, C-494 or ASTM C-1017.

It shall be kept in mind that a small change in the amount of admixture may cause great change in their action and their adequacy of performance is difficult to measure at the construction site during the progress of work. Water reducing admixture, accelerating admixture, water reducing and retarding admixtures, water-reducing and accelerating admixtures shall conform to ASTM C-494 (Chemical Admixtures for Concrete) or ASTM C-1017 (Chemical Admixtures for use in producing flowing Concrete)

5.1.1.7 Reinforcing Bar

High tensile steel reinforcing bar shall be structural grade deformed bar specified as per ASTM, A615M, and BOS 1313: 91, Bars having minimum yield levels of 275 Mpa (40,000 psi) and 415 Mpa (60,000 psi) are designated as Grade 40 and Grade 60 respectively. High tensile steel reinforcing bars shall meet the following strength test requirements:

Properties	Grade 40	Grade 60
Yield strength (minimum)	275 Mpa (40000 psi)	415 Mpa (60000 psi)
Ultimate strength (minimum)	483 Mpa (70000 psi)	620 Mpa (90000 psi)

Tolerance on Mass

Nominal size (mm)	Tolerance of mass per Meter run (%)
Up to 7	□ 8.0
8 to 12	□ 6.0
Over 12	□ 4.5

Tolerance on Diameter

Tolerance in diameter for both plain and deformed bars shall not exceed 2.5% for 12mm and less size and 1.8% for sizes larger than 12 mm.

Tensile Requirements

		Grade 40	Grade 60
	Tensile strength, min. psi	70000	90000
	Yield strength min. psi	40000	60000
	Elongation in 8 in min. %		
Bar Nos.			
3 (10mm)		11	9
4 ,5, 6 (12, 16, 20 mm)		12	9
7, 8 (22, 25 mm)		…	8
9, 10 (28, 32 mm)		…	7
11, 14, 18 (35, 45, 57 mm)		…	7

Bending Requirements

The bend-test specimen shall withstand being bent around a pin without cracking on the outside of the bent portion. The requirements for degree of bending and sizes of pins are prescribed in Table 3 -Bend Test Requirement.

The bend test shall be made on specimens of sufficient length to ensure free bending and with apparatus which provides.

- Continuous and uniform application of force throughout the duration of the bending operation.
- Unrestricted movement of the specimen at points of contact with the apparatus and bending around a pin free to rotate.
- Close wrapping of the specimen around the pin during the bending operation.

Bend Test Requirements

Bar Designation No.	**Pin diameter for Bend Test[A]**	
	Grade 60	Grade 40
3,4,5	$3^1/_2$ d [b]	$3^1/_2$d
6	5d	5d
7,8	5d	--
9,10	7d	--
11	7d	--
14,18 (90^0)	9d	--
Test[A] bends 180^0 unless noted otherwise. d[b] = nominal diameter of specimen		

Frequency of Tensile, Bend, Rebend testing

Nominal size of bar (mm)	Value of x (Quality of materials in tones)		
	Tensile test	Bend test	Rebend test
Under 10	25	50	50
10 to 16	35	70	70
20 to 32	45	90	90

For the specified tests sample length shall be 600 mm long or 20 times the nominal size whichever is greater. Sample shall be selected from each batch at a frequency of not less than one up 5 (five) tones or part thereof where x has the value given in the above table. Samples from the bend and rebend tests shall not be selected from the same bar.

Cross Sectional Area and Mass

Nominal size	Mass (kg/m)	Cross sectional are (mm^2)
6 mm	0.222	28.30
8 mm	0.395	50.30
10 mm	0.616	78.50
12 mm	0.888	113.00
16 mm	1.579	201.00
20 mm	2.466	314.00
22 mm	2.980	380.00
25 mm	3.854	491.00
28 mm	4.830	616.00
32 mm	6.313	804.00

All steel bars prior to its use shall be cleaned with wire brush to make it free from loose scale, dirt, paint, oil, grease or other foreign substances.

All reinforcing steel shall be stored properly under shed not to be contaminated by oil, grease or mud.

Requirement for Deformation in Reinforcing Steel

The requirement of deformation shall meet ASTM A615.

a) Deformations shall be spaced along the bar at substantially uniform distances. The deformations on opposite sides of the bar shall be similar in size and shape.

b) The deformations shall be placed with respect to the axis of the bar so that the included angle is not less than 45^0 deg. Where the line of deformations forms an included angle with the axis of the bar of from 45^0 to 70^0 deg inclusive. The deformations shall alternately reverse in direction on each side, or those on one side shall be reversed in direction from those on the opposite side. Where the line of deformation is over 70^0 deg. a reversal in direction is not required.

c) The average spacing or distance between deformations on each side of the bar shall not exceed seventeenths of the nominal diameter of the bar.

d) The overall length of deformations shall be such that the gap between the ends of the deformations on opposite sides of the bar shall not exceed 12.5% of the nominal perimeter

of the bar. Where the ends terminate in a longitudinal rib, the width of the longitudinal rib shall be considered the gap. Where more than two longitudinal ribs are involved, the total width of all longitudinal ribs shall not exceed 25% of the nominal perimeter of the bar. Furthermore, the summation of gaps shall not exceed 25% of the nominal perimeter of the bar. The nominal perimeter of the bar shall be 3.14 times the nominal diameter

e) The spacing/height and gap of deformations shall conform to the requirements prescribed in Table 1 of ASTM A615.

f) Any bar that fails to satisfy the above requirements is to be treated as plain reinforcement according to ACI Building Code Requirements for Reinforced Concrete ACI 318-95.

5.1.1.8 Timber for Doors/Windows

Timber for doors shall conform to BDS 142; specification for Wood Doors (under revision): BDS 820, Recommendation for maximum permissible moisture content of timber used for different purpose in Bangladesh.

Timber used for doorframe and leaf shall be well-seasoned, dry and straight grained, free from knots and other defects affecting its appearance, strength and durability. All timbers used for doors/windows shall be mechanically seasoned and the moisture content shall not be more than 12-13%.

5.1.1.9 Aluminum Sections

All Aluminum Sections shall conform to U.S. Architectural Aluminum Manufactures Association Standards (AAMA).

The following are the standards to be followed for Aluminum doors, windows and curtain walls or as specified in Bill of Quantity:

Channel thickness for doors	:	1.8 -2.5mm
Channel thickness for windows	:	1.2 -1.8mm
Anodization thickness	:	15 microns
Density of anodization	:	4mg per sq.m.

5.1.1.10 Glass

- Glass for aluminum door and window tinted or clear should be 5mm thick and there should be no undulations
- For smaller wooden panel/M.s. glazed shutters glass should be 3mm thick and there should
- be no undulations.

5.1.1.11 M.S. Pipe

M.S. pipe shall be made from low carbon steel conforming to ASTM A53 and following physical requirements:

Nominal Pipe Diameter	Wall Thickness (mm)	Inside Diameter (mm)	Outside Diameter (mm)	Weight (kg/m)
150 mm	7.11	154.08	168.30	28.26
100 mm	6.02	102.36	114.40	16.07
75mm	5.49	77.92	88.90	11.29
50mm	3.91	52.48	60.30	5.44
25mm	3.38	26.64	33.40	2.50
20mm	2.87	20.96	26.70	1.69
12mm	2.77	15.76	21.30	1.27

5.1.1.12 UPVC Pipe

UPVC pipe shall be of Unplasticised Polyvinyl Chloride (UPVC) and shall conform to the following specifications:

Specific Gravity : 1.36 -1 .43
Tensile strength : 450 Kgf/Cm^2 -560 Kgf/Cm^2
Elongation : 80%
Compressive Strength : 600-700 Kgf/Cm^2

Nominal Size		Mean outside Diameter (MM)		Schedule 40 Wall Thickness (mm)		Schedule 80 Wall Thickness (mm)	
Inch	(mm)	Min	Mix	Min	Mix	Min	Mix
2.00”	50	60.17	60.47	3.91	4.42	5.54	6.20
3.00”	75	88.70	89.10	5.49	6.15	7.62	8.53
4.00”	100	114.07	114.53	6.02	6.73	8.56	9.58
5.00”	125	141.05	141.55	6.55	7.34	9.52	10.66
6.00”	150	168.00	168.56	7.11	7.79	10.97	12.29
8.00”	200	218.70	219.46	8.18	9.17	12.70	14.22

5.2 Mobilization and Preparation of the Site

Description

This item shall consists of mobilization of man powers, materials & equipment and preparation of site by clearing off of the site of rubbish of all kinds including surplus earth, slurry, weeds, grass etc., cutting and uprooting of trees of all girth; removal of drains, dewatering & bailing out of water, during whole construction period, sewers or any other services, leveling of site including filling, if necessary, protection of the periphery of the site by earth to prevent passage of any outside rain and waste water etc. dismantling of existing structure if any, and removal of surplus materials and debris to a safe distance as directed by the Project Manager.

Construction Requirement:

Before setting out the new work and commencing foundation work the site must be cleared off of all those described above. On clearance of site it should be roughly leveled as required.

The trees shall be cut and their roots totally up-rooted as directed by the Project Manager No tree should be cut unless it is absolutely unavoidable. All serviceable materials obtained from the clearing shall be property of the competent authority as determined by the Project Manager. Salvaged material may be handed over by the Contractor to the local authority on instruction from the Employer.

5.3 Dismantling & Removal of Existing Structures for Rehabilitation Sites

Description

This item shall consists of the removal/ dismantling and satisfactory cleaning, stacking, storing or disposal, inside or outside the site of such portions of existing structures as provided in the Plans, Schedule of Quantities and Specifications or ordered by the Project Manager. This includes all items such as breaking and removal of khoa debris, concrete, R.C.C, brick work, plaster and other items as mentioned in schedule of quantity or as directed by the Project Manager.

Construction Requirement

Before commencement of removal/ dismantling work, the structure or parts thereof shall be properly earmarked and necessary arrangement for stabilization of the adjoining structures shall be ensured by means of adequate shoring, shuttering, propping and strutting. The dismantling work shall not commence until the arrangement of safety of the adjoining structure has been insured by the Contractor, inspected and approved by the Project Manager. The Contractor shall be solely responsible for any damage to the portion of structure which' were not intended to be dismantled and make good the damages, if any, at his own cost. The Contractor shall comply with all safety regulations and shall furnish, erect and maintain suitable barricades and warning signs and take such other measures as necessary to prevent personal injury or property damage. All these barricades, warning signs shall comply with the by-laws, regulations and provisions of BNBC and shall be to the satisfaction of Employer, and Local Authorities concerned.

This item of work also includes cleaning and sorting out of the salvaged materials in a usable condition, transporting and storing neatly for use/disposal as directed by the Project Manager. The items of dismantling works of different structures in foundation also include all excavation, bailing out water by pumping, drainage, bracing, shoring, etc. as found necessary and their subsequent removal and satisfactory disposal of all materials obtained from such excavations and backfilling to the level of original ground where required. The Contractor shall keep adequate records of all dimensional measurements of the structures and all other information relating to them as revealed and obtained during their work and have such measurements and information duly endorsed by the Project Manager at site. The work shall not start unless full measurement is recorded by the Project Manager. In some special cases, however, the recording may be done after dismantling.

The salvaged materials before or after dismantling shall be immediately measured and recorded in presence of the Project Manager and shall be in the custody of the Contractor until instructed to be disposed of by the Project Manager. Any loss of any dismantled material shall be recovered from the Contractor's bill at the recovery rate.

5.4 Site office Facilities for the Project Manager and his Staff

Description

The Contractor shall provide and maintain temporary site office facilities during the construction period for the Employer and Consultant.

5.5 Earth Work in Excavation for Structure

Description

The item shall consist of setting out true lines to all foundations for structures, performing the excavations to the required levels and grades in any kind of soil encountered, removing the spoils and backfilling of original ground line as provided in these specification or as directed by the Project Manager.

Construction Requirements

The Contractor shall comply with all safety regulations and shall furnish, erect and maintain suitable barricades and warning signs and take such other measures as necessary to prevent personal injury or property damage.

5.5.1 Earth Filling

Description

The item shall consist of filling any place or area, to make up levels, according to these Specifications and Plans with specified earth materials.

Construction Requirements

Silty Sand or other approved materials, free from large lumps, organic or other extraneous materials, shall be used for fill. Materials from excavation on the sites may be used as ordinary fill if it is approved.

The fill materials shall be deposited and spread in successive uniform horizontal layers of about 150 mm thick and compacted by use of mechanical 1.5 ton “Vibro” compactor or other approved devices to a 98% standard dry density in road and pavement sub-base and 95% standard dry density for other area.

Tests shall have to be carried out at recognized laboratory to ascertain the nature of the fill material and the degree of compaction obtained for the filled material for which samples have to be taken and transported by the Contractor at his expense and as directed by the Project Manager.

5.5.2 Sand Filling

Description

The item shall consist of filling any place or area, to make up levels, according to these Specifications and Plans with specified and approved materials.

Construction Requirements:

Silty Sand or other approved materials, free from large lumps, organic or other extraneous materials, shall be used for filling Materials from excavation on the sites may be used as ordinary fill if it is approved.

Materials
Fineness modulus not less than 1.0 shall be clean and free from organic and other deleterious materials

The fill materials shall be deposited and spread in successive uniform horizontal layers of about 150rnrn thick and compacted by use of mechanical 1.5 ton "Vibro" compactor or other approved devices to a 98% standard dry density in road and pavement sub-base and 95% standard dry density for other area. In filling /back filling against a newly constructed structure precaution must be taken so that the structure is well matured to take the thrust of filling and while filling that against a wall, the filling is done from both sides simultaneously.

Tests shall have to be carried out at recognized laboratory to ascertain the nature of the fill material and the degree of compaction obtained for the filled material for which samples have to be taken and transported to the recognized laboratory by the Contractor at his expense and as directed by the Project Manager.

5.6 Brick Flat Soling (BFS)

Description

The item shall consist of supplying and laying bricks on top of the earth or sand bed to form a sub-base.

Construction Requirements

Bricks shall comply with requirements of First Class bricks. The binding sand shall have a minimum Fineness Modulus of 1.0 and shall be clean, and free of any organic matters.

Bricks shall be laid flat in surface to surface contact with adjoining bricks and their joints shall be filled with sand. The sand shall be brushed in until the joints are filled. Flushing in of sand with water shall not be done unless permitted. Bricks shall not be laid on the floor or foundation bed until the floor or foundation bed is inspected and approved by the Project Manager.

In case of Multi-layer Soling, care shall be taken to stagger or "break" all joints in placing subsequent courses of soling. No brick shall be laid on loose earth or earth filling which are not compacted to the desired degree.

5.7 Lean Cement Concrete (CC) Works

The specification shall be the same as for RCC works excepting that:

(i) No reinforcement shall be used;

(ii) Proportion shall be as noted in Schedule of Items;

(iii) 12 mm downgraded chips of Jhama bricks /Boulder shall be used as coarse aggregate as specified in Schedule of items;

(iv) The curing shall be done for 7 days minimum;

(v) Compaction of concrete may be done by wooden or steel tempers or rammers in lieu of vibrators.

In order to improve bond with masonry/concrete work coming above it, if required, the surface shall be roughened before it reaches initial set, by scouring with the help of a pointed tool.

5.8 Cement Concrete in Floor

Description

The work covered by this item shall consist of constructing in floor or elsewhere, 75mm or 38mm thick cement concrete with 1:3:6 mix of cement, sand of FM 1.2 and 12mm downgraded bricks or stone chips as specified in schedule of items.

Construction Requirements

Construction shall be carried out as per requirements of drawing.

5.9 Damp Proof Course

Description

The work covered by this item shall consist of constructing, on top of foundation walls or elsewhere 75mm/ 38 mm thick artificial stone with a 1:1.5:3 mix of cement, sand of FM 2.5 and 12 mm downgraded crushed stone chips and finishing with a coat of bitumen as per instruction of the Project Manager.

Construction Requirements

Damp-proof course shall extend the full width of the plinth walls unless otherwise required by the plans and shall be laid only after the levels of the plinth have been checked.

5.10 Reinforced Cement Concrete Work (RCC)

Description

This item shall consist of manufacturing concrete as provided in these Specifications and construction where required, and of the form, dimensions and design shown on the plans.

Construction Requirements

Concrete shall consist of a mixture of Portland cement, fine and course aggregate and water. The proportions in which the various ingredients shall be used in the concrete mix for various work, shall be designed in accordance with the specified strength and suitable workability.

Material shall conform to the requirements specified below and in the relevant sections Material Specifications.

Construction shall be according to these specifications. Contractor shall follow the following standards of American Society of Testing Materials along with the Building Code Requirements for Reinforced Concrete ACI 318-89 for Specification not covered in these Specifications. In case of differences between specifications contained in this book and those of ASTM or ACI, the specifications specified in this book shall stand.

Cement

"Specification for Ordinary Portland Cement" (Type-I)	- ASTM C150 or BS12
"Specification for Concrete Aggregates"	- ASTM C 33
"Standard Method of Making and curing concrete Test Specimen in the field"	- ASTM C31-89
"Standard Method of Test for compressive strength of cylindrical concrete Specimens"	- ASTM C39-86
"Standard Method of Sampling Fresh Concrete"	- ASTM C172-90
"Standard method of Making & Curing concrete Test Specimens in the laboratory"	- ASTM CI92-90
"Standard method of obtaining and Testing Drilled Cores and Sawed beams of Concrete"	- ASTM C42-90
"Standard Specifications of Chemical admixtures in concrete"	- ASTM C494
Cement shall be Portland Cement Type-I, ASTM	- ASTM C150

Portland cement to be normally used shall conform to ASTM specification C-150 type-l or BS-12. It shall be free from any hardened lumps and any foreign material other than the manufacturing ingredients. Cement shall have a minimum 90% of particles by weight passing the 75 micron sieve. Cement shall have an initial setting time in excess of 30 minutes and final setting time not longer than 7 hours. The Project Manager reserves the right to reject any cement that fails to achieve specified concrete strength as per proportion of materials laid down in the schedule of items.

Only approved brand, grade or kind of cement shall be used in a given structure above the ground level specially, for fare face finished concrete, tiles works etc. except upon the written permission of the Project Manager of other used.

The Contractor shall be responsible for the proper storage of the cement at the job site. Cement shall be stored in an air tight waterproof shaded area having damp proof floor, waterproof walls and leak proof roof. The cement stacks shall be placed at a minimum distance of 300 mm from the walls. The damp proof floor shall be constructed by raising it minimum 300 mm above the ground. If the cement is damaged and becomes lumpy due to defective storage, it shall be removed from the job site within 24 hours of receipt of instructions from the Project Manager.

Cement may be measured by weight of in a standard bag to weigh 1 cwt or 112 pounds/50kg having a volume of 0.0354 cum or 1.25 cft. The Contractor shall maintain the record of deliveries of cement to the site and its use in the work.

Fine Aggregate (Sand)

Fine Aggregate shall consist of well-graded clean natural sand, free from injurious amount of organic impurities and deleterious substances and shall have a fineness modulus of not less than 2.50. Fine aggregate shall be well graded from coarse to fine and when tested by means of laboratory sieves shall conform to the following requirements:

Sieve	Mass
	Percent passing
9.5 mm (3/8 in	100
4.75 mm (No.4)	95 - 100
1.18 mm (No. 16)	45- 80
0.300 mm (No. 50)	10 – 30
0.150 mm (No. 100)	2 -10

Coarse Aggregate

Coarse Aggregate shall consist of well-graded broken or crushed first class jhama bricks or boulder chips as specified on the structural drawings and/or BQ and shall be free from any adherent coatings.

Grading of Coarse Aggregates

Coarse aggregate shall be well graded, between the limits specified and the size or sizes designated shall conform to the requirements given in the following tables or otherwise specified or directed by the Project Manager.

Designated sizes	**Percentage by weight passing US Standardsieves having square openings**						
	38 mm	25 mm	20 mm	12 mm	10 mm	No.4	No.8
25 mm down graded	100	95-100	--	25-60	--	0-10	0-5
20 mm down graded	----	100	90-100	--	20-55	0-10	0-5
12 mm down graded		--	100	90-100	40-70	0-15	0-5

Delivery and Storage of Materials:

a. Cement

In transit and storage or stock-piled at site shall be protected from dampness or any damage by climatic conditions that would change its characteristics or usability. Cement at site shall be stored in dry weather proof godowns (or shed) built at the cost of the Contractor. Cement must not be stacked in more than l0 bag height. Sufficient space shall be provided for circulation and rotation of bags in order to minimize the length of storage of any of the bags. The floor of the godown shall consists of wooden planks resting on base prepared of dry bricks laid on edge. Batches of cement shall be used for the work in the order in which they are delivered to the site. A register shall be maintained by the Contractor listing date of delivery and quantity of each consignment for easy identification.

b. Aggregates

Aggregate shall be stock-piled at least 7 days prior to their anticipated use to permit the Project Manager to sample each stockpile to determine the acceptability of the material for the intended use.

Aggregates of different sizes or grades and from different sources of supply shall not be mixed. All aggregate shall be stored free from contact with earth and other deleterious matter.

Every precaution shall be taken during transport and stockpiling of coarse aggregate to prevent segregation.

Segregated aggregates shall not be used until they have been thoroughly remixed and the resultant pile is of uniform and acceptable grading at any point from which a representative sample is taken.

Composition of Mix

The strength requirement and workability shall govern the mix proportion for each class of concrete:

Proportion of concrete	28 day cylinder crushing strength (min.)	Place of Use	Aggregates		Min. Cements per m^3 (50 kg bag)
			Fine	Coarse	
(1:1.5:3)	21 MPa	In footing, water tank, column, slab, beam, stair lintel and all other RCC works like switch yard foundation	Sand FM 2.5	20 mm down graded stone chip	8.0 bags
(1:1.5:3.0)	20 MPa	In Damp Proof Coarse	Sand FM 1.2	12 mm down graded stone chip	8.0 bags
(1:2:4)	18 MPa	In all RCC works in Ancillary Structures	Sand FM 2.5 & 1.5	20 mm down graded picked jhama chip'	6 bags
(1:3:6)	15 MPa	In bellow foundation and Floor(C.C)	Sand FM 1.5	20 or 12 mm downgraded picked jhama chips	4.5 bags

Slump Slab, Beam, Columns etc. -50mm.

Trial mixes for every class of concrete with representative materials from site shall be prepared by the Contractor and carried to the laboratory in accordance with approved procedure. The nominal strength in these tests shall exceed the specified minimum strength by at least 20%. No concrete shall be placed in the permanent works until the relevant mix has been approved by theProject Manager.

Batching

The Contractor shall provide and maintain in good order suitable measuring equipment and devices required to determine and control accurately the relative amounts of various materials entering the mix. All measurements shall be by weight/volume and shall be accurate within a tolerance of 1 % for each batch. If the measurements are by volume then standard wooden boxes shall be used.

a. Cement

Unless an integral number of bags, as packed by the manufacturer is used, the Cement shall be weighed. A bag of cement weighing 50 kg net shall be considered as 0.035 m3

b. Aggregates

Different types and sizes of aggregates shall be batched separately by weight/volume.

c. Water

The amount of mixing water shall be weighed/measured, allowance being made for the quantity of the free water contained in the aggregates. Water cement ratio shall be decided for every class of concrete and according to the place of use. The water/Cement ratio shall not exceed 45% by weight for all type of concrete.

Sufficient acceptable materials shall be available at the batching site to ensure continuous placement necessary for structures. The moisture content of the accepted aggregate shall remain consistent to the extent that the resultant successive batches of concrete do not vary in consistency by more than 6 mm of slump. If the moisture content in the aggregate varies by more than the above tolerance, corrective measures shall be taken to bring the moisture to a constant and uniform quantity before any more concrete is placed.

Coarse aggregate shall be saturated with water at least 12 hours before use to prevent absorption of the mixing water.

MIXING OF CONCRETE

a) Machine Mixing:

Concrete shall be mixed in concrete mixer of approved type and appropriate capacity.
Each batch shall be thoroughly mixed for a period of not less than 2 minute after all materials including the water are in the drum and during this period the drum shall be in the mixing position and revolve at uniform rate of not less than 14 or more than 20 revolutions per minute. The cement and sand shall be thoroughly mixed in dry condition.

The batch shall be so charged into the mixer drum that some water shall enter in advance of the cement and aggregate. The entire content shall be removed from the drum before the succeeding batch is placed.

Concrete shall be mixed in quantities required for immediate use. Concrete shall not be used which has developed initial set or which is not in place within thirty (30) minutes after the water has been added. Re-tempering of partially hardened concrete by remixing with or without additional materials or water, or by other means shall not be permitted. The inside of the mixing drum shall be kept free of hardened concrete at all times.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Unless otherwise agreed by the Project Manager, the first batch of concrete through the mixer shall contain only two thirds of the normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

b) Hand Mixing:

Hand mixing shall not be permitted except for unimportant structural members and only at the discretion of the Project Manager. When hand mixing is permitted it shall be taken to ensure that the mixing is continued until the mass is uniform in colour and consistency. If hand mixing is permitted by the Project Manager, the Contractor shall use l0% extra cement for hand mixing for which no extra payment will be made.

Consistency of Concrete

The consistency of concrete shall be determined following evaluation of the placement conditions for each individual section of the work but in no case the slump shall exceed 62mm unless otherwise decided. Mix proportions and consistency shall produce a dense, well compacted concrete with a minimum tendency to segregate under placing conditions, free from sand streaks, honeycomb, air-pockets, exposed reinforcing steel and other forms of structural weakness or unsatisfactory appearance.

Transport and Placing

Concrete shall be so transported from the mixer and placed in the form that contamination, segregation or loss of the constituent materials does not occur. Before placing the concrete, all form work, space and the reinforcement contained in it shall be thoroughly cleaned .of all extraneous matter. Care shall be taken to fill every part of the forms, to work the coarse aggregate back from the face so that sufficient mortar shall be flushed from the mass to form a smooth surface, and to force the concrete under and around reinforcing bars without displacing them.

The concrete shall be deposited in the forms in horizontal layers to a depth not exceeding 300 mm and each layer shall be properly vibrated before laying the next one.

The concrete shall not be dropped freely from a height exceeding 1.0 meter nor shall it be deposited in large quantities at any point. In columns of structures special tremie pipe may be used for drop more than 1.8 meters. Dragging of concrete inside the forms or distribution by vibrators or allowing it to flow by gravity to the ends of the forms shall not be permitted.

In sections where it is extremely difficult, to place concrete containing the larger sizes of the coarse aggregate, a modified mix, as approved by the Project Manager, may be used to ensure against honeycomb and separation of the coarse aggregate from the mortar. Concrete shall be deposited and compacted in its final position within 30 minutes of its discharge from the mixer and shall not be subjected to vibration between 2 and 24 hours after compaction. When in situ concrete has been in place for 4 hours no further concrete shall be placed against it for a further 20 hours.

Compaction

Concrete, during and immediately after placing, shall be thoroughly compacted by mechanical vibration. The vibration shall be internal unless otherwise authorized by the Project Manager.

Vibration shall be of a type and design approved by the Project Manager. It shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

The intensity of vibration shall be such as to visibly affect a mass of concrete of one inch slump over a radius of at least 450 mm.

The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms. He also provided sufficient number of nozzles of different diameter to execute the work smoothly.

Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to lie plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation. Vibrators shall not be used to transport concrete in the forms.

Concrete pouring schedules and construction joint sequences of different stages shall have to be approved well in advance by the Project Manager.

Construction and Expansion Joints

Expansion joints shall be constructed at the locations and to the dimensions shown on the plans. Position and detail of construction joints, not shown on the plans, shall be planned in advance and approved by the Project Manager. Placement of concrete shall be in a continuous operation between consecutive joints.

Where sections of the work are carried out in lifts, the line of the proposed joint on all exposed surfaces shall be made truly straight by tacking a temporary horizontal straight edge on the inside of the form with its lower edge on the line of the joint and then placing concrete 12 mm higher than this edge to allow for settlement. In case of water reservoir PVC water stopper shall be used in all construction joints with 250 mm overlapping at the water stopper joints.

In resuming the work, the old concrete surface shall be thoroughly cleaned of laitance and all loose material by stiff wire brush, roughened, if deemed necessary, and washed with clean water.

The surface then shall be coated with very thick cement slurry before fresh concrete is placed.

Water Reservoir/Tank

Admixture of Sika Plastocrete Super (Conforms to both IS 2645 and IS 9103) 0.2% by weight of cement or similar product of approved quality at manufacturer recommendation for heavy duty water tank are to be used in bases and walls of R.C.C. reservoirs/tank.

Special Casting process for Columns and R.C.C. Wall

Minimum of construction joints shall be allowed in beams, slab and column of the structures. No construction joint in columns from below floor to bottom of beam shall be allowed, column must be cast in a lift, to avoid any construction joint below lintel level. Special shuttering with opening at middle height shall be used for the facility of casting. The opening shall be closed after casting of concrete up to that level without disturbing the green concrete. The Contractor shall prepare shuttering details ahead of actual work and shop drawings are to be approved by the Project Manager. In any case the safety and stability of form work shall be the Contractor's responsibility. No construction joint shall be allowed between beam, web & roof slab of building. For wall & water reservoir no concrete shall be placed from a height of more than 1.0m and the shuttering of the wall shall not be more than 1.25m in height.

Control Tests for Concrete

a. Sampling:

The number, frequency and location of batches to be sampled shall be decided by the Project Manager. The method of sampling shall be according to ASTM C172.

b. Slump

This determination shall be made at the commencement of concreting, on the occasion of each change in mix proportions, and thereafter when requested by the Project Manager. The testing shall be in accordance with ASTM C- 143, current issue.

c. Compressive Strength

Test cylinders 150 mm in diameter and 300 mm high shall be made at the site of the work in sets of three (3) from each thirty (30) cubic meter of each class of concrete or fraction thereof or as directed by the Project Manager.

Casting and curing the concrete cylinders shall be in accordance with ASTM C-31, current issue. Testing of cylinders shall be done in accordance with ASTM C- 39, current issue; one cylinder at 7 days and 2 at 28-days. Cylinder at 7 days test shall not be less than 70% of the specified (design) strength.

If the Project Manager allows cubes to be tested instead of cylinders, the cube strength shall be at least 25.0 percent higher than the cylinder strength specified.

The Contractor shall arrange to transport the cylinders/cubes to the approved laboratory and arrange to have the test results forwarded (in duplicate) directly from the laboratory to the Project Manager or his appropriate site representative. The Contractor shall bear all expenses in connection with the preparation of test cylinders /cubes, i.e. provision of moulds, cost of concrete, labor and transportation charges to the approved laboratory, laboratory testing charges etc.

Formwork

Formwork may consist of steel sheets of minimum thickness of 14 BG or wooden planks of hard wood of approved variety having a minimum thickness of 45 mm with necessary battens, struts, stringers, beams, ties, etc. In case of wooden planks the same shall be new and shall not be used more than three times in contact with concrete.

All formworks, especially for fair face concreting, must be 12 BG steel sheet and should be dented, rust free by using of sanding disk etc. before every lift of casting.
All formwork shall be of sound materials constructed water-tight, true to line as per drawing and of such rigidity to prevent bulging or movement during the placement and curing of the concrete. Form work for bases and walls of water reservoir shall have chamfer of appropriate dimension as per drawing and direction. After hardening the concrete shall conform to the shape, dimensions and surface finish described in the Contract. The forms shall be simple in construction, easy for erection, maintenance and removal

Form lining shall be in largest practicable panel to minimize joints. Under usual conditions the

following minimum periods between concreting and the removal of formwork shall be observed:

Vertical sides	:	72 hours
Soffits from under span of 6 meter or less	:	18 days
Soffits from under span of over 6 meters	:	Min. 21 days and as directed by Project Manager.

Concrete exposed by the removal of formwork shall be left untouched pending inspection by the Project Manager. Cement mortar separators or block of appropriate sizes are to be used in all covering as per drawing or directed by Project Manager.

The drip course shall be constructed at the edge of roof slab etc. by means of an approved batten included in the form work before casting or after casting as desired by the Project Manager.

Surface Finish and Remedial Treatment of Surfaces

Unless otherwise provided on the plans, all reasonably true and even surfaces, which are of uniform colour and texture, and free from stone pockets, honeycomb, depressions or projections, shall be considered as acceptable surfaces.

Immediately after the removal of forms, all cavities produced by form ties and all other holes, broken corners or edges and other defects except air bubble holes, shall be cleaned and after having been kept saturated with water for a period of not less than two hours shall be completely filled, rammed and made good with a mortar of the same proportions as used in the concrete being finished.

The holes shall be completely filled by use of a pressure gun or hand rammed method as directed by Project Manager's representative.

Any remedial treatment to surfaces shall be agreed with the Project Manager following inspection immediately after removing the formwork and shall be carried out without delay. Any concrete, the surface of which has been treated before being inspected by the Project Manager, shall be liable to rejection.

Curing and Protection

Concrete shall be protected against harmful effects of weather for a period of not less than seven (7) days immediately following the placing of concrete.

All concrete surface shall be covered with two thicknesses of wet burlap which have been spot stitched, or wet jute felt or gunny bags as soon after placing of concrete as it can be done without marking the surface and kept thoroughly wet by continuous sprinkling of water for a period of not less than 21 days after the concrete has taken its final set.

In lieu of continuous sprinkling, plastic sheeting or plastic coated burlap may be used to prevent moisture loss. The concrete RCC shall be pre-moistened and the plastic sheeting shall be held securely in place so that positive moisture seal is provided to retain the curing moisture during the 21 days curing period. Form of perforated sheeting shall De without delay repaired or replaced with acceptable material.

TRAINED SUPERVISOR

It is essential that the Contractor's supervisor who is in charge of the construction of all concrete work whether reinforced or not, shall be skilled in this class of work and shall superintend personally the whole construction and pay special attention to :

a) The quality, testing, proportioning and mixing of the materials and particularly control of water cement ratio
b) Laying of materials in place and thorough consolidation of the concrete to ensure solidity and freedom from voids.
c) Position of reinforcements.

5.11 RCC with Water Proofing Admixture

Description

This item shall be done as described in item 2.12 except that for water proofing admixture of Sika Plastocrete Supper (IS: 2645, and IS 9103) in proportion of 0.2% by weight of cement' or "SUPER BARBARA 05" of MBI International AG, NITTOPROOF of FOSROK or equivalent, made in UK/Switzerland/Singapore/Saudi Arabia in proportion recommended by the manufacturer is to be used in the concrete of the basement mat & wall, underground water reservoir and where necessary.

Construction Requirement

This approved admixture shall be put to the concrete mixture machine along with the cement. Other procedures are same as in item 2.10 including formwork etc.

5.12 Reinforcing Steel in Concrete

Description

This item shall consist of furnishing and placing in concrete reinforcing steel (Deformed bar) of quality type size and quantity designated, all as required by these Specifications and as shown on the applicable structural drawings.

Construction Requirements

Reinforcing steel shall be deformed bars of 60 graded as specified on the structural drawings and shall meet the following requirements:

1. Quality of reinforcement steel, its properties including strength, elongation, bending, splicing, hooking, covering and all related events shall be in accordance with the requirements of ACI 318-89.

2. De-formed bars, when used shall meet the requirements of BS: 4461 or ASTM: A615 of high strength of 60 - grade.

It should be noted that steel made from scrap iron shall not be accepted for any type of work. All reinforcement bars shall be clean and free from loose scale, dirt, paint oil, grease or other foreign substance. Bars should be placed in position as drawing/design requirement and be cleaned with a stiff wire brash if required.

Bending of Reinforcement

All reinforcement bars shall be bent cold to pertinent dimensions using bending appliances and method approved by the Project Manager. All bars of slab and beam shall invariably have standard hooks at the end. All standard hooks shall meet the following requirements:

a. A semicircular turn plus an extension of at least four bar diameters but not less than 62 mm at the free end of the bar.

b. A 90 degree turn plus an extension of at least 12 bar diameters at the free end of the bar.

c. For stirrup and tie anchorage only either a 90 degree or a 135 degree turn plus an extension of at least six bar diameters but not less than 62 mm at the free end of the bar.

The radii of bend measured on the inside of the bar for standard hooks shall not be less than the values given below:

Bar size	**Minimum radii**
10 mm, 12 mm, 16 mm	2.5 bar dia.
20 mm, 22 mm, 25 mm	3 bar dia.

Bends for stirrups and ties shall have radii on the inside of the bar not less than one bar diameter.

Placing of Reinforcement

Reinforcement shall be placed, supported and maintained in the position shown in the Drawing and shall be checked and approved by the Project Manager before placement of concrete begins. Unless otherwise permitted by the Project Manager, all intersecting bars shall be tied together with double layer of22G black iron wire and the ends of wire shall be turned into the main body of the concrete. Clear cover must be maintained to the side of reinforcement as shown on the drawing by using concrete blocks or separators.

Splicing of Reinforcement

No splices shall be made in the reinforcement where not shown in the drawing. Wherever it is necessary to splice reinforcement at points other than those shown on the plans, Drawings showing the location of each splice shall be submitted to and approved by theProject Manager before the reinforcing steel is placed.

a. **Splices in reinforcement in which critical design stress is tensile**

Splices at points of maximum tensile stress shall be avoided where possible, such splices where used shall be lapped or otherwise fully developed. In any case 'the splice shall transfer the entire computed stress from bar to bar without exceeding three fourths of the permissible bond values for the concrete. The length of lap shall be 40 bar diameter excluding hook. However length of splices to be used for different bars shall be according to drawing or according to the direction of Project Manager.

b. **Splices in reinforcement in which critical design stress is compressive**

Where lapped splices are used it shall be minimum of 35 bar diameters excluding hook. Where longitudinal bars are offset at a splice the slope of the inclined portion of the bar

with the axis of the column shall not exceed 1 in 6 and the portions of the bar above and below the offset shall be parallel to the axis of the column. Adequate horizontal support at the offset shall be secured by additional stirrups, ties, etc. Offset bars shall be bent before they are placed in the forms.

Supports

Pre-cast concrete blocks or metal supports of adequate strength, of proper dimension and in sufficient number shall be used for supporting the bars in position. Blocks shall be of a shape acceptable to the Project Manager and designed so that they shall not overturn when concrete is stored. They shall be made of concrete with 10 mm maximum aggregate size from same materials and of the same mix proportions as that of the concrete in which they are to be used. They shall be cast and properly cured for at least seven days before use and shall have wire or other device cast in the block for the purpose of attaching them securely to the reinforcement. Where directed chairs made with 12mm bars shall be provided for keeping the negative reinforcement in place during concreting. These chairs when used shall provide proper cover as required and the numbers shall be as decided by the Project Manager.

Welding of Reinforcement

Reinforcement in structures shall not be welded except where permitted. All welding procedures shall be subject to the prior approval of the Project Managers in writing. In pile reinforcement welding may be necessary and shall be done in accordance *to* the drawing and with the approval of the Project Manager. Welding for connecting the damaged portion of the reinforcement shall be allowed on both sides of the Re-bar and shall be 50 mm of welding length on both sides and on ends.

If welded connections are made on intermediate grade reinforcing steel, to hold bars in position, low hydrogen electrodes shall be used.

Concrete protection for Reinforcement

Unless otherwise shown on the plans, the covering of reinforcement for different types of members shall be as follows:

Column, Footing/Mat & Pile Cap All sides, below FGL		75 mm
Column: All sides, above FGL		50 mm
Grade Beam: All faces		60 mm
Other beams in Structures: Side, Top and Bottom		50 mm

Slab, lintle and staircase:		
Bottom		25 mm
Top		20 mm

Protective Coating

All exposed reinforcing steel at construction joints shall be protected with a brush coat of neat cement, mixed to a consistency of thick paint, within one week after the placing of the initial concrete, unless it is definitely known that the steel shall be embedded within 60 days. This coating shall be entirely removed, by lightly tapping with a hammer or other tool, more than one week previous to the placing of the final pour. The Contractor shall notify the Project Manager or his authorized representative when the steel has been placed in position for pouring concrete and no concrete shall be placed until the Project Manager has inspected the steel and given his approval in writing.

5.13 Brick Work

5.13.1 250mm BRICK WORK AND ABOVE

Description

This item shall consist of constructing brick masonry work in **1:5** cement mortar in such thickness and at such heights as required by the plans.

Construction Requirement

All materials shall meet the requirement of the relevant sections of Material Specifications.

a. **Bricks** shall be 1st class well burnt bricks of uniform colour, shape, size with sharp corners bricks unless otherwise specified.
b. **Cemen**t shall be Portland cement Type-I ASTM C- 150 or BS - 12
c. **Sand** shall be clean well graded natural sand having a minimum FM of 1.5.
d. **Water** shall be same as required for concrete.

Mortar

Mortar of brickwork unless otherwise required shall consists of 1 part of cement and 5 parts of sand.

Cement and sand shall be mixed dry in the specified proportions until the colour of the mixture is uniform. Water shall then be added sparingly, only the minimum necessary being used to produce a workable mixture of normal consistency, The water cement ratio in no case shall exceed 0.50 by weight, or as directed by the Project Manager.

The mixing shall be done on a clean hard platform with watertight joints to avoid leakage. The mixture should be covered with polythene sheet or other means so that dust or other foreign materials cannot be deposited. At the close of each day's work, the mixing trough and the pans shall be thoroughly cleaned and washed.

Mortar shall be mixed in quantities required for immediate use within 30 minutes of mixing.

Mortar, which has taken its initial set, shall, on no account be used on the work, nor shall it be remixed with or without additional materials or re tempered by other means.

Workmanship

No bricks shall be used until they have been thoroughly soaked in clear water for at least eight hours. Soaking shall be discontinued one hour before use. Care shall be taken that the bricks are clean and free from lime or dirt of any kind. If necessary, bricks shall be scrubbed clean.

Brickwork shall be built in plumb and shall be carried up regularly throughout the entire length of the structure. Unless otherwise specified, bricks shall be laid in English Bond unless otherwise specified each brick being set with mortar in bed and vertical joints. All bricks shall be whole except where necessary for closers and where expressly authorized. All horizontal joints shall be parallel and level. Vertical joints in alternate courses shall come directly over one another. Joint thickness should be uniform and shall be 6 mm for pointing brick work and shall in no case exceed 10 mm for other brick works. Exposed joints shall be raked and flush-pointed unless otherwise specified and the face of the work shall be kept clean as work proceeds. The height of day's work shall be limited to 1.25 meter unless otherwise permitted. In exposed situations the day's work shall be protected against harmful effect of weather during and for a period immediately following construction until the mortar has sufficiently hardened. All brickwork shall be thoroughly cured for a period of at least 7 days. Fixture in masonry such as anchors, clamps, brackets, pipes, etc. shall be built-in during construction at no additional cost to the Contract.

5.13.2 125 mm THICK BRICK WORK

The work covered by this item shall consists in constructing 125 mm thick wall with 1st class bricks in **1:4** cement mortar at any heights as required by the plans.

Construction Requirement and Materials

Materials and method of construction shall be as stated in item **2.13.1** except that the mortar shall consist of 1 part of cement and 4 parts of sand.

5.14 Patent Stone Flooring

Description

The item shall consist of constructing 25 mm /38mm thick concrete with 12 mm downgraded picked "Jhama" brick chips, sand and cement in specified panels of floor slab and elsewhere in accordance with these Specifications, Use approximately 25 kg of cement per 10 $m^2$for neat cement finish and finish with steel trowel up to the satisfaction of Project Manager or as directed.

Construction Requirements

Materials and construction shall be in accordance with the requirements of item 2.10. The flooring shall be laid preferably not later than 24 hours after the floor slab is poured. When flooring is to be laid on an older concrete slab, the base surface shall be thoroughly cleaned of all loose materials by stiff wire brush, roughened if seemed necessary and washed and soaked with clean water. Surplus water shall be removed and a dense cement grouting is applied to the surface before flooring is placed.

The floor shall be divided into panels of specified sizes, which shall not be more than 16 sq. m. by

means of wooden 'battens. The top of the battens shall be at the level of the finished "surface.

The mixture shall be spread evenly between the battens in alternate panels and shall be uniformly consolidated and leveled by a strike-off. When the moisture has disappeared from the surface, the surface shall be steel trowelled under firm pressure to produce a dense uniform smooth surface free from trowel marks.

The dividing battens shall be removed carefully after 16 hrs and the remaining panels shall be completed in the aforesaid manner. Joints would be marked with thin ropes to allow cracks, if any, to form along straight line and providing neat appearance.

The work shall be cured and protected from weather for at least 10 days immediately following the laying.

5.15 Ceramic Tiles

5.15.1 Glazed Ceramic Tiles

Description

The work covered under this item shall consist of supplying and fixing glazed ceramic tiles on walls and where necessary on a 1:3 cement mortar in accordance with the applicable plans, schedules and these specifications.

Construction Requirements

Glazed ceramic tiles unless otherwise specified, shall be standard Grade 200mm x 300mm x 6mm and 250mm x 400mm x 6mm white interior wall tiles free from war page, blemishes and dimensional defects and conforming to the standards of Federal specification SS-T-308b.

Mortar for installation shall consist of 1 part cement to 3 parts sand (FM 1.5).

Grout for tile joints shall be made of white cement coloured as and where specified with inert pigments.

Preparation of wall surface and application of mortar bed shall comply with the provisions of item 2.16.1 &2.16.2. If the surface needs leveling a scratch coat of plaster shall be applied, leveled and scratched for key and allowed to dry for 12 hours before installing tiles. The setting mortar shall be applied evenly and a neat-cement paste to a thickness of about 1.5mm shall be trawled to the back of tile and the tile set on firmly tapped into place to ensure full contact. The joints shall be in specified pattern and shall not exceed 1.5 mm in width.

The mortar bed shall be minimum 6mm thick and shall be cut through horizontally and vertically every 400 mm to 600 mm. The tiles shall be soaked in water for at least 6 hours before setting. Installation shall be controlled by strings, pegs, spacers, levels or other suitable methods to ensure correct layout and uniform leveled joints. The joints shall be grouted, cleaned and damp-cured for at least 3 days.

5.15.2 Non Slip Tiles Work

The Non slip tile shall be smooth, water proof, dust pressed with square edges (Bangladeshi) and size of the tiles shall be between 200mm x 300mm or 250mm x 250mm or 300 mm x 300 mm. No

border edging or rounding pieces shall be used. Length of each size of floor/wall shall be filled by the tiles completely. The cut sizes if used at the ends shall be equal in size and as closed to full size as possible by making either the edge or the centre of tile to coincide with the vertical centre line of floor/wall. The waI1/floor on which the tile shall be applied shall be kept moistened for 2 hours. The bedding mortar in 1:2 using medium sand (FM 1.5) shall be applied. The joints in tiles shall be minimum 5 mm wide, kept clean for pointing and to be filled flush with pointing material with white or coloured cement mortar unless otherwise specified. Measurement shall be given for the actual area covered by the tiles. No measurement of the under bed shall be given.

5.16 Plaster Work

5.16.1 Plaster on Brick Masonry

Description
This item shall consist of providing 12 mm to 20 mm thick (1:4)/ (1:6) on walls, and where necessary in accordance with these Specifications & direction ofProject Manager.

Construction Requirements
Materials shall meet requirements specified below and in the relevant section of Material Specifications.

a. ***Cement*** shall be Ordinary Portland cement Type-I ASTM C- 150 or BS-12

b. ***Sand*** shall be clean well-grade natural sand having a fineness modulus of 1.50. Sand shall be washed if necessary.

c. ***Water*** shall be potable and clean and contain no salt or organic materials.

d. ***Admixture*** shall be mixed with the cement mortar of approved quantity where item in BOQ is specifically mentioned.

Cement and sand shall be mixed dry in the specified proportion until the mixture is uniform in colour. Only enough water shall be added to provide plasticity. Mortar shall be mixed only in quantities for immediate use. Mortar which has taken initial set shall not be used on the work with or without addition of fresh material.

Before application of plaster, the joints in brick walls shall be adequately raked out where necessary and smooth concrete surfaces shall be roughened to provide key. The surfaces shall be scrubbed clean of loose materials and soaked with water and kept damped for 24 hours in case of brick masonry.

Plaster which consists of two coats, under and finish, when applied over brick masonry, the "under and finish coats shall be applied with an interval to permit the undercoat to set. Water proofing admixture of specified quantity shall be mixed with cement mortar as per manufacturer’s instruction.

Plaster shall be kept moist by watering and protected from weather for at least 10 days immediately following completion.

If any cracks appear in the plaster or any part sounds hollow when tapped or is found to be soft or

otherwise defective after the plaster has dried, it shall be considered as defect and the defect shall be made good by cutting out and re-plastering at the Contractor's own cost.

5.16.2 Plaster on R.C.C Surfaces

Description

This item shall consist of providing 6 mm to 12 mm thick 1: 4 cement-sand plasters on all RCC members in accordance with this Specification.

Construction Requirement

Plaster shall consist of 1 part cement and 4 parts sand and have thickness of 6 mm and shall be applied in a single coat, where plaster on concrete surface is required 12 mm thick, it shall consist of two coats, under and finish. The under coat shall consist of a grout application and shall have minimum thickness of 6 mm and shall be leveled with straight edge and scratched for key. The finish coat shall be trowelled over with care and leveled with straight edge to obtain a flat smooth surface. The under and finish coats shall be applied with an interval to permit the under coat to set. All edges and corners unless otherwise shown on the plans, shall be rounded or chamfered as directed by the Project Manager. All moldings shall be neat, clean and true to template.

5.16.3 Plaster with Water Proofing Admixtures

Description

This item consists of providing 20 mm thick 1:4 cement mortar plaster with water proofing admixture of "Sika Plastorate Super" 0.2% by weight of cement or any other admixture of internationally reputed manufacturer in the proportion recommended by them shall be used as per manufacturer’s instruction. This plaster shall be used on RCC surface or Brick wall or as directed by Project Manager.

Construction Requirement: Plaster shall consist of 1 part of Portland cement and 4 parts of sand with recommended quantity of approved water proofing admixture. However the whole procedure of this works shall be subject to the approval of the Project Manager.

5.17 Neat-Cement (Skirting/Dado)

Description

This item shall consist of providing 12mm thick neat cement with black/red oxide finished **(1:2)** cement- sand Skirting/Dado on a **(1:4)** cement-sand mortar plaster of 12 mm thick underbid on walls or where necessary in accordance with these specifications.

Construction Requirements

Materials shall meet requirement as stated in item in 2.16.1

Wall plaster, if any, shall be removed along the floor to the required height and the surface shall be thoroughly scrubbed and wetted before applying the underbid. The second undercoat shall have a nominal thickness of 6 mm and the total built-up thickness shall be same as that of the plaster on the wall. A 3 mm deep and 3 mm wide groove shall be formed where skirting/Dado meets wall plaster.

The skirting/Dado shall be installed flush with the finished wall surface. The intersection with the floor shall be a right angle and the top of the skirting/Dado shall be straight and sharp.

The underbid shall be laid as uniformly as possible and allowed to become firm before scratching for key and subsequently allowed to become thoroughly dry before applying the second undercoat. A neat cement paste 3 mm thick shall be spread evenly over the second coat and shall be steel trowelled under firm pressure to produce a dense uniform smooth surface free from trowel marks.

The work shall be cured and protected from weather for at least 10 days immediately following the installation.

5.18 Making Groove on Wall Surface

Description

The work covered by this item shall consists of making groove of 38 mm wide & 25 mm deep and to be provided on all types of wall surface as per drawing and direction ofthe Project Manager. The *faces* of the groove must be straight and well finished.

Construction Requirement

Before making groove wall shall be chiseled to attain the required depth of the groove. Care shall be taken for chiseling. In case of any damage the Contractor shall make good to the damage at his own cost.

5.18.1 Making Groove in RCC Casting (On Railings, Drop Walls & RCC Walls)

Description

Fair faced concrete of drop wall, railing and RCC wall shall have 20mm deep grooves as shown. All horizontal grooves shall be 40mm wide in the front and 30mm wide at the back and all vertical grooves shall be 25mm wide in the front and 20mm wide at the back.

Continuous horizontal grooves shall run between the parapet and the slab and also between the slab and the drop wall. Vertical grooves shall be 2.20m apart, positioned along the column axes and additionally two numbers in each bay except when otherwise shown. For R.C.C works in lift walls and staircase walls, the grooves shall be positioned as shown in the drawing. This is to be done by using approved hard wood plank made plain as per sizes to be fixed on the shuttering before casting of fair faced concrete. This wedge shaped timber shall be used for one time only and shall have to be changed/ replaced at the time of changing of plywood during shuttering work of fair faced concrete. This timber must be straight and free from any defect. REEBOL release agent or any other approved type is to used before every casting.

5.19 Painting Works

5.19.1 Distempering

Description

The item shall consist of applying 2 coat of distemper of approved color over a coat at priming on plastered wall or ceiling surfaces where necessary in accordance with this specification.

Construction Requirements

Distemper shall be water bound distemper of Bangladeshi made (SPD of BERZER) of approved colour, shade and supplied in original sealed container. Priming consist of chalk wash with glue. The surface to be distempered shall be dry, well cleaned and free from efflorescence, dirt and stain of grease. The surface shall be given a thorough rub down to remove all loose materials and all cracks and surface irregularities shall be repaired with patching plaster and filler to obtain a smooth and even surface. The mixing of distemper shall be carried out in accordance with the instruction issued by the manufacturer of the particular brand of distemper that is to be used. Before starting work distemper shall be mixed in such way that one room can be finished with the same mix. Distemper is to be applied quickly. The brush to be dipped and stroked cross wise on the surface. No patchy overlaps shall be tolerated under any circumstances. Distemper shall only be applied with proper distemper brushes as supplied or recommended by the manufacturer. A sample area must be prepared first and got inspected and approved by the Project Manager before the full scale work commences. The distempers shall be used till such time as it gives a uniform texture.

5.19.2 White Wash

Description

The work covered by this item shall consist of applying minimum 3 coats of white wash with lime on plastered or un-plastered surfaces in accordance with these Specifications.

Constructional Requirements

Lime shall be slaked lime. The wash shall be prepared by mixing and stirring lime and water in such quantities as shall produce a mixture of the consistency of thin cream. When sufficiently mixed, the mixture shall be stained through a clean coarse cloth. Gum Arabic in proportion of 1 Ib of gum to 15 lb. of lime shall be dissolved along with approved quantity of blue & zinc oxide in the strained wash.

The surface to be white washed shall be thoroughly cleaned of all foreign matter by the use of stiff wire brush, sand papering or other approved means. White wash shall be applied in minimum 3 coats alternately laid on vertically and horizontally. Each coat shall be perfectly dry before the succeeding one is laid over it. The wash shall be laid on with good hair brush & not with brush made of jute. The wash shall be laid in such a way that the whole surface should give a uniform texture.

5.19.3 Water Repellent Coating

Description

The item shall consist of applying 2 coats of clear silicone water repellent on exposed brick or concrete surfaces and cement plaster on wall, ceiling and elsewhere in accordance with these Specifications.

Materials

Silicone water repellent shall consist of sodium silicate or other alkaline silicates based clear approved product supplied in original sealed containers bearing the manufacturer's trademark.

Application Method

The application of water repellent coat shall strictly comply with the manufacturer'sinstructions. The application shall preferably be carried out after a period of dry weather and before applications; the surface shall be thoroughly clean and dry. A heavy coat shall be applied evenly direct from the container by flooding the surface with a wide brush so that at least 6mm penetration is achieved.

A second coat, applied as above, shall follow after 24 hours subjected dry & clean weather.

5.19.4 Enamel Paint

Description

The work covered under this item shall consist of applying 2 (two) coat of synthetic enamel paint of approved colour over a coat of priming on plaster wall or ceiling surface where necessary in accordance with these specification.

Construction Requirement

The plaster surface shall be painted with two coats or more of synthetic enamel ready mixed paint of best quality and approved color. *Before* application the surface shall be given a through rub down to remove all loose materials and all cracks and surface irregularities shall be repaired with patching plaster and filler to obtain a smooth and even surface. The paint shall be applied on appropriate primer after the surface has been finished with filler/putty, etc.

Before applying the paint on plastered surface the surfaces must be thoroughly smooth and cleaned from grease dirt and other foreign materials by a use of stiff wire brush, sand papering or other approved means. Painting shall not be carried out in damp weather. No patchy overlap shall be tolerated under any circumstances.

The enamel paint should Robialac (Berger**)** or equivalent and must be approved by the Project Manager.

Manufacturer's instructions for application for paint must be followed. The colour of the paint should be according to the direction of the Project Manager.

A sample area must be prepared first and got inspected and approved by theProject Manager before the full scale work commences

5.19.5 French Polishing to Wooden Surface

Description

The work covered by this item shall consist of providing French polishing work to wooden surface as per direction of the Project Manager.

Construction Requirement

French polishing to door frame and shutters three coats over a coat of priming including cleaning finishing and polishing with sand paper etc. all complete in all floor.

5.19.6 Plastic Paint

Description

The work covered under this item shall consist of applying 2 (two) coat of plastic paint of approved color over a coat of priming on plastered wall or ceiling surface where necessary in accordance with these specifications. The painted surface shall be easily washable by soft soap and water.

Materials

The plastic paint should be Robialac (Berger) or equivalent and must be approved by the Project Manager. The priming consists of appropriate type as specified for the paint by the manufacturer, and shall be applied accordingly.

Application Method

The surface to be plastic painted shall be dry, well cleaned and free from efflorescence dirt and stain of grease. The surface shall be given a through rub down to remove all loose materials and all cracks and surface irregularities shall be repaired with patching plaster and filler to obtain a smooth and even surface. The mixing of plastic paint shall be carried out in accordance with the instruction issued by the manufacturer of the particular brand of plastic paint that is to be used. Before starting work plastic paint shall be mixed in such way that one room can be finished with same mix. Plastic paint is to be applied with proper brushes as supplied or recommended by the manufacturer. A sample area must be prepared first and get inspected and approved by the Project Manager before the full scale work commences, The paint work shall not be considered as complete till a surface of perfect uniformity in color, shade and texture is achieved.

5.20 Timber Works

Descriptions

The item shall consist of supplying and fixing timber for doors, windows fitted with hardware and finished in accordance with the applicable plans, schedules and these Specifications.

Construction Requirements for Timber Doors

Timber for shutters, trims and frames shall be Silkorai/Teak/Chapalish. Grounds, studs and blocking shall be in sound Jam or other approved wood. All timber shall be free from sap, shakes, large or loose knots and defects affecting the appearance, strength and durability of construction and shall be well seasoned, dried to moisture content of 6% by weight and treated with non-swelling, non-staining water repellent paintable wood preservative.

Glue shall be waterproof approved product consisting of synthetic resin (phenolic, amino plastic or polyvinyl acetate) emulsion adhesives for wood or any other approved materials conforming BS-1204.

Knotting shall consist of a uniform dispersion of 25% flake shellac in 75% methylated spirit or other approved natural or synthetic resin in a suitable solvent and conform to BS-I336.

Stopping shall be made from white or red lead and sufficient linseed oil to produce a stiff paste and conform to BS-544.

Hardware shall be of approved material, finish, type and make and shall be complete with necessary screws, trims and all other accessories required for proper installation. All screws and accessories shall be of suitable size and type and shall match with the pigment as to material and finish.

Joinery workmanship shall be of the highest quality. All joints shall be well made, cleanly matched and tight. Verticals shall be plumb. Joints shall be put together with waterproof glue and if necessary further secured with finishing nails of softwood or with screws of hardwood.

Surface shall be finished smooth free from disfiguring defaces such as raised grain, stain, evidence of poor and uneven planning and sanding, tool marks, gouges and scratch.

All edges of woodwork shall be carefully trimmed and the arises eased by rounding to a radius 1.0mm.

Door frames in masonry walls shall be installed only after the walls are in place and have been cured.

Styles and rails shall be accurately cut and glued together with close fitting mortise and tenon joints which shall be further pinned with corrosion resisting metal pins of diameter not less than 5 mm or with hard wood pins of diameter not less than 7 mm. The joints shall be such as to ensure complete rigidity of framing throughout.

Panels shall be tongued-and-grooved unless otherwi8se shown on the plans, Wide flat surfaces shall be made of several narrow strips glued, dowelled, splined or dovetailed together as required.

All faces of frame buried or hidden in masonry shall be painted with 2 coats of tar paint before erection. The frames shall be installed plumb and fixed to brick masonry with flat iron hold fasts (225×37×6) mm tongued and turned at the ends and to concrete with No. 12- 90 mm long screws with suitable expansion-shields or fiber-lugs. The hold fasts and fixing screws shall be spaced not over 1 meter apart. The screw heads shall be countersunk at least 12 mm below the surface and plugged.

Butt hinges shall be set flush. All hardware shall be installed carefully in correct position strict conformity with the manufacturer's instructions. All hardware, fitting must have previous approval of the Project Manager before using into work.

Application of surface finishes shall conform to British Standard Code of practice CP-231.
After erection and before any finish is applied, all woodwork shall be hang -sanded using a succession of grit sizes each removing in turn all the coarser grooves created by the preceding grit. Knots and resinous streaks shall be treated with 2-3 coats of knotting applied evenly and thinly. Nail holes, cracks and cavities shall be filled in with stopping pressed well home with a stopping knife. Large holes or knots shall be plugged in with a mixture of red lead and enamel glue in equal quantities laid hot. Knotting and stopping shall extend slightly beyond the resinous area or cavity on to the adjacent surface.
The final preparation shall be by rubbing down with fine abrasive paper and dusting off with air jet. The sanding shall always follow the line of grain. No cross -grain sanding marks shall be admissible for any finish system on veneered or solid wood members. All wood surfaces shall be kept free of dust, dirt adhesives or other substances which would interfere with normal finishing procedure. Painting shall be done as per specification of respective item. If varnishing is required

the following specification shall be followed.

Oiling shall be done with linseed oil, either raw or boiled according to whether a flat or glazed surface is required. Unless otherwise specified a mixture of raw and boiled oil shall be used. The oil shall be rubbed into the wood till the surface is dry. The oil shall be applied sparingly and excess removed to avoid a sticky surface.

Lacquer varnish shall consist of a colourless finish of shellac diluted in alcohol. A wash coat of sealer consisting of $^1/_4$ Kg cut of shellac shall be applied first and when dry sanded lightly.
For internal works, 2 coats of lacquer consisting of 1 Kg cut of shellac shall be applied from a well charged clean brush which shall be worked on the surface no longer than is necessary to ensure even spreading. For external works 4 coats shall be applied. Each coat of varnish shall be lightly rubbed down with fine steel wool or abrasive paper and dusted before applying the next.

5.20.1 Single Leaf Flush Door

Description

The work covered under this item shall consist of supplying and fitting, fixing single leaf flush door in accordance with applicable plan or same as existing door.

Construction Requirement of single leaf flush door

The single leaf flush door of approved size of best quality Bangladesh made (as approved) shall be BFIDC or equivalent standard.

5.21 Metal Works

Description

The item shall consist of providing installing and finishing in place steel doors & windows with grill, rolling shutters, collapsible gate, ventilators, gates, boundary grill, hand rails or any other items, including frames made of plain steel structural shapes, plates, angles, pipes rods, wire mesh, steel sheet etc. where necessary in accordance with the applicable plans, schedule and these Specifications.

Construction Requirements

Mild steel pipe shall be of specified size conforming to the requirements of ASTM AS3.

Structural steel shall conform to the requirement of ASTM A-36 and shall include plain structural shapes and plates cut to length or fabricated.

Glazing shall be provided with 3mm thick transparent acrilic panes (sheet).

All components of every item of work shall be accurately cut, formed, cast, fitted, welded and finished true to form and dimensions as indicated on the plans and drawings. Unless otherwise specified all welding shall be fillet welding.

All steel surfaces shall receive 2 coats of hard-gloss paint of approved colour over a coat of approved anti-corrosive primer unless otherwise specified. Prior to painting, the surface shall be cleaned of mill scale, rust, oil grease and dirt. Surface not painted to the Project Manager's satisfaction shall be repainted at Contractor's own cost.

5.21.1 M.S. Grill

Description

The steel frame shall be made of mild steel as per drawing and design. This is to be fitted at any places as per drawing and direction of the Project Manager.

Construction Requirement

The mild steel shall conform of the requirements of ASTM A-53. The structural steel shall conform of the requirement of ASTM A-36. These flat and angle M.S. sections are to be cut to sizes, fabricated, welded (continuous) and to the shape and sizes of the frame as per drawing. This frame shall have two coats of synthetic enamel paint over a coat of approved anticorrosive primer. The enamel paint should be of approved colour. Each frame must have min. 8 nos. of clamps on 3 sides of the frame.

A frame should be prepared and deposited with the Project Manager for his approval. Only after approval the manufacturing should start.

5.21.2 Switchyard Structures

The switchyard structures shall be a cost effective combination of spun concrete poles (SPC) and galvanized members. The concrete poles shall be design/manufactured in accordance with the standard REB specifications.

Method of Construction

A truss is a formed structure composed generally of straight members so arranged and fastened together at their ends. The stresses in the members, due to the forces at the joints are either tension or compression. Most of the trusses in practice are composed of a number of triangles formed together.
The plane truss consists of a number of bars jointed together such that they lie in one plane & form a frame-work which is suitable against any type of loading acting in the same plane.

Mild steel work in trusses should be done with mild steel sections of different sizes as per design and drawings. These sections are to be fitted and fixed in positions carefully as per design and drawing with gusset plates, nuts & bolts, rivets or by welding. Then after cleaning the surface adequately two coats of anticorrosive paint over a prime coat of red oxide or red lead shall be applied with appropriate applicator. To determine the number of rivets, must be known the design load, thickness of gusset plate and angles, the sizes of rivets and allowable unit stresses.

5.22 Aluminum Doors, Windows etc.

Description

The works under this item shall consists of supplying and fixing of aluminum products of various types such as doors, windows, curtain walls, curtain rails, cladding/ flushing of sills, etc. fitted with necessary hardware and finished in accordance with applicable drawings and specification.

Construction Requirements

a) Materials and Products

Doors, windows, curtain walls etc. shall be of approved standard conforming to the U.S. Architectural Aluminum Manufacturers Association (AAMA) or BT A specifications. The frames and sash members shall be of extruded shape made of 6063 T5 high quality aluminum alloy having a minimum section thickness of 2mm unless otherwise shown on the drawings or indicated in the schedule of items and shall conform to AAMA or BT A standard.

b) Fasteners, Hardware and anchors

Fasteners, hardware and anchors shall be of aluminum or non-magnetic, non-corrosive material compatible with aluminum, All windows shall be provided with non-jamming latches of rocker type designed to be locked from inside. Window locks shall be flush type as manufactured by the Adams Rite Manufacturing Company of Gleudale, California or approved equivalent. The doors shall be provided with cylindrical locks and suitable built-in non jumping latches and bolts.

Security locks shall be pin type mortise lock, 6 or 7 pins and adaptable to Master, Grand master and Great Grand Master keys. Sliding windows and doors shall be fitted with adjustable sealed bearing sheaves of durable hydrated nylon or approved equivalent. Closers Push/pull and kick plates shall have to match with the frames. Any other hard wares to be incorporated in the work shall also match with the frame. Assembly and installation screws shall be of stainless steel. Doors, Windows, curtain walls etc. shall be installed with teflon injected expanding bolts, Sills shall contain adequate provisions for drainage. Head, sills and jamb members shall be of one piece construction. Aluminum to aluminum contact between hardware parts or moving members shall not be permitted. Such contacts shall be properly insulated.

c) Glass Pane

Glass shall be 6mm thick tinted dark bronze float glass panes (Japan, Bangladesh or Equivalent). Or as per drawing, schedule of item and direction of the Project Manager.

d) Glazing Beads

Glazing beads shall be aluminum shape-in interchangeable type.

e) Glazing Strips

Glazing strips or channels shall be of formed neoprene of acceptable quality.

f) Weather Stripping

Weather stripping shall be of neoprene or silicon treated woven wood or approved equal.

g) Joints

Joints shall be mechanically done square (telescopic) joints. No mitred Joints shall be accepted. No forced fitting shall be accepted. All units shall be fabricated at the factory to accurate dimensions.

It shall be rigid and designed to permit complete weather stripping. In principle, the parts should be put together by self-tapping screws.

h) Surface Finish

All exposed surfaces of aluminum members shall be factory finish and of substantially uniform appearance conforming to "Architectural" standard.

All exposed surfaces shall be given a natural Anodic Oxide hardcore coating of 15 micron in thickness and a density of 25mg. per square inch and a uniform color tone conforming to the U.S. Aluminum Association or equivalent standard. The color spectrum shall be natural silver/approved shade of bronze or all exposed surfaces of the Aluminum frames shall be electrostatically painted with VV resistance hard resin powder with minimum coating thickness of 40 micron of approved color shade. Finish of hardware shall match closely with the door/window/curtain wall finish.

i) Accessories

Accessories necessary for proper fixing and preparation such as anchors, clips, fins, sub-frames, metal sills, mullion, covers, casing, other trim, cleaning anchors, glazing beads, weathering and glazing strips, hardware and mechanical operators shall be supplied ready to set in place with the door, window, curtain wall units.

Steel or wood sub frames shall be painted with Zinc-chromatic primer in case of steel and' with wood preservative in case of wood. Steel anchor shall be properly insulated from aluminum frame.

j) Sealant

Sealant shall be one part elastic compound of "Architectural" grade caulk and shall be in matching color or as approved by the Project Manager.

k) Shop Drawings

The Contractor shall prepare detailed design of all work involved in line with the Consultants design and prepare Shop Drawings for the total work and submit to the Project Manager for approval before factory fabrication. All exterior doors, windows and curtain walls shall be designed to withstand a wind pressure of 30Ib/sft.

l) Installation

All units shall be assembled at site under proper conditions, erected, fixed and glazed in place in strict conformity with manufacturer's instruction. All cut-out operations for hardware preparation shall be made accurately and reinforced as required.

All doors, windows, curtain walls etc. shall be set plumb, square, level and in exact alignment with surrounding works and shall be securely anchored ready for operation. All joints between the masonry openings and frames hall be caulked and sealed after installation of the frames. All installation works shall be done and finished in such a way as to ensure a free and smooth operation.

Abrasion or other injury to finished surfaces shall be carefully avoided. Cleaning should be accomplished with plain water or a petroleum type cleaning agent or with the manufacturer's recommended cleaning reagent. No corrosive reagent shall be used.

5.23 Water Proofing Polythene Sheet

Description

The work covered under this item shall consist of supplying and laying in place polythene sheets over brick flat soling in floor of buildings and where needed in accordance with the applicable Plans, Schedules and Specification.

Construction Requirement

The sheets shall be laid within the building covering the entire inside floor area. Before laying the sheets the brick surface shall be cleaned with a duster to give the surface a free of extraneous particles. The sheets shall be free of damage, tear or other imperfection and shall be laid such that there is a minimum of 225 mm overlap between, adjacent strips. The second layer shall be laid over the first in the same direction but with a stagger of half the strip width.

5.24 Lime Terracing on Roof

Description

The item shall consist of constructing a layer of lime concrete 2:2:7 on roof slabs in accordance with these Specifications.

Construction Requirements

Lime concrete shall consist of a mixture of 2 parts lime to 2 parts surki and 7 parts brick chips.

Lime shall be unslaked lime and shall be mixed by weight. Lime weight shall be measured at Unslaked Condition and one cubic meter of lime terracing work requires 4.60 mounds (172.16 kg) of lime. Slaked lime shall be screened through 3.35 mm sieves and the residue shall be rejected. The lime stone should be brought to site and slaked in the ground of the working place.

Surki shall be made from 1st class (well-burnt but not vitrified) bricks crushed or ground to pass through a 2 mm sq mesh.

Brick chips (khoa) shall consist of 18 mm down-graded angular fragments of broken or crushed 1st class bricks.

The mixing shall be done on a clean platform but not on roof. Lime and surki in the specified quantities shall first be mixed dry till the mixture is of uniform colour. Then the mixture shall be screened. Specified quantity of previously wetted khoa shall be added .and the whole turned over once without adding water and twice by gradually adding small quantities of water for tempering. The mix shall then be allowed to age for at least 7 days. During this period the mixture shall be turned by spading twice a day and further lime water added if needed to prevent drying up. Care should be taken to keep it under cover to protect against rain. The mixture shall then be laid evenly on the roof slab to proper slope and in thickness 30% more than that shown on the plans and thoroughly beaten for 7 days with wooden mallets to the finished thickness and proper slope. Before beating a lime slurry shall be laid on the top and allowed to soak well. The lime water mixed with molasses shall be continually sprinkled on the concrete to keep it wet while being beaten. Beating should not be stopped until the metallic sound is obtained. The mortar which comes to the surface during the beating is to be rendered smooth and finished off with lime rubbing. The terracing shall be kept wet after completion for a period of not less than one week. The soundness

of the lime terrace roof should be tested by cutting a small portion of the materials 75 mm square and 50 mm deep in few representative areas and filling the holes with water and observing for half an hour. If the water level does not go down in any of the' holes the compaction of the L.C. shall be considered to have been adequate. If not, the L.C. shall have to be done again.

5.25 Screeding on Roof

Description

Average 50mm thick screeding with concrete on top of roof slab with cement, sand (FM 2.5) & 12mm downgraded stone chips. Concrete is to be laid in slope as per drawing and direction of the Project Manager.

5.26 Surface Drain

Description

The item shall consist of 300 mm or 450 mm deep drains in accordance with these specifications.

Construction Requirement

Bricks, cement, sand and all other materials shall conform to the requirement of respective materials specified in the relevant sections of materials specifications.

The surface drain shall be constructed in true line and level as per drawing and direction of the Project Manager.

300 mm deep drains shall have 300 mm clear width with 125 mm thick brick wall (1:6) on 75 mm thick cement concrete (1:3:6) base over single layer brick flat soling. The exposed surface shall have 12 mm thick cement plaster (1:3) with neat cement finishing and curing at least for 7 days must be done.

5.27 Apron

Description

The item shall consist of construction 50 mm thick cement concrete over a layer of Brick flat soling around the structure in accordance to this specification.

Construction Requirements:

Cement Concrete (1:2:4) with neat cement finishing.

Brick flat soling by first class bricks unless otherwise specified.

Sand shall be clean well graded natural sand having F.M of 2.0 for concrete.

Water shall be same as required for concrete.

The area specified for construction of apron shall be thoroughly cleaned, leveled &' compacted to proper slope & level. Brick flat soling shall be laid over compacted earth according to specification no. 2.6, then cement concrete (1:2:4) as per specification no. 2.7shall be placed over BFS with maintaining proper level & slope towards drain, Simultaneously neat cement finish shall be applied on top surface curing for a period of at least 7 days as prescribed in item no. 2.7complete as per drawing & direction to the Project Manager.

5.28 Road Work

The proposed substation sites are located in different parts of Bangladesh. These are the low lying area mostly are paddy land. The proposed substation sites may be connected by a road which shall be constructed during construction period.

The Construction work of roads shall be carried out in accordance with the Drawing. The design and drawing shall be as per AASHTO specification. However, demolition and restoration of the public roads (including private roads) shall be carried out according to the specifications designated the official in charge of road management not withstanding the provisions described in the specifications and the Drawing.

5.28.1 Road Work Inside The Premises

Sub–grade

a) Any excavation and banking work required for sub-grade construction shall be carried out in accordance with the respective provisions in General Provision of earth work.
b) The material required for banking and displacement shall be so placed that the finished thickness of one layer after compaction shall become 20 cm or less.
c) The sub-grade surface shall be finished by proof- rolling in order to obtain the contact pressure sufficient to permit smooth traffic of vehicles of 8 tons or over should any defects be detected as a result of proof-rolling, such detective sub-grade surface shall be finished again to the satisfaction of the Project Manager.
d) The finished sub-grade surface shall be within + 5 cm of the design elevation.

Sub base Course

(a) The materials to be used for sub base course shall be in accordance with the specification described in the Drawing. The Contractor shall submit a report concerning the quality of materials and the methods of sampling to theProject Manager for approval.
(b) The finished surface of sub base course shall be within –10 mm and+5mm of the design elevation.

Surface Course (Asphalt pavement) – Approach/Access Roads

(a) Prior to commencing pavement, the sides of concrete side walk, manhole, etc. shall be cleaned, and molten asphalt, etc. shall be coated over the sides.
(b) The surface to be seal-coated and prime- coated shall be finished into even level, and after perfecting removing any bloc, dust and other foreign matters, such surface shall be cured and dried.
(c) The mixtures shall be spread uniformly, rolled and finished into the specified thickness. Then, the finished surface shall be measured in parallel to the center line of the load by using a 3 m straight line ruler. In this case, the depth of any concave sections shall not exceed 5 mm.
(d) The Contractor shall submit a report on the materials to be used for pavement of surface course and method thereof to the Project Manager for approval.

Inspection

The Contractor shall invite inspection by the Project Manager during the course and after completion of sub base course and surface course works.

5.28.2 Public Road (Including Private Road)

(1) Demolition of Pavement

Demolition of Pavement for public roads including private roads shall be carried out so carefully as not to cause any hazardous effect upon the surrounding portions of cement, concrete or pavement.

(2) Road Keeping and Restoration

(3) The road keeping shall be of a construction applicable to the prevailing site conditions and so provided as not to cause any danger or trouble against traffic.

(4) The Contractor shall submit the drawings for road keeping to the Project Manager for approval.

(5) The Contractor shall constantly patrol any spots of road keeping and exert his utmost efforts perform maintenance and repair of such roads in order to eliminate any trouble against smooth traffic.

(6) The Contractor shall carry out maintenance and repair of any pertinent roads so carefully as not to cause any trouble against smooth traffic until the said roads have been restored and taken over to the official in charge of road management.

5.28.3 Herring Bone Bond Brick Pavement

Description

This work shall consist of a base composed of bricks, laid on edge in a herring bone pattern, placed on a prepared single layer brick flat soling in accordance with these specifications and to the lines, grades, levels, dimensions and cross section shown in the drawings and as required by the Project Manager.

Materials

The materials shall consist of first class bricks.

Construction Methods

The bricks shall be laid either flat or on edge with the shortest side vertical , in a single layer in a herring bone pattern to the lines, grades, levels, dimensions and cross section shown on the drawings and as required by the Project Manager. The edges/lines of the layer shall be made with cut bricks to produce a line which is compatible with brick soling. The joints shall be filled with sand brushed in and the completed layer shall be sprinkle liberally with water

5.28.4 RCC Pavement – Internal Roads.

Description

The item shall consist of constructing R. c.c. road with 250mm thick guid wall of height 0.30 meter and 150mm thick R.C.C. work over one layer first class brick flat soling and reinforcement 10mm dia M.S. rod @ 175mm c/c in both direction.

Reinforcement

In pavement shall be placed and secured as shown on the plans in accordance with the requirements of item 2.12.

Construction and expansion joints

Shall be constructed exactly in accordance with the details shown on plans and with best workmanship and as per direction of the Project Manager.

Extreme care shall be exercised in placing, compacting and finishing concrete at the joints to prevent displacement of the joints and to avoid the formation of honeycombs and voids. The concrete along the joints shall be thoroughly consolidated by the use of vibrators.

As soon as the concrete is sufficiently hardened, the edges of the pavement, the longitudinal joints, the construction, and expansion joints shall be carefully executed as per drawing and direction and finished with an edging tool so that the radius shown on the plans is obtained.

Curing and protection

Shall start as soon as newly-laid pavement is sufficiently, hardened and shall be continued for a period of at least 7 days as prescribed in item no. 2.10

After hardening of concrete the joints shall be cleaned and filled with sand bituminous masticto the satisfaction of theProject Manager.

5.28.5 Laying of Curb Stone(Concrete Block)

Description

The work covered by this item shall consist of providing and laying curb stone in sidewalks, driveways, road islands, garden paths, parking areas, etc. as per manufacturer specification, drawings and direction of the Project Manager.

Materials

Materials shall meet requirements specified below and in accordance with the specifications.

Curb stone shall be with concrete class C18.
The mortar for joining shall be 1:2 cement mortar.

Installation Requirements

Preparation of bed, laying and joining shall be as per manufacturer specification.

5.29 Clearing after Completion

The Contractor shall thoroughly clean all work upon completion. Clean off an strains, marks, spots, and disfigurements from all works, touch up as required, clean all windows panes, remove all rubbish and debris from building and site and leave premises clean and tidy and fit for occupation in all respects and to the entire satisfaction of the Project Manager.

5.30 AS Built Drawings

The Contractor shall prepare as-built drawings for entire project after completion of Construction, installation and all tests, and obtain approval from Owner/Consultant, and shall submit 3 (three) set of such as-built drawing to the Owner for keeping record. Minimum one computer soft-copy shall be accompanied with the as-built drawings.

5.31 Tests for Materials

The following tests for the construction materials shall be performed.

5.31.1 Sand

At least two samples shall be tested for each consignment but not exceeding 275 cum.

a) FM

b) Percentage of clay lump

c) Mica content

d) Organic Impurities

e) Material fiber than # 200

5.31.2 Brick

At least 6 bricks to be tested for each consignment not exceeding 50,000 no. of brick.

a) Unit weight
b) Compressive strength
c) Water absorption
d) Dimensions
e) Efflorescence, if necessary

5.31.3 Reinforcement

Each set of sample shall consist of 3 (three) representation standard places of Deformed bar for each size for each consignment or as directed and shall be tested for the following properties:

a) Yield or 0.2% Proof strength test
b) Ultimate tensile strength test
c) Elongation
d) Bend test
e) Cross section area

f). Unit Weight/meter

5.31.4 Stone Chips

At least two samples shall be tested for each consignment but not exceeding 600 cum.

a) Gradation
b) Unit weight
c) Specific Gravity
d) Los Angeles Abrasion Test.

5.31.5 Cement

At least 3 samples of cement shall be tested for each consignment but not exceeding 100 tons.

a) Fineness
b) Setting times
b) Compressive strength for 3rd, 7th and 28th day

5.31.6 Concrete

For all concrete work at least 3 (three) sets of 3 (three) samples cylinder/cubes and for each days casting or for each 15 cum of concrete shall be preserved and tested to for 7 days and 28 days crushing strength.

5.31.7 Water

Sulphate and Chloride content shall be tested for construction works of each site.

5.31.8 Where Tests to be Done

All tests shall be performed in the BRTC of BUET or any other laboratory approved by theProject Manager.

5.31.9 Cost of Tests

The cost of making any test shall be borne by the Contractor if such test is clearly intended by or provided for in the specifications or Bill of quantities and is required to ascertain whether the design of and / or quality of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill and conforms to specifications.

5.31.10 Building Furniture

The required building furniture is listed on the drawings. The final specification of the supplied furniture shall be to the approval of the Project Manager.

B. CIVIL

6.0 BUILDING, SANITARY AND ANCILLARY FACILITIES

TABLE OF CONTENTS

Clause No.	Description	Page No
6.1	Plumbing Fixtures	
6.2	Wash Basins	
6.3	Kitchen Sink	
6.4	Soap Tray	
6.5	Toilet Paper Holder	
6.6	Glass Shelf	
6.7	Towel Rails	
6.8	Mirrors	
6.9	Shower Rose	
6.10	CP Grating	
6.11	CP Bib Cock	
6.12	CP Stop Cock	
6.13	G.I. Water Pipes and Fire Stand Pipes	
6.14	PVC Sewer Pipes and Fittings	
6.15	UPVC Soil and Waste Pipes and Fittings	
6.16	RCC Pipes	
6.17	Inspection Chambers with R.C.C. Cover	
6.18	Water Tank	
6.19	Water Pump	

6.1 Plumbing Fixtures

6.1.1 Water Closets

Description

The work shall covered by this item shall consist of furnishing and installing white-glazed vitreous china water closest (WC) long pan/commode/Combi closet in accordance with these specifications.

Construction Requirements

Water closet (commode/Combi closet} shall be "S" or "P" type with low down cistern of vitreous China and shall be standard product of Bangladesh Insulator and Sanitary ware Factory (BISF) Ltd/International- standard complete with seat and cover shall be made of formal dehyde molding compound of VICTORY brand/ equivalent of approved quality. Size of commode shall be as per requirements of schedule of item.

Long Pan Shall be squat type as per BISF/ International -standard with integrated foot rests and shall be as specified in schedule of item.

Low down Cistern for commode/Combi closet/long pan shall be BISF/ International standard quality cistern of size 550mm x 260mm x 375mm and capacity 12.00 liters.

Cistern For long pan shall be overhead 13 liters type (MAANCO/ BISF/ International Standard or approved equivalent) complete with float valve, fittings and fixtures as per requirements of schedule of item.

Angle stop shall be as per drawing and instruction.

Pans shall be fixed to the floor with 1:2 cement mortar in case of squat type and with 4 nos. CP round headed screws in case of pedestal type.

Cistern shall be secured to the wall by 2 nos. #14 CP round headed screws and supported on centre bracket fixed to the wall with 2 nos. #14 CP countersunk screws. Cistern shall be connected to water supply with 12 mm plastic connecting pipe and CP angle stop.

6.2 Wash Basins

Description

The work shall covered by this item shall consist of furnishing and installing white-glazed vitreous china wash basin on wall and supported by concealed wall hangers and fitted with chrome-plated 30 mm waste, bottle trap and waste pipe, 12 mm angle stop and pillar faucet, chain, stay, rubber plug and 12 mm plastic supply connector pipe in accordance with these specifications.

Construction Requirement

Wash basin shall be of BISF-standard colour and size as specified in schedule of items.

Pillar faucets and angles stops shall be 12mm bore chrome plated brass and be of best quality (king size) Bangladesh made prior approved.

Traps (Syphone : dismantle type) shall be 30mm bore Chrome plated copper alloy having at least 75mm water seal and shall be priority approved best quality Bangladesh made.

Waste pipe shall be of 30mm. PYC pipe best quality available for sewer grade.

Basins shall be supported on 2 concealed wall hangers. The basin in the executive/Master toilet room shall be provided with pedestal: 652mm x 204mm x 204mrn size BISF standard coloured.

Hangers shall be screwed to hardwood plugs built in the wall using 3 nos14 countersunk screws for each hanger. Hangers shall be painted with 2 coats of oil paint, over a coat of red lead primer or shall be galvanized.

Taps, valves and traps shall be connected with water supply installation by means of standard unions, coupling nuts and fittings.

6.3 Kitchen Sink

Description

The work covered by this item shall consist of furnishing and installing Kitchen sink and tray on bracket in accordance with these specifications.

Construction Requirements

Kitchen sink and tray shall be Stainless Steel as per requirements of schedule of items. The construction requirement shall be similar to Wash Basin.

6.4 Soap Tray

Description

This item covers the supply and installation of soap tray as per following requirement.

Requirements

The soap tray shall be C. P. cast iron of standard size best quality Bangladesh made (as approved) and should be fixed in wall by drilling & fixing by screws etc. all complete. The dimension shall be 150mm x ll0mm x 40mm.

6.5 Toilet Paper Holder

Description

The work covered by this item shall consist of furnishing and installing Toilet paper holder in accordance with these specifications.

Construction Requirements

Toilet paper holder shall be of approved quality as specified in schedule of item. The holder shall be fixed with chrome plated brass screws to plugs built in the wall.

6.6 Glass Shelf

Description

This item shall cover supply and installation of glass shelf 5mm as per schedule of item fm: basins & toilets as per following requirements.

Requirements

The glass shelf shall be best quality local made (Priority approved) with C. P. or stainless steel supports & guide rails and should be fitted in the wall with screws etc. complete.

6.7 Towel Rails

Description

The work covered by this item shall consist of supply of towel rails and installation of the same as per following requirements.

Requirements

The towel rails shall be chromium plated heavy type 20mm dia 600mm long with C. P. flanged holder, counter sunk screws. The rail should be fixed in walls by drilling holes in wall, fixing screws through rowel plugto the satisfaction of theProject Manager.

6.8 Mirrors

Description

The work covered by this item shall consist of furnishing and installing plate glass mirrors Japan/Belgium of approximate dimensions 450 mm x 350 mm and of 5 mm thickness over lavatory basins according to these specifications.

Construction requirements

Edges of mirror shall be clean cut and round smooth. Mirror shall not be installed in direct contact with the wall. The separation shall be effected by 6 mm thick rubber or cork spacers. Fixing shall be by means of chrome-plated holders and screws to hardwood plugs built in the wall. Care shall be taken to place the mirror symmetrical to the axis of the basin and with sides vertical and horizontal.

6.9 Shower Rose

Description

The item shall consist of furnishing and installing chrome plated brass shower rose in accordance with these specifications.

Construction Requirements

The shower rose shall be of nominal 100 mm diameter best quality Bangladesh made prior approved and shall be connected to the water supply installation by screwing giving a leak-proof joint.

6.10 CP Grating

Description

The work covered by this item shall consist of furnishing and installing chrome-plate gratings in accordance with these specifications.

Construction Requirements

CP grating shall be 125mm dia. heavy type and approved quality and shall be installed in direct contract with the floor.

6.11 CP Bib Cock

Description

The item shall consist of furnishing and installing chrome-plated brass bib taps in accordance with these Specifications.

Construction Requirements

Bib taps shall be of 12mm bore heavy type with at least 75 mm projection and shall be best quality Bangladesh made (Nazma, Sharif or equivalent) prior approved Draw-off taps and stop valves for water services!

Taps shall be connected with the water supply installation by means of standard unions, coupling nuts and fittings.

6.12 CP Stop Cock

Description

The work covered by this item shall consist of furnishing and installing chrome-plate stop cocks in accordance with these specifications.

Construction Requirements

The stop cock shall be 12mm dia heavy duty chrome-plated concealed and shall be approved quality Bangladesh made (Nazma, Sharif or equivalent).

Stop cock shall be connected with the water supply installation by means of standard unions, coupling nuts and fittings,

6.13 G.I. Water Pipes and Fire Stand Pipes

Description

The work covered by this item shall consist of supplying and installing galvanized steel water pipes on wall surface or in wall, underground through stack (duct) and where necessary in accordance with these specifications.

Constructional Requirements

GI pipes shall be galvanized steel welded tubes of screwed and socketed type, Class A and shall be equivalent to as specified in BS-1387.

Stop valves
Shall be of brass and equivalent of the screw down pattern conforming to as specified in BS-1953.

Draining

Staps shall be screw-down pattern conforming to BS-2879.

Ball valve

Shall be of brass and conform to BS- 1212.

Float for ball valve

Shall be of copper with solder joints and conform to the requirements of Class A, BS-1968.

All fittings shall be standard GI products and shall conform to BS-534.

The piping work shall be carried out in accordance with British Standard Code of Practice CP-310 Water Supply!

Pipes shall be jointed with preferably with raplon tape according to manufacturer's instructions. However, strands of find jute may be used with the approval of the Project Manager.

A gate valve along with a float valve shall be provided with a socket union where the service pipe from main is connected to the underground reservoir.

Stop valve shall be provided on the supply pipe to individual buildings in an accessible position inside the building as near as practicable to the point of entry of the pipe to each building so that the supply may be readily shut off for repairs. A draining tap shall be provided just above the stop valve to enable the service piping in the building to be emptied of water when stop valve is shut. Stop valve shall also be provided at the outlet from roof storage tank and on every branch pipe of the feed pipe as near as possible to the point at which the pipe leaves so as to minimize interruption of supply during repairs.

Where the service pipe is less than 50 mm bore, all the stop valves shall be of the screw down type. Other stop valves shall be of the gate type.

Pipe in structures shall be installed during construction. No hole or chasing in wall or floor shall be allowed without prior approval. Pipes shall be supported by steel clips placed at an interval of approximately 1 meter. All clips and brackets shall be fixed with rawal plugs into the masonry.

The fire stand pipe shall be 4" dia G.I. unless otherwise specified. Each floor shall be equipped with fire hose, made of rubber lined cotton 63mm diameter. Rubber covered or unlined linen may be provided with the approval of the Project Manager. A closet in which hose is stored should be ventilated and installed at least 1300mm above the finished floor. The hose is to the equipped with 25 to 33mm nozzle.

The joint shall be made with hose coupling. The length 63mm hose should be about 30m. This length, measured around obstruction and partitions, should make possible the use of nozzle within 10m of every part of every floor in the building. Two such closets with hose are to be provided for each floor in each tower as shown in the drawing.

A hose valve is to be installed close to the water supply pipe (stand pipe) between it and the hose. The gate valve so equipped shall have thread that are interchangeable with those used by the local fire department.

Since the stand pipes in the building are supplied from roof tank, they are to be linter connected at the top as shown in the drawing.

Fire department hose connections shall be provided with an approved straight may check valve located in the value pit (or the building), but not with a gate valve. Check valve shall be of the approved extra heavy flanged rattern or as required by the local fire department.

Piping outside building shall be laid underground and the depth of cover measured from the top of the pipe to the finished surface of the ground shall not be less than 750 mm where the pipe passes under roadways or through structures, a min. 100 mm RCC sleeve shall be fixed to allow freedom of movement.

The Contractor shall carry out and provide as part of the contract all excavation in any kind of soil encountered for laying pipes to the required depths. No tunneling shall be done except with the consent of theProject Manager. Where necessary the Contractor shall support the sides of the pipe trench by suitable timbering, bail out water, remove spoil and backfill to make up level with sand FM 1.0 without extra cost. Backfilling shall be carried out as provided under item 2.5.2 of Spec. civil**.**

After installation the pipe system shall be hydraulically tested for two hours at a pressure .equal to 50 psi without showing any sign of leakage.

6.14 PVC Sewer Pipes and Fittings

Description

This item shall cover the supply & installation of PVC for conveying away soil water from sanitary filaments, waste and rain water pipes with supply of fittings as may be necessary according to the following requirement.

Requirement

The PVC waste and rain water pipes & fittings shall comply with ASTM D2729-89 for different diameters and joints should be made to comply with ASTM D267289, ASTM D2855. Pipes shall be jointed to each other by using suitable solvent cement recommended by the manufactures. Installation of PVC pipes indirect sunlight is not permitted. Once the joints are made, they should be left undisturbed for 12 hours for the solvent cement joints to attain its strength.

6.15 UPVC Soil and Waste Pipes and Fittings

Description

The item shall consist of supplying and laying cast-iron pipes for conveying away soil water from sanitary filaments.

Construction Requirement

Cast-iron pipes, shall be equivalent to that specified in BS-416 'Cast -iron spigot and socket soil waste and ventilating pipes (sand cast and spun) fittings and accessories;

The sanitary pipe work shall comply with British Standard code of practice CP-304.
All pipes shall be aligned properly, laid to specified slope (I in 100) and securely fixed to the structure above the false ceiling by using ears on pipe sockets or cast-iron/G.I. holder bars or purpose made straps.

Cast-iron spigot and socket pipes shall be joined to each other with tarred-jute packed in half the depth of tile socket, while the other half shall be filled in with molten lead properly caulked and furnished. All joints shall be made perfectly air and water tight. Joints shall not be embedded in the structure without prior approval. All pipes to be furnished with cement grouting internally and to be bituminous painted externally.

All junctions shall have back or side door for inspection and clearing.

All necessary fittings such as cowls, gratings, bends, tees (plain or door), offsets (plain and door), sockets, traps, Y -Tees (plain and door), loops, and siphon with horn shall be furnished and fixed at no additional cost to the Contract.

Traps shall have a minimum water seal of 75 mm for pipes up to and including 50 mm dia and minimum water seal of 50 mm for pipes over 50 mm dia. Floor channel drain shall have properly trapped outlet fitted with a removable grating. After installation, water seal tests are to be made to check against any leakage before backfill.

6.16 RCC Pipes

Description

The item shall consist of supplying and laying underground reinforced cement concrete pipes for sewerage and drainage and connecting to existing sewer or to the septic tank in accordance with these Specifications.

Construction Requirements

Concrete pipes shall have a minimum barrel thickness of 14 mm and conform to BS. 556.

Granular bedding shall consist of 12 mm down-graded brick chips.

Cement shall be Portland cement Type-I ASTM C-150, or BS-12
The work shall be carried out in accordance with British standard code of practice CP-301 'Building Drainage' and CP-2005 Sewerage. Pipes shall be laid in trenches at depths and slopes shown on plans. Unless otherwise specified the pipes shall have a slope of 2%. The pipes shall be laid in a straight line and at one gradient between manholes. No bend pipe shall be allowed. Inspection chamber shall be provided at all change of direction and gradient on pipe except where such change is not too large for cleaning. Manholes or inspection chambers shall also be provided at all pipe junctions where cleaning is not otherwise possible. The distance between the access

points in no. case shall exceed 50 meter. All branch pipes shall meet with the main line at manholes. No branch shall be permitted to enter into the main without inspection chamber.

The centre line and width of trench shall be accurately set out established by means of suitable pegs and reference points. Where the width of the trench is not specified it shall be 300mm greater than the external diameter of the pipe.

No less than 3 sight rails shall always be fixed by appropriate surveying method on each length of trench at any gradient to control excavation and laying.

The trench bottom shall always be kept free from water by suitable drainage and dewatering if necessary and the walls shall be supported by adequate timbering where so required. Excavated material shall be deposited at a safe distance from the edge of the trench so as not to endanger the stability of excavation. All pipes, ducts cables, mains or other services exposed in the trench shall be effectively supported by suitable means.

Where works are to be executed in the public highway, excavation shall be arranged in agreement with proper authority so as to cause the minimum obstruction to traffic. Proper warning and directions to traffic shall be given.

Trench shall be excavated and trimmed to a depth 150 mm below the invert level of the pipe. Pipes shall be laid on granular bed which shall extend to the full width of the trench to a thickness of 150 mm and adjusted to ensure exact line, level and uniform bearing. If the formation is in-advertently low at any point, it shall be brought up to the correct level by granular fill to ensure uniformity of pipe support. Soft spots, obstructions, and large roots shall be removed and tamped-in solid with approved fill to the satisfaction of the Project Manager with additional cost of material.

In short connection runs, where the ground is not wet and allows the trench formation to be trimmed so as to provide a uniform and solid bearing, the pipes may be laid upon the formation directly. The pipes shall be mortar-jointed using a 1:3 cement-sand mortar. Before mortar is inserted, a gasket of tarred yarn shall be caulked into the joint. Ends of the pipe shall be wetted immediately before jointing. Newly made joints shall be kept damp and protected from weather and disturbance until covered by the backfill. The interior of the pipe shall be examined as each joint is made and any intrusion of mortar or gasket removed. Where it is necessary to cut pipes this shall be done with a suitable tool so as to leave a clean end, square to the axis of the pipe.

Connection to the existing sewer and excavation around it shall be done only with express consent and in accordance with the instructions of the local authority. After installation, water seal tests are to be made without showing any leakage before backfill.

Backfilling shall be with sand F.M 1.0 built up in layers not exceeding 150 mm. Filling shall proceed downhill and in all other respect comply with the provisions of item 2.5.2 of Spec. civil.

All surplus excavated material shall be disposed of to the satisfaction of the Project Manager.

6.17 Inspection Chambers with RC.C Cover

Description

The item shall consist of constructing inspection chambers, on the underground drainage and sewerage lines where necessary, of dimensions as indicated and of suitable depth, in accordance with these specifications.

Construction Requirements

Materials shall conform to the requirements set forth below and in the relevant sections of the Material Specifications.

Bricks shall be 1st class solid bricks.

Cement shall be Portland cement Type-I ASTM C- 150 or BS-12

Stops irons shall be of galvanized malleable cast iron complying with requirement of BS1247 or of mild steel galvanized after manufacture by hot-dip process.

R.C.C cover and frame for manhole shall be of dimensions shown on the plans.

Excavation shall be as stated in item 2.5 of Spec. civil.

Brick flat under base concrete shall be as stated in item 2.6of Spec. civil. Concrete for base shall be constructed as stated under item 2.10 of Spec. civil.

Brickwork shall be as stated in item 2.13.1 of Spec. civil, &2.13.2 of Spec. civil constructed of 1st class bricks and (1:4) or (1:5) cement mortar as 'per requirement.

Plaster shall be as stated in item 2.16.1 of Spec. civil, 2.16.2 of Spec. civil and consist of (1:4) or (1:5) cement mortar as per requirement.

Brickwork of chamber shall be built in English bond with watertight joints. The inside shall be rendered with a neat-cement finished 12 mm thick coat of cement plaster and the exterior shall be flush pointed. The cover frame shall be correctly positioned and, cast-in during concreting.

Backfilling shall be done after at least 7 days of curing of brickwork and shall comply with the requirements of item 2.5.2of Spec. civil unless otherwise permitted to use the excavated material.

6.18 Water Tank

One overhead tank shall be provided for each substation the minimum requirements for which is provided below:

The tank should be of Blow Molded fabrication and should be strong and long lasting with a U. V. Stabilizer. The capacity of the tank shall be 2000 liters (440 Gallon). It should be installed on the concrete roof of the building. It should be capable of withstanding a temperature of 110° C.

6.19 Water pump

The water pump provided must be of the submersible type and should be capable of functioning satisfactorily under the particular site conditions. As a minimum it should conform to the particulars below:

Submersible AC Motor

Technical Particular's	**BREB Specification**
General Description	Pressure balanced submersible AC motor.
Motor type	Highly efficient 3 Phase AC motor
Internal filling	Water filling
Lubrication	Water lubricated
Electronics	Any electronics must not be inside the submersible motor
Bearing	Water lubricated slide bearing axial bearing: Carbon ceramic
Wetted material	Stainless steel (AISI304 or higher), Rubber (Drinking water
Voltage	3×100V electronically commutated
Input Voltage	440 V
Submersion limit	300 M
Rated Power	Minimum 3.70 KW
Rated Speed	1150 to 3425 RPM
Warranty	05 years or above.
Efficiency	92% or better

Submersible Pump end

Technical Particular's	**BREB Specification**
General Description	Submersible multistage centrifugal pump
Back flow protection	Non return valve
Dry run protection	Preset
Material	Body: Stainless steel (AISI 304) Impeller: SS (AISI 304)
Maximum flow rate	130m3/hr
Minimum borehole diameter	152mm minimum
Average daily flow at the static head and Bangladesh insulation condition	200,000 Litres per day.

Note: In Support of offered Specification, Printed Catalog must be submitted by bidder.

B. CIVIL

7.0 INTERNAL AND EXTERNAL ELECTRIFICATION

TABLE OF CONTENTS

Clause No.	Description	Page No
7.1	Scope of Work	
7.2	Standard, Code & Regulation	
7.3	System Structure, Equipment and Installation	
7.4	Main Distribution, Distribution & Sub-Distribution Board (MDB/SDB)	
412 7.5	Switch and Switch / Fan Regulator Board	
413 7.6	Socket/MCB Outlet	
413 7.7	Earthing	
414		
7.8	Service Illumination Levels	
7.9	Power Outlets	

7.1 Scope of Work

The electrical installation for each site comprises electrical wiring of light, fan, small power, ventilation power, water pump and all other utilities power supply in the substation building, switchyard, guard room and parking area. There shall be two types of power supply 4I5 V, 240 V 50 Hz i.e. 3-phase 4-wire and single-phase 2 wire.

The Contractor shall have to submit shop drawings on the basis of Consultants drawing for the project for each and every item of work. The Contractor shall submit at least one month prior to start of the particular part or parts of their work to the Project Manager for approval. Similarity the brand, country of origin, design and /sample of all equipment, material, fitting etc. as applicable and which are required for the building, either local or imported item shall have to be approved by the Project Manager. Before taking the item at site or before placing order (for imported items) for procurement, manufacturing etc. or shall be carried out without having such approval.

The bidder shall specify brand name, country of origin, model number etc. of all equipment and material and also attach original catalogue with the bid.

Scheduled quantity may vary as per site requirement. Quantity of some items have been shown as unity. These are only for fixing rate, in case these items are required to be executed, to avoid NT (Non Tendered Item).

7.2 Standard, Code & Regulation

The installation in general shall be carried out in conformity with the Electricity Rules of the Govt. of Bangladesh, Bangladesh National Building Code [BNBC] and the 16th edition of the Regulation for Electrical Equipment of Buildings of the Institute of Electrical Engineers (U.K), hereinafter referred as I.E.E. wiring Regulations, and the British Standard Code of practice for the relevant works. Any special requirement of the Electrical Inspector, Govt. of Bangladesh or the Power Development Board, Dhaka Electric Supply Authority, Dhaka Electric Supply Company, or the Telegraph and Telephone Board, or any other Legal Authority shall also be complied withno extra cost to the Employer.

The following standards, in addition shall be followed for design, manufacture, installation, testing and commissioning of wiring and the communication system of this project:

Bangladesh National Building Code	BNBC
International Electro technical Commission	IEC
Institute of Electrical and Electronics Engineers	IEEE
National Electrical Manufacturers Association.	NEMA
German International Standard	VDE
International Standard Organization	ISO
Japan International Standard	JIS
British Standard	BS

7.3 System Structure, Equipment and Installation

7.3.1 Conduit Work

7.3.1.1 Metal Conduit

Metal conduits shall conform to B.S. 4568 part 1 & part 2, or B.S. 31:100, and shall be 18 SWG (minimum) thick, either solid drawn or formed and then welded. In the later case, the bore must be free from any burs. The conduits shall be black enameled or galvanized. The steel shall be such that when bends are formed, the conduit shall not break, crack, or be deformed. Appropriate sample shall be submitted prior to installation of conduit.

G.I. Conduit

GI conduit shall be used in sized grade as shown on the drawing. Inside surface of the pipe must be free from any burs. All G.I. bends shall be preformed and shall be of same materials as the pipe. Recommended specifications of GI pipe are as follows:

Nominal pipe size (mm)	Outside dia. (mm)	Inside dia. (mm)	Wall Thickness (mm)	Weight of pipe (kg/m.)
25	32.875	26.225	3.325	2.50
37.5	47.5	40.25	3.625	4.05
50	59.375	51.675	3.85	5.45
62.5	71.875	61.725	5.075	8.63
75	87.5	76.7	5.40	11.28

Junction box, Pull box, Circular box, etc.

Junction box and pull box should be made of 16 SWG (minimum) galvanized steel sheet or any other materials as directed by the relevant authority depending on where it is installed, and to the satisfaction of the Project Manager, to match with the existing construction in which these are installed. The circular box shall be of brass/PVC. Circular boxes made of aluminum are not acceptable. The cover (metallic or plastic) of the metallic box should be fixed by using countersunk brass screws or galvanized machine screw. Box ears shall be at least 14 SWG, Each box (except circular boxes) must have an earth block of copper or brass of appropriate size (minimum), being for one earthing lead, 3/8"x3/8"x3/8" (l0mrnxl0mrnxl0mm) block with 3/16" (M5) drilled hole and 1/8" (M3) machine screw tapped for 24 t.p.i. where earth continuity conductors shall be screwed in. The circular box shall have at least $^{1}/_{2}$" (12mm) long hub.

Appropriate samples shall be submitted prior to installation of these boxes.

Conduit/Pipe Bends

Wherever possible, instead of using bends, the conduit should be bent to the required angle using pipe bender. The minimum bending radii shall be such as to allow compliance with standard specification for bends in cables, and in addition the inner radii of bends shall not be less than 2.5 times the outside diameter of the conduit.

Cable Bending Radius

The recommended bending ralii are given below:

Dia. of Conduit	Radius of Bends
20mm	125mm
25mm	150mm
32mm	200mm
38mm	225mm

If the situation warrants use of separate bends for conduit shall be made from 18 SWG steel, black enameled or galvanized. Aluminum bends must not be used Brass/PVC bends are acceptable. No inspection bends shall be used and at places where inspection is required, steel boxes shall be used.

Separate bends shall be used only after obtaining approval of the Project Manager.

In case of G.I. pipes, long radius preformed bends of the same materials and of required angle (221/20, 450, 600 & 900) shall be used.

G.I. pipe may be bent to required angle only after obtaining written approval of the Project Manager.

Conduit Termination and Fittings

At the end of a run, the conduit/G.I. pipe must terminate in a metal box, galvanized or black enameled. When a conduit is terminated in a metal box (except circular boxes), a smooth bore brass/PVC bush or ring bush must be used along with brass lock nuts of the following specification or its metric equivalent:

LOCK NUT

Conduit size (mm)	Thickness (mm)	O.D. (mm)	No. of threads
19	1.56	28.125	3
25	4.68	31.25	3

BUSH

Conduit size (mm)	C.D. (mm)	Length (mm)	No. of thread	Length of smooth bore at end (mm)
19	21.875	8.59	4	1.95
25	28.125	10.54	5	2.73

Installation

Metal / G.I. Conduit

In general, conduit pipes shall have surface installation at the truss member and shall be placed under the truss member to the satisfaction of the Project Manager.

Conduits of each circuit must be completely erected before any of the cables are drawn in. The pipe run should be continuous throughout its length, and kept straight as far as possible. It should run either horizontally or vertically, and never at an angle. The conduits are to be properly welded with the truss member at 1 Meter spacing using appropriate welding electrode and other consumables. If the pipes are installed exposed in wall/over false ceiling these shall be placed over 10mm space pipe diameter and clamped with saddle or M.S. flat bar 25mmx3mmat 1meter spacing using rope plug/ rowel bolt to the satisfaction of the Project Manager at no extra cost to the Employer.

All pipe runs should be kept clear of gas, air and steam pipes, and pipes of other services. To avoid other service pipes, the pipe should be either routed or set out so that at least 75mm separation is maintained between other pipes and electrical pipes. Conditions other than those stated above, if encountered by the Contractor, must be brought to the notice of the Project Manager for instructions.

Pipes installed in ground / R.CC. Floor shall be placed at the time of construction to the satisfaction of the Project Manager.

Pipes installed in R.CC. Wall and column shall be placed at the time of construction of the wall. No cutting in wall and column shall be allowed without prior approval.

7.3.1.2 PVC Conduit

PVC conduit must conform to NEMA TG2 or equivalent designed for installation of reinforcement and before casing in slabs, or exposed. These shall be heavy wall rigid type-40. The minimum dimensions shall be as per schedule of items and bill of quantities.

No PVC fittings shall have wall thickness at any point less than 2mm.

Installation

PVC Conduit

In general, conduit pipes shall be installed as peritem 4.1.3.1. Where PVC conduit uses fittings made of PVC fiber or other insulating materials, these shall be press fitted and then sealed with PVC solvent cement. Where metal fittings are used thread PVC pipe may be made by using the threads on the fittings as a die.

All exposed PVC pipe runs up to a height of 2 Meter from the floor shall be protected by a metal enclosure.
PVC pipes shall be bent either by using a pipe bending guide lines as detailed in item 4.1.3.1 or by using a hot-box bender or by using a flame. In any event, the bending radii shall conform to relevant portion of item 4.1.3.1 and the bend must be we formed and be without reduction in internal diameter.

Conduit *I* Pipe in Floor
All conduit / pipe shall be installed having a slope of 1:1000 towards the floor mounted pull box or cable duct so that condense or leakage water drains out easily to the pull box or cable duct. For runs of more than one conduit in the same floor the direction of slope of different conduits should be decided in such a systematic manner as to ensure an uniform drain out of the leakage. All socket joints shall be made water tight.
No U-bend in floor shall be installed.

7.3.2 Cable Work

Material:

Single Core Cable:

Single core low voltage cables and conductors shall be as per BS-6004, BS2004 and VDE 0250, 0271. Conductors shall have 450/750 Volt grade (for BYA cable) and 300/500 Volt grade (for BYM cable) of PVC insulation. All cables shall be multi strand type unless otherwise specified. All flexible cables shall be as per BS-6004 unless otherwise specified.

Multi Core Cables:

Multi-core low voltage cable shall be PVC insulated PVC sheathed copper conductor, termite proof, made and tested according to VDE 0250 and 0271 with rated voltage being 600/1000V.AlI cables shall be multi stranded unless otherwise specified.

Cables directly buried in soil shall be steel wire armored (SW A) type.

Installation:

Cable in Conduit:

Single core cables are to be installed either in metal or in PVC (water grade) conduit. The conduit size shall be as specified in the drawing. Separate conduit pipe must be used for individual discipline of supply and services cables, for example, normal power, essential power, telephone, paging, fire alarm etc. It must be ensured that cables are not scratched/ damaged during pulling. For long lengths, pull boxes must be used even if not indicated in the drawings.- Cable shall not be drawn round more than two 90 degree bends (or their equivalent) between two boxes in serial, and any single bend must not be less than 90^0.

Cable in Tray and Ladder:

Cables in tray or the ladder shall be installed according to design, specification, and standard andto the satisfaction of the Project Manager. Proper spacing shall be maintained for laying cable. Cables are to be fastened with tray or ladder by appropriate and approved type fasteners.

Cable in Trench:

Unless otherwise stated in design and schedule, generally the size of the trench shall be of minimum 825mm-depth and 450 mm width for each cable to be laid. Where more than one cable is to be laid in the trench, the width of the trench is to be increased by 150mm for each extra cable for size below 70-sq. mm and 300mm for bigger size cables.

A cushion of sand (F.M 1.5), 125 mm thick is to be placed over the bed of the trench over which the cables are to be laid.

After laying the cable, first class brick on edge or flat is to be placed as separators in between the cables. After installation of the brick separators, sand filling is to be carried out up to' 150 mm from the top of the bigger cable. After sand filling, one layers of first class brick flats are to be placed

along the length and breadth of the trench as a protection against injury. The rest of the trench shall be filled with earth, watered and rammed at 150mm layers. Then red plastic sheet of 0.5mm thick shall be placed throughout the trench as an indications that power cable(s) has been laid down. After cables are laid the original ground conditions shall be restored. But if brick pavement, drain, concrete road, or bituminous carpeted road are cut across or damaged, they shall be remedied and restored to the original specification.

The cable route shall be as direct as possible and shall receive the Project Manager's approval before excavation.

Cables shall always be laid out or laid into the ground through GI pipe of suitable size as decided by the Consultant. No extra cost shall be paid for such pipes. The exposed end of the pipes shall be sealed using PVC or wooden plugs.

Cable marker of approved type shall be provided in the cable trench 300mm below GL level, along the length of laid cable.

GI cable marker shall be installed at every turning point of the trench.

After the cable is laid, it shall be tested by the Contractor in presence of the Project Manager. If the test is unsatisfactory, the cost of all repairs and replacement shall be borne by the Contractor.

All surplus earth shall be removed by the Contractor at their own cost to the indicated places.

Any damage done to any other services by the Contractor for cable laying operations shall be made good by the Contractor, at their own cost.

All chasing and passages necessary for laying of cable indoor or outdoor shall be carried out by the Contractor and the same shall be made good to the satisfaction of the Consultant by the Contractor without any extra charge to the relevant Authority.

When trenches are left open overnight, and where the road shall be cut, the Contractor shall exhibit a suitable danger signal such as banners, red flags and red lamps at his own cost. Temporary arrangement by placing wooden sleepers/steel sheet etc. across the road cutting for vehicular traffic are also to be made by the Contractor at no extra cost. The Contractor shall be wholly responsible for any accident, which may occur due to the negligence of the Contractor.

All excavations shall be filled up in layers with powdered earth and suitably watered and rammed in such a manner that after completion of the work there is no land subsidence. The road top shall be re-constructed to match the existing road pavement.

No trench shall be dug until all cables meant for laying have been procured and brought at site store. Cost of any watering or shuttering and shoring of trench required to be done shall be borne by the Contractor.

Road Crossing:

At road crossings, the cable shall be protected from damages by passing the cable through metal or concrete conduit and protecting that conduit with appropriate road construction.

Cable Termination and Joint:

There shall be no twisted joint in the entire wiring system. Cables from 2.5 sq. mm and above sizes shall be terminated through cable lugs and with spring washer, nut etc. Cable gland shall be provided for cable termination at the entrance of boxes, panels, chambers etc. For armoured cables, earth tags shall be provided with cable gland, for connection with system earth or Earth Continuity Conductor (ECC).

Cable Bending Radius

Refer item 4.1.3.1

Connection to Switches:

The Switches or Isolators shall be provided at phase conductor only.

Cable Colour:

All cables used must have colour as stated below:

Two wire single phase A.C. system:

Red, Yellow or Blue for phase.
Black for neutral.
Green or Green-Yellow for Earth.

Three or four wire three phase A.C. system:

Red for first phase.
Yellow for second phase.
Blue for third phase.
Black for neutral.
Green or Green-Yellow for earth

Two wire D.C. system:

Red for positive or switch wire.
Black for negative.

For two wire final sub circuits.

Whether A.C. or D.C. supplying lighting or power circuits, the neutral or 'middle' wire shall always be black and the phase or outer wire (no matter which phase it is connected to) shall always be red. For lighting, the red wire shall always feed the switch, and the red wire shall always be used from the switch to the light.

Cable Identification:
All cables, all feeders or circuits in all distribution boards shall be provided with permanent and approved type of identification.

7.3.3 Earth Continuity Conductor (ECC)

7.3.3.1 Earth Continuity Conductor

Material

All ECC shall be insulated copper (BYA cable) as indicated in the schedule of items and bill of quantities. ECC shall be of white/green/green-yellow colored.

Installation

The earth continuity conductor and earthing lead shall run in accordance with the drawings and direction, and all metal fittings shall be earthed with continuity conductors. All the earth continuity conductors from various circuits, sockets, etc. shall be connected to the earthing block located within the MDB/SDB. Size of earth continuity conductors shall be as stated in the drawings. The earth continuity conductor shall be drawn along with the cables as per drawing and to the satisfaction of Project Manager and no joint shall be allowed from earthing block to the respective earth point. Light and fan points, except where indicated otherwise shall not be earthed.

7.3.3.2 Light Fitting

Material:

The light fitting shall be manufactured as per design, specification and schedule of items and BOQ and shall comply with the relevant requirements of standards, including BS 4533.

The chokes, if applicable, shall comply with the requirements of BS 2818, and shall have appropriate power factor correction capacitor (250V, 3.5 μF for 20W and 40W tubes), the improved P.F shall not be less than 0.90. In no case power consumption by the choke shall be more than 16W for magnify ballast.

The starters shall be 2 W-I amp type and shall have built-in radio interference suppressor capacitor.

All incandescent light fittings, except where specifically stated otherwise, shall have un switched brass holders, lamp caps, complying with BS 52.

Type of lamp and detail technical data of various categories of lamps shown in design and schedule shall be followed. Appropriate sample of light fitting with choke starter and any relevant control gear shall be submitted for approval, prior to installation.

The bidder must submit detailed technical specification supported by catalogue for all light fittings, lamps, and accessories. The country of origin or manufacturer's country, brand name, model number etc. details are also to be furnished with the bid.

Any special feature, or equipment or control gear, such as photocell switch, time switch, power supply support battery, frame for installation of lamp and fixture, remote control wiring and equipment, relay etc required for any lamp, shall be inclusive of the respective light fitting item. No extra charge claimed for any of such feature or support. The entire work shall be carried out as per design, standard, schedule of works and to the satisfaction of the Project Manager.

Installation:

The light fittings shall be installed in accordance with the applicable lighting layout drawings, and to the satisfaction of Project Manager.

All pendant fittings shall be supported from brass ceiling base plate with at least 100mm screw-hub.

The location of outlets shown in the design shall be considered as approximate and it shall be the responsibility of the Contractor, before installation of outlet boxes, to study all related drawings and obtain precise information from the architectural drawing and schedule. Outlets incorrectly located and lights improperly installed, or any mal-function of any lamp shall be properly relocated or replaced by the Contractor at the Contractor's expense.

7.3.4 Lamp Post

Material:

The G.I. pipe for lamp post shall be hot dip galvanized. The thickness of the pipe shall be as below:

Normal pipe size (mm)	Wall thickness (mm)
25	2.65
30	2.65
38	2.90
50	2.9
63	3.25
75	3.25
100	3.65
150	4.85

Installation

Fabrication, installation, testing and commissioning shall be done as per drawing, schedule and to the satisfaction of the Project Manager.

7.3.5 Ceiling Fan

Material:

Ceiling fans shall be of capacitor type, AC 240V single phase, 50Hz, complete with suspension rod of required length, canopy and shall be constructed in accordance with applicable B.S. The minimum air velocity for 1400mm fan at horizontal distance of 600mm from the fan center and vertical distance of 1950mm shall be 47meter minute. Appropriate sample of fan shall be submitted prior to installation for approval.

Installation:

The fans shall normally be installed at a height of 2550 mm from the floor and in accordance with the applicable fan layout drawings and to the satisfaction of Project Manager. Circular box with ceiling rose for fan outlet shall be at the center of the clamps.

Fan incorrectly located or any mal-function of any fan shall be rectified or replaced by the Contractor at their own expense.

7.4 Main Distribution Board& Sub-Distribution Board (MDB/SDB)

Material

The MDB/SDB shall be as per design, specification mentioned in the schedule items and bill of quantities. Panels shall be designed for operation on a 240/415V, 50Hz, 3 phase, 4 wire system. The panels and bus bars shall have clearly marked identification.

The panels shall have printed directory on frames and on/inside of door. The door is to be provided with flush lock handle. All doors are to be keyed alike. All hinges shall be concealed. All bus bar shall be isolated by proper voltage rating insulators from board body, & front side of bus bar must have protective paints. Provision for cable entry to the DB shall be from top, bottom and sides.

The MCB/MCCB's shall be quick-make, quick-break type, and shall have inverse time limit characteristics with instantaneous magnetic trip elements functioning on overload, earth fault and short circuit. All circuit breakers shall be 'trip free'. Ratings and frame sizes of breakers shall be in accordance with design and schedule. Each breaker shall be capable of carrying rated full load current continuously without exceeding temperature rise specified in the applicable IEC standard. Circuit- breaker insulation shall be coordinated with the DB structure and shall be designed for use on 600-volt system. The MCB must comply with BS 3871 part I category M3 (5 A-60 A). Rated voltage 240/415V, A.C.50Hz, minimum interrupting capacity 6000 amp as per B.S. and capable of providing overload and short circuit protection, through thermal and magnetic trip actions respectively. Temperature rating, of CB shall be *400* C, preferably tropicalised (moisture fungus corrosion treated), with contacts of silver alloy. The MCCB must comply with BS 3871; part 2. MCCB above 25 A TP shall be adjustable type.

The MCCB's shall have the minimum symmetrical interrupting capacity as per B.S. and IEC, at 415V A.C. if not indicated otherwise:

MCB up to 63A TP or SP shall have 6 KA rating. SDC (Switch Disconnector) up to 125 A TP is 3 KA, up to 250 A TP is 4.3 KA.

The continuous current rating of individual MCB/MCCB's may be varied within + 15% at the time of installation without any additional cost implication.

Installation:

The Board shall be installed in accordance with applicable layout drawing. Minimum height to bottom of the Board from the floor level shall be 600 mm and maximum height of any circuit breaker/switch shall be 1800 mm from the same level or as specified in the drawing. The minimum depth of MDB, DB or SDB etc. shall be in accordance with schedule of items and bill of quantity.

The location of MDB/SDB shown on design shall be considered as approximate and it shall be responsibility of the Contractor before installation of MDB/SDB to study all pertinent drawings and obtain precise information from the architectural drawings. MDB/SDB incorrectly located or any malfunction of any equipment, instrument in any board shall be properly relocated or replaced by the Contractor at the Contractor's expense.

Number of outgoing circuits in different panel boards may be varied by ±5% at the time of installation.

7.5 Switch and Switch / Fan Regulator Board

Material:

Switch board and fan regulator board shall be as per design, specification and schedule and shall have gang switches MK England and fan regulators. The switches shall be vertical, single pole (1-way/2-way) 5A A.C., white or approved color, to BS 3676, complying with the test requirements for inductive, fluorescent or resistive loads as specified, and satisfy the test requirements of fluorescent lamp circuits, up to the ratings of these switches, as set out in BS 3676 amendment 3. The switches must have minimum clearance of 3mm between the contacts, and a similar distance. All contacts shall be faced with pure silver/silver-cadmium oxide alloy. The switch operating member shall make the speed of 'make and break' independent of the speed at which the switch is operated. Sample shall be submitted for approval prior to installation of switches.

Each board shall have copper earthing block/blocks of suitable size with necessary connecting arrangement.

Installation:

The switch board and fan regulator board shall be installed on wall at a height of 1.5 meter, if not specified otherwise, from the floor and at locations shown in applicable layout drawings. The fan regulators shall be installed inside the box with regulator knobs projected over the covering, if not specified otherwise. The phase wire shall be connected to the switches and the neutral wire shall be kept solid in all switch connections. The ECC shall be connected to the earth point inside the switch boards. Approved size steel boxes shall be installed at the time of construction of the wall to avoid chisell in wall.

The location of board shown on design shall be considered as approximate and it shall be responsibility of the Contractor, before installation switch board/regulator board boxes, to study all pertinent drawings and obtain precise information from the architectural drawings and approved shop drawings of other trades. Switch boards/regulator boards incorrectly located shall be properly relocated at the Contractor's expenses.

7.6 Socket/MCB Outlet

Material

Socket outlets shall be white in color, and conforming to B.S.546: (3 pins) and B.S. 372: part 1 (2 pins). All switched sockets shall have pure silver/silver-cadmium oxide alloy contacts in which contact pressure shall be permanently, maintained by subsidiary helical compression spring. These shall be supplied with countersunk cadmium plated fixing screws and mounted in 18 SWG (1.5 mm) hammer painted sheet steel box having brass earth point as per drawing and direction. All switch and socket outlets shall be international standard type and shall be of same manufacturer. The country of origin of switches and sockets shall be USA, UK, Germany, French or Japan.

The Controlled sockets of MCB/MCCB, if applicable, shall be un switched and the box shall have earth point.

The lift indicator outlets shall be made of 16 SWG sheet steel, [stainless steel].

Installation:

The Socket/MCB/MCCB shall be installed on wall with lower end of the face plate at a height of 225mm (Skirting level) from the floor, if not specified otherwise, and locations shown in applicable design.

The fixing of the outlets boxes shall be by means of flat head cadmium plated screws. The flat head of the screw shall be sunk in the plates so as to finish flush with the surface of the cover. The mounting height of the outlet shall be as shown in the drawing. The earth wire shall be connected to earth point of the box to the 3rd pole of the 3-pin socket.

7.7 Earthing

Material:

Earthing Electrode:

a. Pipe Electrode

This would be 40mm dia. G.I. pipe with two 3mm dia. holes across the diameter at every 1200mm at the pipe.

b. Plate Electrode

This earth electrode shall be cold rolled double copper plate 600mmx 600mmx3mm having provision for connecting the earthing lead.

Earthing Lead:

Earthing lead shall consist of copper conductor as per specification given in 23. All terminal lugs shall be of copper and nut bolts of brass.

Earth Inspection Pit

The size of earth inspection pit shall be constructed as per drawings. The Pit cover shall be constructed by RCC slab with l0mm dia. MS rod. & having two holding hook of 20mm dia. MS rod. The designed drawing shall be submitted for the Project Manager's approval.

Installation:

Earth electrode:

a. Pipe Electrode:

The pipe earth electrode shall be buried below ground level, as per design and schedule by tube-well sinking method. The terminal connected to the earth electrode shall use a brass clamp. After making the connection, the clamp shall be covered with bitumen poured hot and covered with jute cloth.

b. Plate Electrode:

The plate earth electrode shall be buried below ground level as per schedule and installed in an

upright position, completely surrounded by a bed of at least 300mm of charcoal and packed hard. Distance between any two-earth electrodes shall be at least 8 meter.

Earthing Lead:

The earthing lead from the earth electrode shall be connected to the earth block in MBDB etc. A double run of specified copper conductor (preferably tinned) shall be brought out of earth electrode through GI pipe and connected to the earth block. All earthing leads shall follow the shortest and most direct route to earth electrode arid sharp bends shall be avoided. The earthing lead shall be made mechanically strong and electrically continuous and of minimum resistance. There shall be no joint in earthing lead conductor, between terminals.

Earth Inspection Pit

The earth inspection pit shall be constructed as per design, schedule and to the satisfaction of the Project Manager. The slab shall have level surface and the pit shall have well formed regular sides. Water curing for the slab and the pit shall be done for a minimum of 7 days.

Earth Loop Resistance test:

The maximum earth loop resistance from any point in the installation, including earthing lead to the earth electrode shall not exceed the resistance specified in the relevant standard of earth test. The Contractor must ensure that the leads are efficiently bonded to all metal works of the building other than the current carrying parts. It shall be the responsibility of the Contractor to provide earth tester, all equipment and supports, required for testing and test the installation in presence of the Consultant or authorized representative of the Authority & submit the earth test report to the relevant Authority for approval.

7.8 Service Illumination Levels

The lighting system shall be designed in accordance with the relevant standards to achieve the following levels of luminance.

Building Lighting

The following minimum luminance levels shall be provided.

Toilets	100 lux
Control / switchgear room	300 lux
Battery room	200 lux
Customer Serrviceroom	300 lux
Stores room	200 lux

The illumination levels at control of instrument panels shall be measured in a vertical plane at the panel location.

Emergency Lighting

An emergency lighting system shall be installed to provide the following.

Control / relay Room	50 lux
Customer Serrviceroom	50 lux
Workshop	50 lux

An emergency exit light shall be mounted above each exit/entrance.

Switchyard Lighting

The following minimum service illumination levels shall be provided;

General switchyard lighting	20 lux
At control panels and marshaling boxes	50 lux

7.9 Power Outlets

Power Outlets shall be installed in accordance with the relevant standards and according to the following tables. The actual location shall be determined during the detailed design stage with the approval of the Project Manager.

Table 1 Switchyard (New and Rehabilitated Substations)

	Amp	Nos.	
1 ø	30	6	General Area
3 ø	100	2	Transformer Area

Table 2 Building for New 10 MVA Substations

	Amp	Nos.
1 ø	10	6
	30	6
3 ø	50	1

Table 3 Building for New 5 MVA Substations and Augmented Substations

	Amp	Nos.
1 ø	10	3
	30	4
3 ø	50	1

C. MISCELLANEOUS

8.0 DESKTOP/LAPTOP COMPUTERS & ACCESSORIES

TECHNICAL REQUIREMENT AND GUARANTEE SCHEDULE
For Desktop/Laptop Computers & Accessories

(To be filled up by the tenderer with appropriate data, otherwise the Tender will be rejected) Failure to provide all of the information requested may lead to the rejection of the tender.

Technical Particular's	BREB Specification	Guaranteed
Desktop Computer (Brand)		
Brand	Internationally Reputed Brand	
Model	To be Mentioned by bidder	
Country of Origin	To be Mentioned by bidder	
Processor	Intel core i5 4th Generation or Higher	
Speed	3.10 GHZ or Higher	
Cache	6 MB or Higher	
Chipset	Intel Express Chipset or Higher	
RAM	4GB High-Speed DDR-3 RAM, Expandable up to 8 GB	
HDD	Min. 500 GB, SATA, 7200 RPM (Min) or Higher	
LAN Card	Integrated-10/100/1000	
Expansion Slots	1 PCI (Conventional), 1 PCIeX1, 1PCIe X 16, 4 SATA Connector	
Ports	USB Port Minimum-6 (2 Front USB 2.0 ports & 4 Rear USB 2.0), 1 VGA Display connector, RJ-45 etc.	
Graphics (AGP)	Built-in	
Audio (Sound Card)	Built-in	
Speakers	Built-in High Definition audio codec or external Speaker	
DVD-RW Drive	16XDVD Writer or Higher	
Monitor	18.5" LED Color, Same Brand	
Key-Board	USB enhanced, Same Brand	
Mouse	USB Optical Mouse, Same Brand	
Casing	Tower, Drive Bay: 3X3.5" & 2X5.25"	
OS Support	Windows7/WindowsXP/Windows Vista	
Software	Windows7/XP/Vista, Office & Other Software as per site Requirements.	
Accessories	Dust Cover, Driver DVD (Copy) & Manual & Heavy duty Power supply strip (Multiple pin plugs supported), All necessary power and data connection cable.	

Technical Particular's	BREB Specification	Guaranteed Specification
Antivirus	Internet Security Antivirus, License for 1 year	
Warranty	3 Years (Full)	
Laptop (Note Book) Computer		
Brand	Internationally Reputed Brand	
Model	To be Mentioned by bidder	
Country of Origin	To be Mentioned by bidder	
Processor	Intel core i5-4200M or Higher	
Speed	2.5 GHz or Higher	
Cache	3 MB L3 Cache.	
RAM	Min. 4GB DDR-3, 1333 MHz	
Display	Min. 14" HD LED Brightview Display (1366X764)	
Grapchics	Intel HD Graphics	
Hard Disk	500 GB SATA or Higher	
DVD Drive (Combo)	DVD+/-RW	
Sound System	To be mentioned	
Keyboard	Full-size 85 Keys US Keyboard.	
Mouse	Integrated pointing device with touch pad.	
Modem	Wireless	
NIC	In-built with 10/100/1000	
Web cam	Integrated	
Slots	1 Multi-Format Digital Media Card Reader for Secure Digital cards, Multimedia Cards	
Expansion Ports/Interface	3 USB 2.0, 1 GVA, 1 Microphone in, 1 headphone-out, 1 RJ-45	
Battery	6-cell Lithium-ion Battery with 3 Hours Back-up time.	
Power Supply	Universal 100-240V AC Adaptor for worldwide usage.	
Operatinng System	Free Dos	
Carrying Case	Including Original Carrying Case	
Standard	ISO, CE & FCC Class-B.	
Warranty	3 Years (1 year full and 2nd& 3rd year service only)	

Technical Particular's	BREB Specification	Guaranteed Specification
UPS (Un-interruptible Power Supply)		
Brand	Internationally Reputed Brand	
Model	To be Mentioned by bidder	
Country of Origin	To be Mentioned by bidder	
Capacity	600 VA or Higher	
Backup time	Minimum 30 Min. in half load &Minimum 15 min in full	
Input Voltage range	170-265V AC.	
Frequency	50 Hz ± 5%	
Protection	Fuse.	
Out put voltage	230V AC, 50 Hz, ± 5%	
Transfer time	<5 ms typically (Max.).	
Battery type	Lead acid.	
Recharge time	8 hrs to 90% after fully discharge.	
DC Start up	Yes.	
Protection	Built-in Automatic voltage Regulator with lighting surge protection, Spike burnouts, over voltage & under Voltage Cut-off, Battery low & Over charge protection & Surge protection.	
Standard	FCC Class-A	
Warranty	3 Years (01 year Full and 2nd& 3rd year Service only)	

Note: In Support of offered Specification, Printed Catalog must be Submitted by bidder.

C. MISCELLANEOUS

9.0 AIR CONDITIONER

TECHNICAL REQUIREMENTS FOR AIR CONDITIONER

Four Split Type air conditioners of capacity 2 Tons each shall be provided for each control room. Each unit shall conform to the following specifications:

Technical Particular's	BREB Requirements
Brand	Internationally Reputed Brand
Model	To be Mentioned by bidder
Country of origin	To be Mentioned by bidder
Cooling Capacity (BTU/HR)/Ton	24000/2
Power Supply	230V+/-5%, 50 HZ
Power Input (Watt)	2400W (Max.)
Current (Amp)	10.8 A (Max.)
Indoor Air Circulation (CBM/H)	1100 (Min.)
Temperature Control	Thermister
Auto Air Swing	2-way to be provided
Minimum Noise Level Db(A)	Indoor Unit: less than 45 db. Outdoor Unit: less than 55 db.
Remote	More than 10 meters remote control distance. Remote handset: LCD display with night glow.
Installation	Bidder will complete the first time installation.
Refrigerant	Environment-Friendly
Type of Compressor	High quality and approved brand with rotary type compressor
Other	o Elegant panel design, with LED/LCD central Display. o Galvanized outdoor unit or plastic outdoor unit for anti-corrosion. o Flat panel for easy cleaning, washable plastic filter and horizontal auto louver.
Warranty	One year replacement of all components free of cost and next two years Service free.
Supporting documents	Must be supported by printed Catalogue/Manual.

C. MISCELLANEOUS

10.0 CONTROL ROOM FURNITURE

TECHNICAL REQUIREMENTS FOR CONTROL ROOM FURNITURE

Item	Quantity
Table with Side Rack, TSR-2 **Size: Table:** 1800×800×750H mm, **Side Rack:** 1050×400×750H mm Made of stratch proof pesticide treated MFC/Melamine coated liminated Board of Beech-graphite color. Table top of 30 mm and other panels are 18 mm thickness. Edges of panels and top are to be sealed by 2 mm PVC edging by Automatic edge bending machine. Top and panels should be joined by using housing, dowel, bolt, jibe screw, T.nut & pneumatic nailing where necessary \. PVC stopper to be used at the bottom of Table. Knockdown facility with fixing manual is a mandatory with drawer unit	1 Nos. for each sub-station
Revolving Chair RC-1 **Size:** 500×570×1140H mm Foam cushioning with foreign leather upholstery upon a contoured high back, tilt & locking system. Chemically de-rusted, Zinc phosphate coated oven baked (150°-200°C). Electro-static powder paint finished mild steel structure. Gas lift system. Design as per photo image. Color of leather to be approved by the authority.	1 Nos. for each sub-station
Visiting Chair VC-1 **Size:** 560×600×900H mm Made of Foam cushioning with foreign rexene upholstery. Arm with foam cushioning with leather. Structure made of cold rolled mild steel round tube which is chemically de-rusted with Zinc phosphate coated oven baked (150°-200°C). Electro-static powder paint finished. The tube structure should be V-shaped, cantilever type and the diameter for tube must be 1.25" & with PVC stoppers. Design as per photo image. Color of rexene to be approved by the authority.	4 Nos. for each sub-station
File cabinet (3 Drawer) **FC-1 Size :** 476×610×1069 mm. Made of high-grade cold rolled steel steet of .7mm (22 SWG) thickness reinforced with stiffeners equpped. High strength drawer channels, nylon drawer grip with three drawers high quality central locking system. All sheets chemically de-rusted, zinc phosphate coated with oven baked (150°-200°C), electrostatic paint finished. Design as per photo image. Color of cabinet to be approved by the authority.	1 Nos. for each sub-station

Computer Table CT-1 **Size:** 620×530×1020H mm Made of scratchproof pesticide treated MFC/Melamine coated laminated Board of Beech color. Table top of 18 mm and other panels are of 16 mm thickness. strong PVC Edging done by Automatic bending machine. Sliding Key-board tray and drawer with locking system. Half shelf for UPS/Stabilizer. Top and panels should be joined by using housing, dowel, bolt, jibe screw, T.nut & Pneumatic nailing where necessary. PVC	1 Nos. for each sub-station

Note: In Support of offered Specification, Printed Catalog must be submitted by tenderer.

C. MISCELLANEOUS

11.0 FIRE DETECTION & PROTECTION FACILITI

FIRE DETECTION & PROTECTION FACILITIES

11.1 Design Requirements

All fire protection installations shall comply with the requirements of the codes of practice of the National Fire Protection Association, Boston, Massachusetts, U.S.A. as appropriate for the respective systems, subject to the approval of the Project Manager. The Codes and practice of the Japanese Fire Protection may also be considered.

11.2 Fire Detection and Alarm system

Fire detection shall be by means of smoke detectors/heat detectors with a backup system utilizing rate-of-rise temperature detectors along with alarm system. The system and its components must conform to the applicable appropriate standards. The use of these detectors shall be subject to specific approval by the Project Manager as regards their type and location.

(a) Fire Alarm Panel: 16 Zone Capacity:

Supply and Installation of 16 Zone Conventional Fire alarm control panel with power supply unit, batteries and other accessories. The panel shall be complete with zone indicating LED, Fault Indication and optional telephone Jack etc. The pane shall be input 220V AC and output 24V DC. Panel shall be confirmed UL Listed or EN54.

Country of Origin: Japan / Italy / UK / USA or equivalent approved by the Project Manager.

(b) Fire Alarm Bell:

Supply and installation of Conventional type Fire Alarm Bell of 150mm dia, red color, shall be UL / ULC / CSFM / FM / MEA / BFP / EN54 approved. Power supply shall be 24VDC. Sound level shall be not less than 92 dBA @ 3meter.Color of the Bell shall be red.

Country of Origin: Japan / Italy / UK / USA or equivalent approved by the Project Manager.

(c) Optical / Photoelectric Smoke Detector:

Supply and installation of Smoke Detector complete with base. Shall be UL / ULC / CSFM / FM / MEA / BFP / EN54 approved. Integrated alarm LED. Remote LED connection. Power supply shall be 24VDC.

Country of Origin: Japan / Italy / UK / USA or equivalent approved by the Project Manager.

(d) Heat Detector:

Supply and installation of Heat Detector complete with base. Shall be UL / ULC / CSFM / FM / MEA / BFP / EN54 approved. Integrated alarm LED. Remote LED connection. Power supply shall be 24VDC.

Country of Origin: Japan / Italy / UK / USA or equivalent approved by the Project Manager.

11.3 Fire Extinguisher

(a) Dry Chemical Powder Type:

Supply & fixing the multipurpose ABCE dry chemical powder stored pressure type with manometer system. Fire Extinguisher suitable for repeated use complete with wall bracket, discharge valve, hose pipe, easy refilling system etc. as per sample approved by the Project Manager.

Country of Origin: China / Malaysia or equivalent approved by the Project Manager.

Quantity: Two (2) portable 6 kg dry powder fire extinguishers shall be located adjacent to each power transformers.

(b) Carbon-Di-Oxide Type:

Supply & fixing the Carbon-di-Oxide type Fire Extinguisher suitable for repeated use complete with wall bracket, manometer etc. as per sample approved by the Project Manager.

Country of Origin: China / Malaysia or equivalent approved by the Project Manager.

Quantity: Two (2) portable 5 kg stored pressure carbon dioxide types shall be located inside the control room and one (1) portable 5 kg stored pressure carbon dioxide types shall be located inside the Customer Services room.

11.4 Sand Buckets

The Bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to NFPA Codes and Standard.

6.3 Form of Completion Certificate

Contract No: Date:
To:

[Name of Contractor]

Pursuant to GCC Clause 39 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, for the supply and installation of plant and Services for *[name of contract],* we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: _____

2. Date of Completion: _____

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

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

Very truly yours,

for and on behalf of the Employer

[***Signature***]

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

6.4Form of Operational Acceptance Certificate

Contract No: Date:
To:

[Name of Contractor]

Pursuant to GCC Clause 40.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, for the supply and installation of plant and Services for *[name of contract],* we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: _____

2. Date of Operational Acceptance: _____

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

Very truly yours,

for and on behalf of the Employer

[***Signature***]

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

6.5 Form of Change Order Procedure and Forms

Contract No: Date:
To:

[Name of Contractor]

CONTENTS

1. General
2. Change Order Log
3. References for Changes

ANNEXES

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

Change Order Procedure

1. General

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

2. Change Order Log

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

3. References for Changes

(1) Request for Change as referred to in GCC Clause64 shall be serially numbered CR-X-nnn.

(2) Estimate for Change Proposal as referred to in GCC Clause 64 shall be serially numbered CN-X-nnn.

(3) Acceptance of Estimate as referred to in GCC Clause 64 shall be serially numbered CA-X-nnn.

(4) Change Proposal as referred to in GCC Clause 64 shall be serially numbered CP-X-nnn.

(5) Change Order as referred to in GCC Clause 64 shall be serially numbered CO-X-nnn.

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

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

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

Annex 1. Request for Change Proposal
(Employer's Letterhead)

To: Date:
Attention:
Contract Name:
Contract Number:

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

1. Title of Change: _____

2. Change Request No. _____

3. Originator of Change: Employer: _____
   Contractor (by Application for Change Proposal No. _____[1]:

4. Brief Description of Change: _____

5. Facilities and/or Item No. of equipment related to the requested Change: _____

6. Reference drawings and/or technical documents for the request of Change:

   Drawing No./Document No. Description

7. Detailed conditions or special requirements on the requested Change: _____

8. General Terms and Conditions:

   (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.

   (b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.

   (c) If you have any opinion negative to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.

   (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.

   (e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

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

Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GCC Sub-Clause64.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub-Clause64.2.2, is required before estimating the cost for change work.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Brief Description of Change: _____

4. Scheduled Impact of Change: _____

5. Cost for Preparation of Change Proposal: _____[2]

   (a) Engineering (Amount)

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

   Total Engineering Cost

   (b) Other Cost

   Total Cost (a) + (b)

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

[2] Costs shall be in the currencies of the Contract.

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

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

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Estimate for Change Proposal No./Rev.: _____

4. Acceptance of Estimate No./Rev.: _____

5. Brief Description of Change: _____

6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause64 of the General Conditions.

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

Annex 4. Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

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

1. Title of Change: _____

2. Change Proposal No./Rev.: _____

3. Originator of Change: Employer: *[*_____
   Contractor: _____

4. Brief Description of Change: _____

5. Reasons for Change: _____

6. Facilities and/or Item No. of Equipment related to the requested Change: _____

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

   Drawing/Document No. Description

8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:[3]

(Amount)

   (a) Direct material

   (b) Major construction equipment

   (c) Direct field labor (Total _____hrs)

   (d) Subcontracts

   (e) Indirect material and labor

   (f) Site supervision

   (g) Head office technical staff salaries

   Process engineer _____hrs @ _____ rate/hr
   Project engineer _____hrs @ _____ rate/hr
   Equipment engineer _____hrs @ _____ rate/hr

[3] Costs shall be in the currencies of the Contract.

Procurement _____hrs @ _____ rate/hr
Draftsperson _____hrs @ _____ rate/hr
Total _____hrs

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

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

(j) Taxes and customs duties

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

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

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

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

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

13. Other terms and conditions of this Change Proposal:

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

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

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

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

[2] Specify where necessary.

Annex 5. Change Order

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We approve the Change Order for the work specified in the Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with GCC Clause64 of the General Conditions.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Change Order No./Rev.: _____

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

5. Authorized Price:

   Ref. No.: _____ Date: _____
   Foreign currency portion _____ plus Local currency portion _____

6. Adjustment of Time for Completion

   None Increase _____ days Decrease _____ days

7. Other effects, if any

Authorized by: _____ Date:
(Employer)

Accepted by: _____ Date:
(Contractor)

Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause64 of the General Conditions.

1. Title of Change: _____

2. Employer's Request for Change Proposal No./Rev.: _____ dated: _____

3. Contractor's Change Proposal No./Rev.: _____ dated: _____

4. Brief Description of Change: _____

5. Facilities and/or Item No. of equipment related to the requested Change: _____

6. Reference Drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description

7. Adjustment of Time for Completion:

8. Other change in the Contract terms:

9. Other terms and conditions:

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

Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

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

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

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

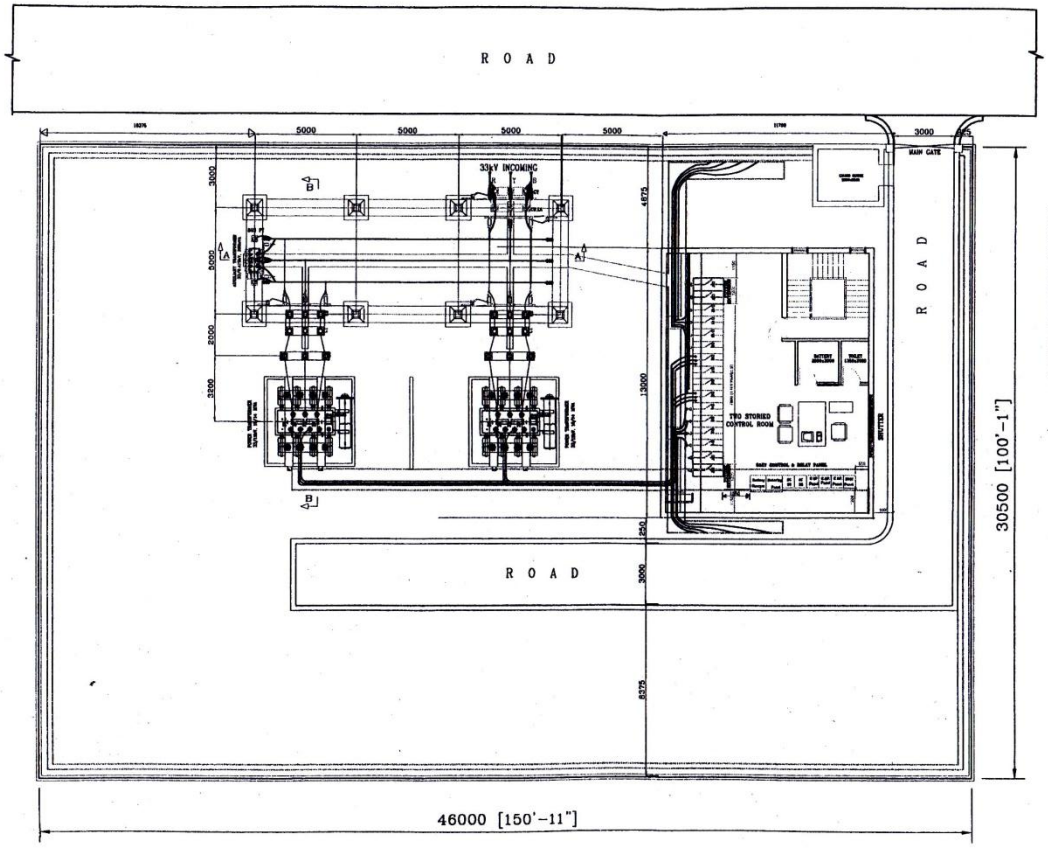
Signature Seal

Section 7. Drawings

ALL DIMENSIONS ARE IN mm

INDICATIVE DESIGN OF 33/11 KV INDOOR TYPE SUB-STATION

BANGLADESH RURAL ELECTRIFICATION BOARD



LEGEND	
11kV CIRCUIT BREAKER PANEL	
D1 = FEEDER PANEL-O/G-1	D8 = TRANSFORMER PANEL-I/C-2
D2 = FEEDER PANEL-O/G-2	D9 = FEEDER PANEL-O/G-5
D3 = FEEDER PANEL-O/G-3	D10= FEEDER PANEL-O/G-6
D4 = FEEDER PANEL-O/G-4	D11= FEEDER PANEL-O/G-7
D5 = TRANSFORMER PANEL-I/C-1	D12= FEEDER PANEL-O/G-8
D6 = BUS RISER PANEL	D1'/D2'/D3'/D4'= FUTURE PROVISION
D7 = BUS COUPLER PANEL	

TYPE-B, 2x10/14MVA (In only, no out)

FUTURE PROVISION

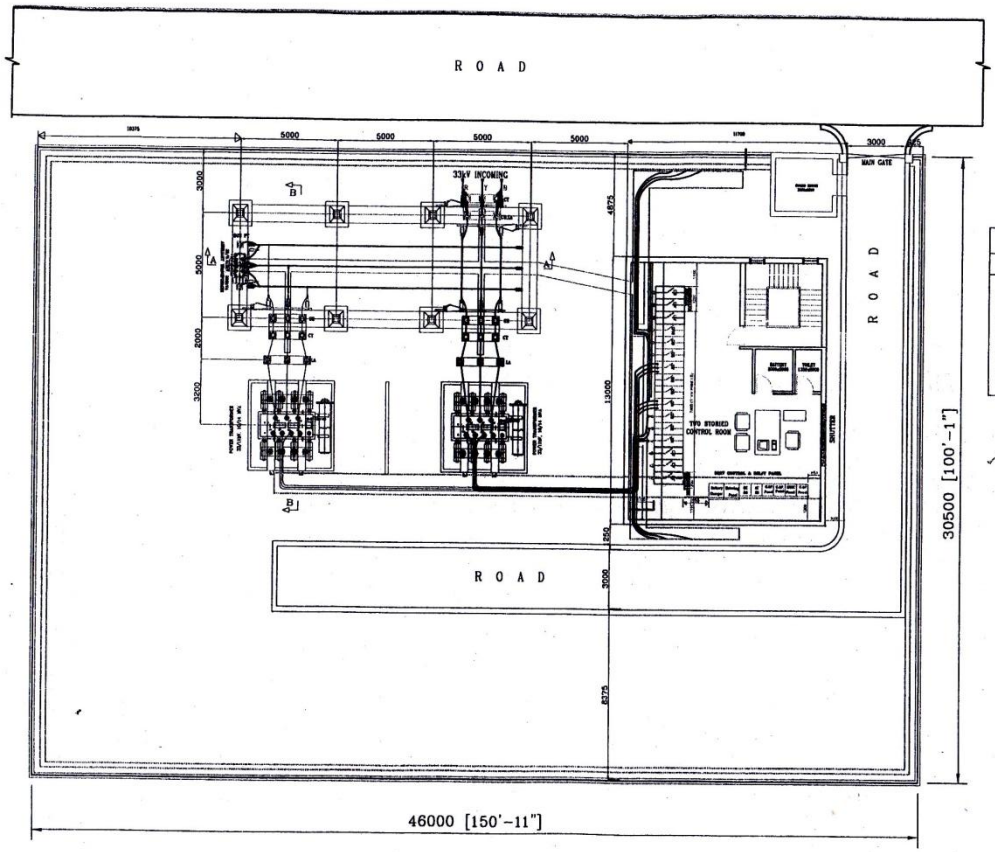
Executive Engineer Sub-Station Cell	Superintendent Engineer Grid & Sub-Station	Director SE&D	Chief Engineer (P&O)	Chief Engineer (Project)	Member (P&D)
20.10.15		20/10/15			

TITLE : LAYOUT PLAN OF 33/11kV SUBSTATION.

ALL DIMENSIONS ARE IN mm

INDICATIVE DESIGN OF 33/11 KV INDOOR TYPE SUB-STATION

BANGLADESH RURAL ELECTRIFICATION BOARD



LEGEND	
11kV CIRCUIT BREAKER PANEL	
D1 = FEEDER PANEL-O/G-1	D8 = TRANSFORMER PANEL-I/C-2
D2 = FEEDER PANEL-O/G-2	D9 = FEEDER PANEL-O/G-5
D3 = FEEDER PANEL-O/G-3	D10= FEEDER PANEL-O/G-6
D4 = FEEDER PANEL-O/G-4	D11= FEEDER PANEL-O/G-7
D5 = TRANSFORMER PANEL-I/C-1	D12= FEEDER PANEL-O/G-8
D6 = BUS RISER PANEL	D1'/D2'/D3'/D4'= FUTURE PROVISION
D7 = BUS COUPLER PANEL	

TYPE-C, 1x10/14MVA (In only, no out)

FUTURE PROVISION

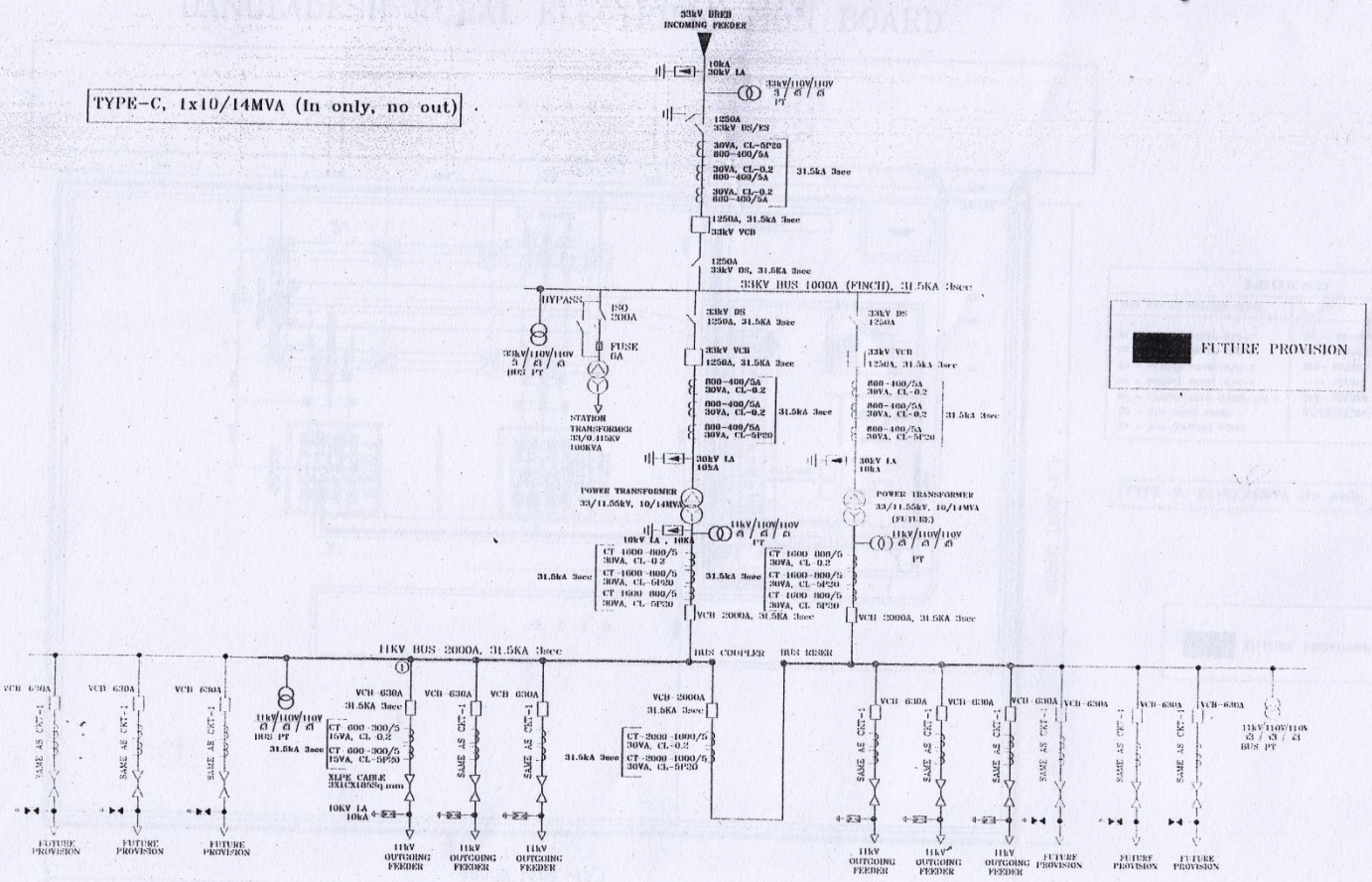
Executive Engineer Sub-Station Cell	Superintendent Engineer Grid & Sub-Station	Director SE&D	Chief Engineer (P&O)	Chief Engineer (Project)	Member (P&D)
20.10.15		20.10.15			

TITLE : LAYOUT PLAN OF 33/11kV SUBSTATION.

INDICATIVE DESIGN OF 33/11 KV INDOOR TYPE SUB-STATION

BANGLADESH RURAL ELECTRIFICATION BOARD

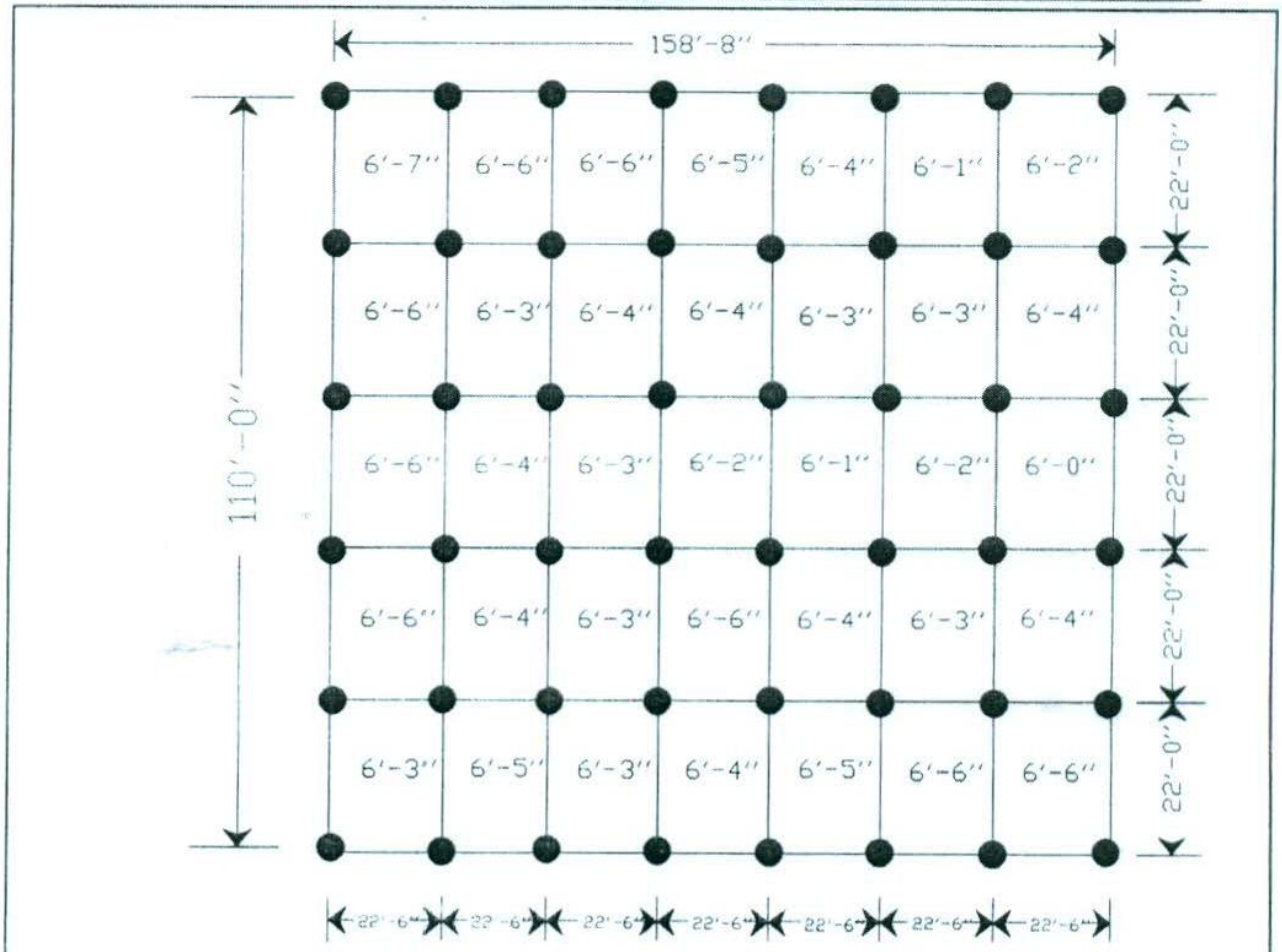
TYPE-C, 1x10/14MVA (In only, no out)



Executive Engineer Sub-Station Cell	Superintendent Engineer Grid & Sub-Station	Director SE&D	Chief Engineer (P&O)	Chief Engineer (Project)	Member (P&D)
20.10.15		20.10.15			

SINGLE LINE DIAGRAM OF 33/11kV SUBSTATION.

PRE-CONTOUR OF KUSHTIA-05(LAHINI)
NEW 10MVA SUB-STATION UNDER KUSHTIA-PBS



= 158'-0" X 110' -0"X 6'-3"(AVERAGE HIGHT)

=108464 cft

= 3072 cum (2'-0" Above Road)

= 2087 cum (Road Level)

19.12.19
(মোঃ মহিউদ্দিন)
নির্বাহী প্রকৌশলী
পাবিবো, কুষ্টিয়া।

BM= Top of the pitch road (To be filled 4'-3")

FGL= 6'-3" (2'-0" Above the road)

BANGLADESH
RURAL ELECTRIFICATION BOARD

KUSHTIA PBS	
Consultant:TechSuS-MuM (JV)	
Drawn by: MD. ABU SAYED	Checked by: MD. SHAHJAHAN ALI
SCALE : NTS.	DATE

Md. Abdul Momin)
Supervision Engineer
echsus-MuM (JV) Consultant
Kushtia PBS

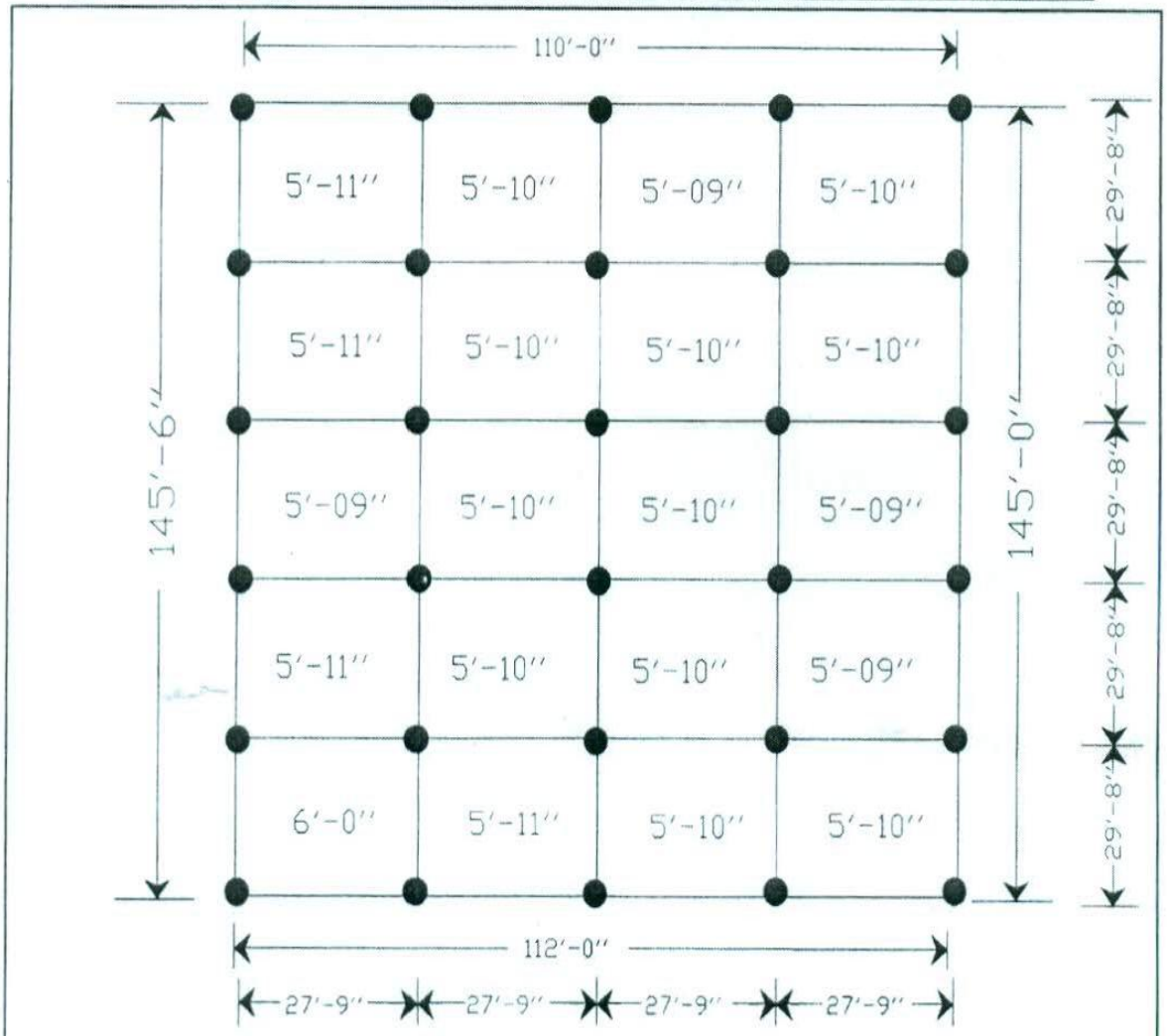
Md. Shahjahan Ali
Project Engineer
Techsus MuM (JV) Consultant
Kushtia PBS.

19.12.19
Engr. Ranjan Kumar Ghose
DGM (Tech-HQ)
Kushtia PBS.

জেনারেল ম্যানেজার
পল্লী বিদ্যুৎ সমিতি

13.12.19
মোঃ আজাদুজ্জামান
সহকারী প্রকৌশলী
পাবিবো, কুষ্টিয়া।

PRE-CONTOUR OF MIRPUR-03(AMLA)
NEW 10MVA SUB-STATION UNDER KUSHTIA-PBS



= 145'-3" X 111' -0"X 5'-10"(AVERAGE HIGHT)

=94044 cft

= 2663 cum (2'-0" Above Road)

= 1750 cum (Road Level)

20.01.2020
(মোঃ মহিউদ্দিন)
নির্বাহী প্রকৌশলী
আপবিবো, কুষ্টিয়া।

BM= Top of the pitch road (To be filled 3'-10")

FGL= 5'-10" (2'-0" Above the road)

BANGLADESH
RURAL ELECTRIFICATION BOARD

20/01/20
Md. Shahjahan Ali
Project Engineer
Techsus-MuM (JV) Consultant
Kushtia PBS

20.01.2020
Engr. Ranjan Kumar Ghose
DGM (Tech-HQ)
Kushtia PBS.

20/01/20
মোঃ হারুন-অর-রশিদ
জেনারেল ম্যানেজার
কুষ্টিয়া পল্লী বিদ্যুৎ সমিতি

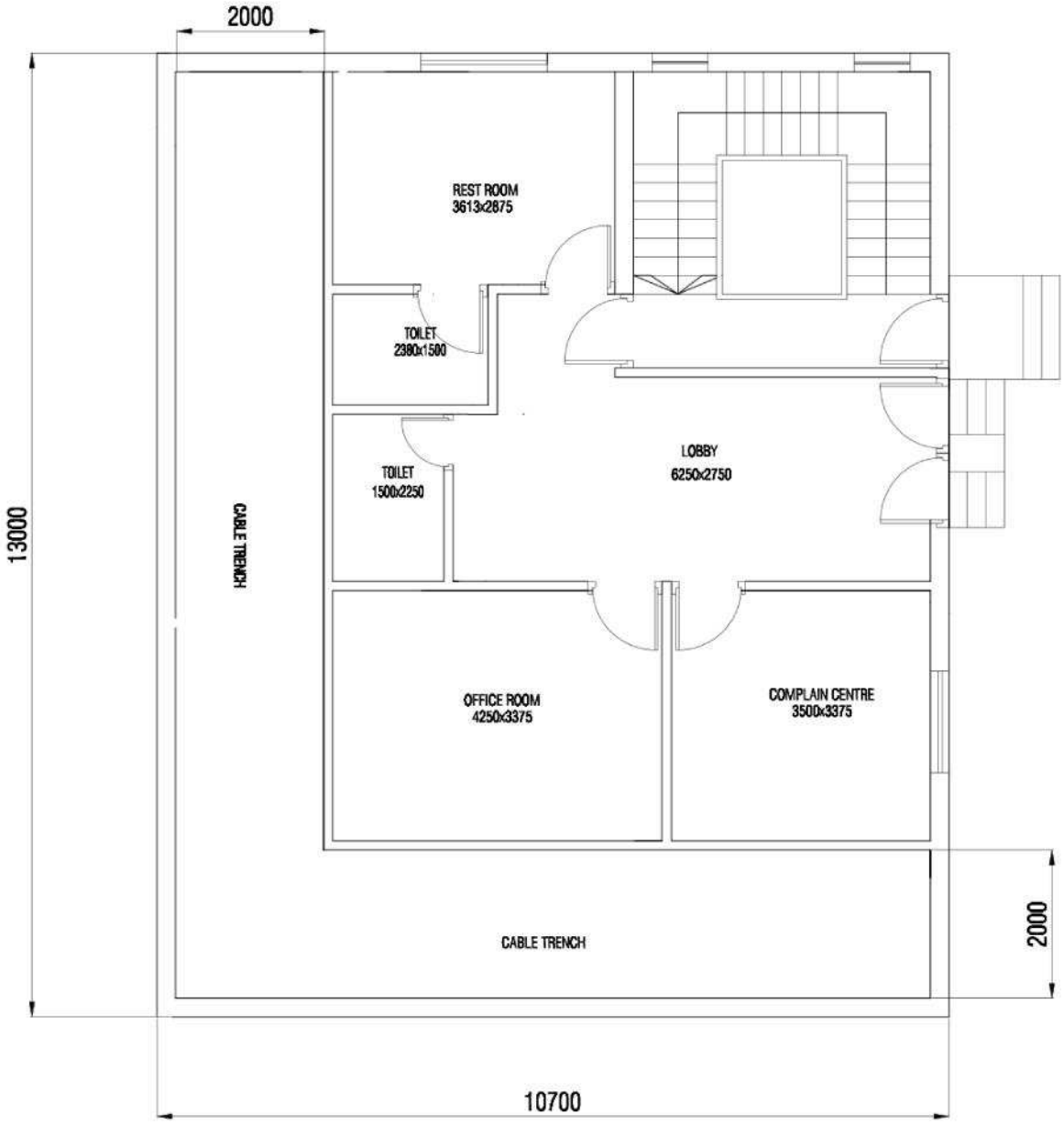
20/1/2020
(Kh. Md. Abdul Momin)
Supervision Engineer
Techsus-Mum (JV) Consultant
Kushtia PBS

7.12.19
মোঃ আজাদুজ্জামান
সহকারী প্রকৌশলী
আপবিবো, কুষ্টিয়া।

KUSHTIA PBS	
Consultant:TechSuS-MuM (JV)	
Drawn by: MD. ABU SAYED	Checked by: MD. SHAHJAHAN ALI
SCALE : NTS.	DATE

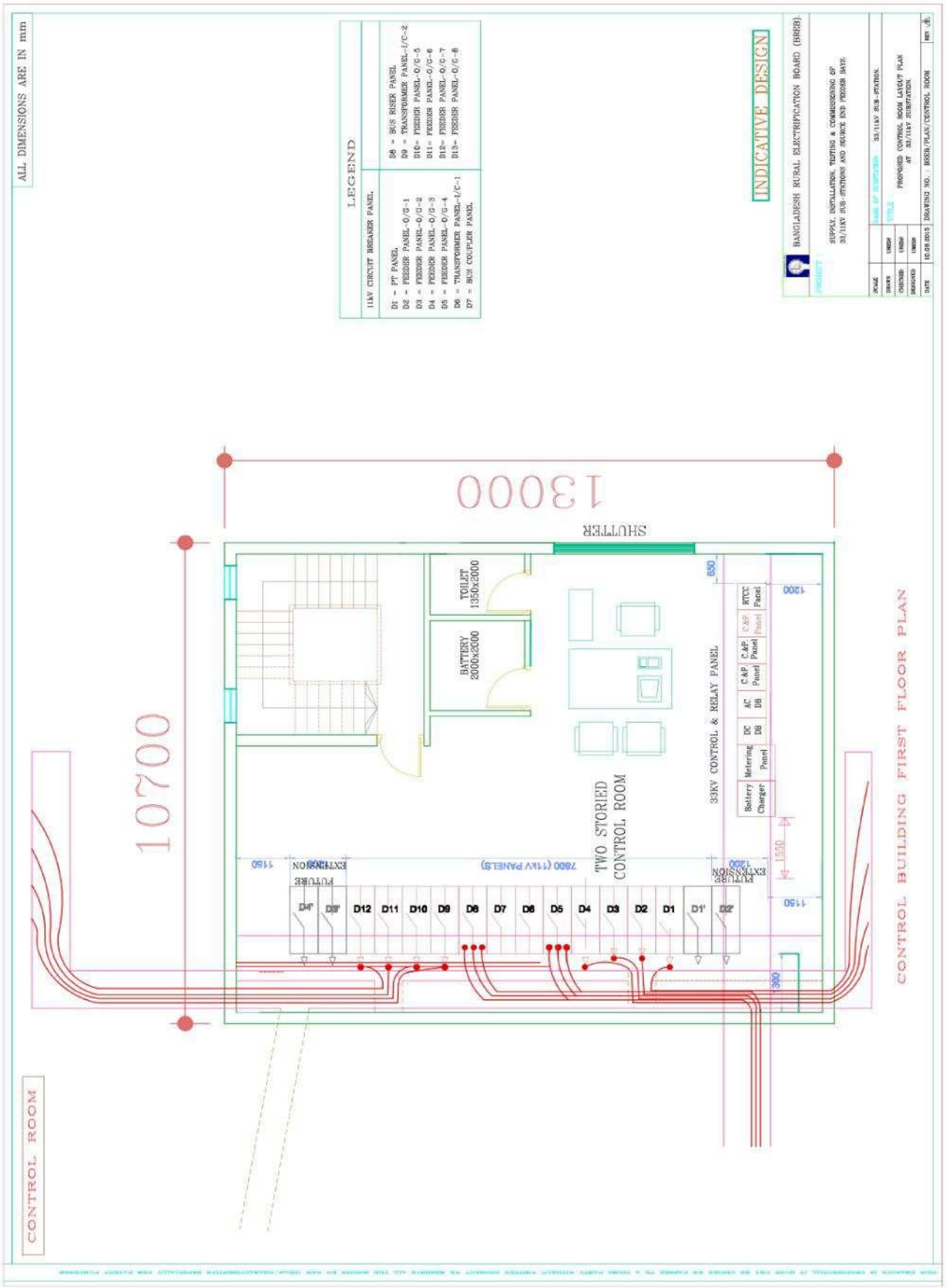
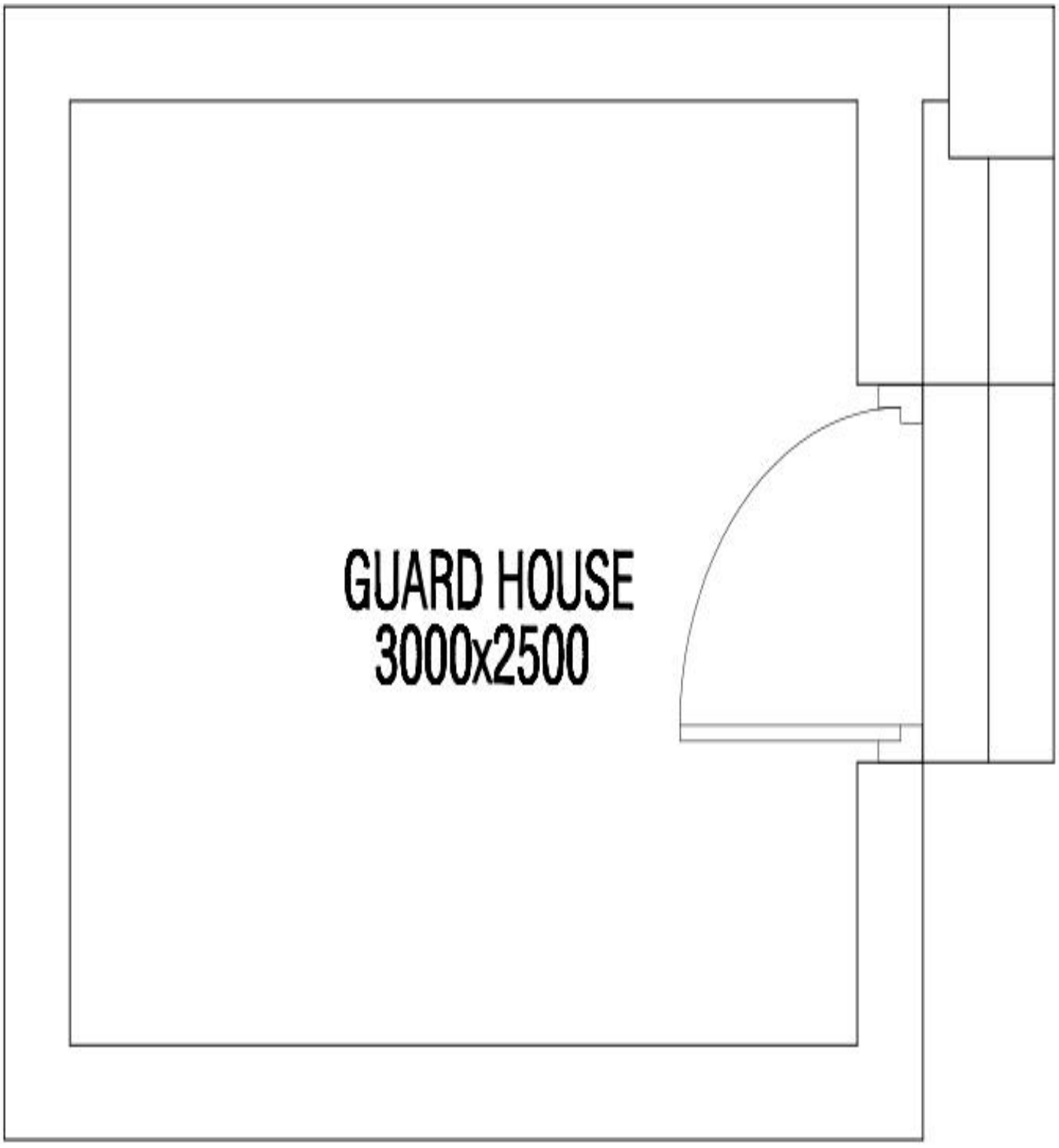
INDICATIVE CIVIL DRAWINGS

Ground Floor Plan
(Control Room Building For all Substations)



GROUND FLOOR PLAN (UNIT IN mm)

First Floor Plan
(Control Room Building For all Substations)



Guard Room Plan
(For all Substations)