

**BIDDING DOCUMENT
For**

**Procurement of
Construction of 230kV Transmission Line
and Substation at Araihasar JEZ area
(Package-2)**



Volume-3 of 3

IFB No. : 27.21.0000.101.07.421.23.3932
Employer :Power Grid Company of Bangladesh
Limited (PGCB)
Country : Bangladesh
JICA Loan No. : BD-P86, BD-P108
Project :Infrastructure Development for Japanese
Economic Zone at Araihasar,
Narayanganj (Foreign Direct Investment
Promotion Project (FDIPP))

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1.1.1. General Specification

1.1 General Description of the Project

Recently, many Japanese companies have started their operation in Bangladesh. However, the existing EZs are facing a shortage of available land for Japanese companies that are currently interested in investing in Bangladesh. In addition, a certain number of Japanese companies are hesitant to invest in Bangladesh due to unstable supply of electric power and not smooth road infrastructure, and uncertainties towards the investment promotion policies and the implementation capability of the Bangladesh government.

In connection with FDIPP, Japan International Cooperation Agency (JICA) implemented “Project for Development Study and Capacity Enhancement of Bangladesh Economic Zone Development Plan Authority” from February 2015 thru March 2017. Within the above project, analysis and site comparisons of the candidate EZ locations were conducted, and then Araihaazar and Nayanpur were selected as prominent locations for EZ development. The project also undertook pre-feasibility studies for these two locations as of July 2017.

Taking into consideration the site location, available infrastructure, existing industries, investors interest and infrastructure and logistic requirement of the proposed industries, Araihaazar Economic Zone is more like to be selected for EZ development through FDIPP. The proposed Araihaazar Economic Zone (AEZ) site is located at Mouza: Panchrukhi, Panchgaog, Union: Satgram & Duptara, under Araihaazar Upazila, which is adjacent to the Dhaka–Sylhet highway.

Under these circumstances, the government of Bangladesh has requested the government of Japan to provide Yen loan for “the Foreign Direct Investment Promotion Project (hereinafter FDIPP)” in order to establish a new EZ mainly targeting Japanese companies and to further facilitate investments from Japan.

The Project consists of three (3) components and Project Sector Loan is one of the components and contains following five (5) packages.

- 1) Package 1: Land Development
 - a) Land reclamation works for about 200ha
 - b) Construction works of 300m long access road
 - c) Construction works of retention canal, retention pond and pumping station
- 2) Package 2: Construction of Substation and Transmission Line (Originally; Power Plant Development, Construction of Power Plant only has been halted)
 - a) Construction of 2 x 120/140 MVA -230/33kV (self-cooling/forced fan cooling) Substation; and
 - b) Construction of 230 kV Transmission Line.
- 3) Package 3: Gas Pipeline Development
 - a) Construction Works of Gas Station; and
 - b) Construction Works of 6 km long Gas Pipeline.
- 4) Package 4: Telecommunication Development
 - a) Construction works of Telecommunication Exchange Station.
 - b) Construction works of 23 km long Telecommunication Optical Fiber Cable.

- 5) Package 5: Existing Gas Pipeline Relocation
- a) Construction works of Relocation for Existing Gas Pipeline (around 4.5 km long).

This Contract aims to construct the system/equipment described in above Package 2 for the construction of Substation and related 230 kV Transmission Line.

Scope of Supply of Plant and Installation Services and Works

The scope of supply of Plant and Installation Services to be covered by the Contract shall include the designing, manufacturing, testing before shipment, finishing, protective coating where specified, packing for export, insuring, inspecting before shipping, shipping and transport to the port of destination, landing, customs clearance, transport from the port of destination to the Site, unloading at the Site, storing, hauling to installation position, installation, site test, pre-commissioning, commissioning for verification of guaranteed value and remedying defects of the following plant, but not limited to, including the supply of special tools, testing equipment and spare parts and consumable materials. The civil work, building works and training of the Employer's staff are also included in the scope under the Contract.

1.2.1 230 kV Transmission Line

Two LILO of the transmission line to be supplied and constructed under this Contract includes but is not limited to the following main components:

- Construction of two temporary by-pass lines using ERS towers, demolition all when complete the transmission line: Removing of the existing tower no.75.
- Construction of two new double circuit angle lattice steel towers (named 75A, 75B) under the route of existing transmission line and one new four circuit lattice steel terminal tower (named 75C).
- Conducting of two LILO from the existing transmission line to proposed 230/33kV Substation using three above new towers (75A, 75B, 75C) with Twin ACSR Mallard conductor per phase and 7x4.00steel earthwire and 7x4.00 steel earthwire equivalent OPGW.
- Conducting necessary adjustments of on neighboring tower (if necessary).

The Contractor can propose another construction method, with or without ERS tower; the new construction method should be approved by the Employer and the Licensee (PGCB/NLDC).

1.2.2 2x120/140 MVA - 230/33kV SUBSTATION

The scope of the construction of the new substation includes but is not limited to the supply, installation, and commissioning of a new one 230/33kV substation with two 2 x 120/140MVA transformers; The new substation comprises the following main components:

- Complete 230kV Indoor double busbar GIS consisting of four transmission line bays, two section bays, one coupler bay, two transformer bays, two bus voltage modules.
- Two 230/33 kV, 120/140 MVA Main Transformers with On Load Tap Changer (OLTC)
- Two 33/0.4 kV – 300kVA Station Transformers
- Surge arresters
- Complete 33kV Indoor double busbar GIS consisting of sixteen outgoing line bays, two

transformer incomer bays, bus section, two bus coupler, two VT bays, two outgoing bays to auxiliary transformers

- Control, Protection and Substation automation system (SAS) as well as metering system for two stations (230kV and 33kV respectively)
- LV AC and DC distribution systems for two stations (230kV and 33kV respectively)
- Fiber Optic Multiplexer Equipment for Protection and Communication,
- Digital Fault and Disturbance Recorder (DFDR)
- Civil works associated with GIS buildings, equipment, and other facilities.
- Fire protection, grounding system
- Other ancillary system.
- Spare parts
- Training of Employer's Staff

1.2.3 Training of Employer's Staff

The Contractor shall provide the trainings of the Employer's staff:

- Manufacturer's Country
- Employer's Country (at site)

1.2.4 Civil Works

The civil works for this project consist of the following portions:

- Ground works including all necessary excavations
- Foundation work for Substation Structures
- Foundation work for Substation Transformers including ducts around equipment
- Foundation work for Transmission Line Towers
- Foundation work for buildings
- Cable trenches
- Related civil works in the substation yard area and in the buildings
- Related civil works in the Transmission Line Tower locations
- Road and Parking

1.2.5 Building Works

The Contractor shall include in the Scope of Works the complete Architectural and Engineering (A&E) design, construction, and commissioning of the following operations buildings:

- a) 230kV Building
- b) 33kV Building
- c) Guard House

The complete A&E design for each building shall include the following building design disciplines:

- Architectural
- Structural

- Mechanical
- Electrical
- Plumbing/Sanitary
- Fire protection system
- Electronics and Communications
- Air Conditioning

1.2.5.1 230kV Building

The 230kV Building shall be designed and constructed. This 230kV Building shall have the following spaces/rooms to make the operations smooth and efficient:

- 230kV GIS Room with overhead crane
- Technical Room
- AHU Room
- Control Room
- Battery Room
- Electrical Room
- Telecom Room
- Manager's Office
- Meeting Room
- Office
- Staff Lounge and Dining Area with Pantry
- Prayer Room with Ablution fountains for male and female
- Toilets facilities for male and female with PWD toilet
- Storage Room
- Ancillary Spaces for lift

1.2.5.2 33kV Building

The 33kV Building shall be designed and constructed. This 33kV Building shall have the following spaces/rooms to make the operations smooth and efficient:

- 33kV GIS Room
- Battery Room
- Capacitor Room
- AC / DC Room
- Control Room
- Manager's office
- Toilets facilities for male and female with PWD toilet
- Storage Room

1.2.5.3 Guard House

The Guard House shall be designed and constructed for the 230kV area and the 33kV area, respectively. It shall have the following spaces / rooms:

- Guard's Station
- Toilet Facilities with Lockers

1.2.6 Preparation, Installation and Removal of the Employer's Engineers' Site Office

Temporary site office for the Employer's Engineer, his inspectors and the supervision consultant of the Employer shall be provided near to Contractor's site office. This site office, complete with furnishings, fittings, access roads and hard standings shall be established at early stage of the site construction and removed after project completion. The following facilities shall be furnished with the office.

- (1) Wi-Fi Facilities
- (2) Lighting, Outlet for power supply
- (3) Copier for A3 size with worktable
- (4) Air Conditioner
- (5) Kitchen, Refrigerator, Microwave, Potable Water Station
- (6) Storage space and shelves for documents and drawings with lighting and air conditioner
- (7) Well furnished toilet with wash basin
- (8) Changing room with locker for ten (10) personnel
- (9) At least one executive desk, one executive chair and two visitor chair for each office
- (10) Meeting room or meeting space for ten (10) personnel with table and chair
- (11) PD office shall be well furnished as per standard requirements.
- (12) The approximate room size shall be as follows:

Room Description	Minimum Room Size (sft)
PD office	300
Accounts office	100
Employer's Engineer office	200
Meeting room	200
Consultant office	200
Kitchen	75
Toilet (3nos)	125
Changing room	50
Storage space	100

The Particular of the Employer's Engineers' site office shall be as follows;

- This office shall be protected against weather, dust, insects, noise and other nuisance to the satisfaction of the Employer's Engineer .
- The office shall be located in a position with access roads approved by the Employer's Engineers' .
- Before construction, the contractor shall prepare an architectural plan of the proposed Site Office incorporating requirements of the employer and get it approved by the Employer's Engineer.
- The Contractor shall provide required number of furniture of design, standard and finish approved by the Employer's Engineer. The crockeries, tea sets, glass sets, door & window curtain shall have to be provided.
- Necessary cleaning, washing, dusting of rooms and toilets shall be done by the Contractor by engaging his own personnel.

- The Contractor shall provide electricity, water, firefighting extinguishers, internet connection system capacity having more than 10 persons and lighting, ceiling fans, Air Conditioners of required number and capacity to the satisfaction of the Employer's Engineer and the toilets shall be with tiles, wash basin, shower, high commode, and pan including water supply and sewerage facilities. The required number of electric bulb, ceiling fans, calling bells and electric power points etc. including IPS or standby generator of required number and capacity for emergency power supply shall be provided.
- The Contractor shall provide required office equipment/consumables like staplers, punches, pens & pencils, files, papers etc.
- The Contractor shall provide first aid box, safety helmet, etc. as per requirement by the Employer's Engineer .
- The Contractor will arrange necessary security of the office, engage office peon and cleaner, etc.
- All cost relating to the water and power supply for the site office shall be included in the Contractor's scope.

1.3 The Works to be Undertaken by Other Contractors

The Contractor shall cooperate with the Employer and other Contractors to ensure the satisfactory completion of the Project as a whole.

Main works provided by other Contractors are as follows.

1.3.1.1.1 Land development by Package-1 Contractor

Land development for the substation will be completed prior to the Commencement Date. The land development for other SEZ area may be continued after the **Commencement Date** of the Project.

1.3.1.1.2 Construction of SEZ infrastructure and tenants

Construction of SEZ infrastructure and tenants will continue after the **Commencement Date** of the Project.

1.5 Training and Inspection

The Contract Price shall include all costs of training & inspection of Employers and the instruction of staff on-site for the following. All local and foreign training and their remuneration shall be arranged as per entitlement of govt. officials and govt. laws by order of the Chairman of BEZA.

(a) International Training

The following engineers nominated by the Employer shall be provided with training at a Manufacturers' premises /factory as follows. The final schedule with contents shall be finalized during execution stage.

SL NO.	Description (a)	No. of Engineer	Duration (weeks)
1.	HV GIS Substation & Equipment Design, Testing and MRE (as per IEC)	03	02
2.	Protection & Substation Automation System	03	02

(b) Pre-shipment Inspection:

The engineers nominated by the Employer shall participate in the inspection and witnessing of FAT (factory acceptance tests) at manufacturers' works as as per entitlement of govt. officials and govt. laws by order of the Chairman of BEZA.

No. of visit and duration shall be fixed by ITP (Inspection Test Plan) submitted by Manufacturer and approved by PGCB. ITP shall include Type test, Routine test, Special test and Site test.

SL No.	Description (b)	No. of Engineer	No. of Visit & Duration (excluding travelling time)
1.	Transformer	02	1 visit: - 1 visit for 230/33kV Tr.: 10 days
2.	GIS	02	2 visits: - 1 visit for 230kV GIS: 7 days - 1 visit for 33kV GIS: 7 days
3.	Control, protection & SAS	02	1 visit: -1 visit for 230kV Control, protection & SAS: 7 days

During factory witnessing the following sample rate of the tested Equipment shall be applied:

All transformer shall be factory tested in front of Employer's Engineers.

For GIS, at least one from each type of bay, such as Bus Coupler bay, Transformer bay, Line bay, Cable bay (if any), Bus PT bay shall be tested.

For CRP, at least one from each type of relay, such as Busbar protection relay, Transformer protection relay, Line protection relay, Cable protection relay (if any) shall be tested.

For SAS, point-to-point communication, Relay communication protocol (PRP, HSR, RSTP etc. if applicable) test, inter-operability test (if applicable) shall be performed.

(c) Local Training

On-site instruction/training by the manufacturer's engineer on operations and maintenance

SL No.	Description (c2)	No. of Engineer	Duration (working days)
1.	HV GIS switchgear	10	06
2.	Protection & Substation automation system	10	06
3.	Utility Communication	10	06

The Contractor shall be responsible for bearing all costs for the trainees and inspectors (for item (a) & (b)), including air fares, accommodation, meal, healthcare, transportation, visa fees etc. The remuneration should be arranged as per entitlement of the Govt. officials/Govt. laws by order of the Chairman of BEZA. The air ticket class shall be Economy class. The Employer's engineer attending the Pre-shipment inspection (as mentioned in item no. b) shall be provided with the same facilities as per remuneration of the Govt. officials and Govt. laws by order of the Chairman of BEZA. For on-site instruction training, (item no. c), the contractor shall not be responsible for any costs for trainees and the aforementioned onsite trainings shall have to be arranged at any Substation's respective local Grid Circle or GMD area with the consultation of Superintending Engineer, Grid Circle.

Due to any unavoidable circumstances, if any pre-shipment inspection can't be witnessed by the engineers nominated by the Employer, such inspection may be witnessed by any 3rd party inspector nominated by the Employer, or may not be witnessed by the employer's representatives. In such case, the contract price shall be adjusted in accordance with the relevant contract provisions.

Note: The Contractor shall have to submit the Schedule of each Training & FAT and take approval from the Employer prior to each Training & FAT. The International training shall have to be arranged within one (1) year from the date of contract signing.

1.5.1 Training Contents

The minimum requirements for different trains are described here. The final schedule with contents shall be finalized during execution stage

a) HV GIS Substation & Equipment Design and Testing (as per IEC)

SL	Topics	Contents
1.	GIS Substation Design	1. Layout design of GIS Substation upto 800kV 2. Insulation coordination including PSCAD for EMTP

SL	Topics	Contents
		3. Selection of Continuous & Short circuit current rating of series equipment 4. Selection of Protection Scheme & SAS Protocol 5. Different Calculations: DSLP Calculation, switchyard & Building, CT-PT sizing, DC System Design, Earthing design for GIS Switchyard, Conductor sizing for Bus & cable sizing, Cantilever strength Sizing, Lighting Design for Indoor & Outdoor, LVAC system Design including HVAC Design 6. GIS Design (Bus, Encloser, CT, PT, DS, ES, FES, LCP, Wiring, Jointing, PD monitoring, Voltage & pressure co-ordination, temperature limit, accessories etc.) 7. Maintenance, Repair and Extension of GIS maintaining required service continuity 8. Testing as per IEC
2.	Circuit Breaker design	1. Selection of CB arc extinction principle including PIR & CSD 2. Operating mechanism Design 3. Arcing chamber design for EHV (400kV & above) 4. Arcing Contact design 5. Testing as per IEC
3.	Lightning Arrester Design	1. Design of ZnO Block for HV to EHV, Design of Energy Absorption Capability, Selection of Voltage rating & current rating, Design of housing, Design of LA 2. Testing as per IEC
4.	MRE	1. Design of MRE for O&M 2. Erection and QC

b) Utility Communication & SAS

SL	Topics	Contents
1.	Utility Communication	1. Basic Architecture: a) ADM b) SDH/SONET & PDH 2. Use of Boosters 3. Network management Server 4. Fiber Optic Technology - Utility Perspective 5. PLCC in Utility – Digital & Analog 6. Testing & Commissioning as per IEC: Pros & Cons - Routine, Design & Special test
2.	SAS	1. SCADA & Protocols 2. Protection Schemes a) Line Distance Protection/Line Differential Protection b) Transformer & Busbar Protection c) Other Protection 3. Substation Automation as per IEC 61850 a) PRP b) HSR

SL	Topics	Contents
		c) RSTP 4. Interlock scheme a) Hardware b) Software 5. Panel, Wiring & Testing 6. Fault Recorder a) Acquisition b) I/O selection c) other design d) Data Analysis software & Testing

e) Protection & Substation automation system

SL	Topics	Contents
1.	Line Impedance Protection	1. Basic principles of impedance protection 2. Zones of impedance protection 3. Zone 1 extension scheme 4. Mho and Quadrilateral characteristics 5. Zone reach calculation (ph-ph and ph-ground) 6. Load encroachment area: basics, setting calculation and testing 7. Power swing detection: basics, setting calculation and testing 8. Pole slip protection: basics, setting calculation and testing 9. Fuse failure detection: basics, setting calculation and testing 10. Switch on to fault: basics, setting calculation and testing 11. Communication aided schemes, their advantages and disadvantages: a. Direct transfer trip b. Permissive under-reach transfer trip c. Permissive over-reach transfer trip d. Current reversal guard logic e. Weak-end infeed condition f. CB echo logic g. Blocking and unblocking schemes 12. Testing of various functions
2.	Auto-reclosing	1. Application of auto-reclosing a. Dead time b. Reclaim time c. Single shot or multi shot 2. Operation features and cycles of auto-reclose 3. Auto-reclose lock-out 4. Auto-reclosing of HV distribution networks 5. Factors influencing HV auto-reclosing scheme

SL	Topics	Contents
		6. Auto-reclosing of EHV transmission lines 7. High-speed auto-reclosing of EHV system 8. Single phase auto-reclosing 9. High-speed auto-reclosing of lines employing distance schemes 10. Delayed auto-reclosing of EHV system 11. Auto-reclose schemes 12. Master and follower auto-reclosing 13. Setting calculation 14. Testing
3.	Line Differential Protection	1. Line differential protections principles 2. Biased differential characteristics 3. Harmonics component blocking 4. Differential stability with Open CT, CT saturation and external faults 5. Unrestrained differential tripping 6. Negative sequence differential protection 7. Communication principles of line differential protection 8. High impedance line differential protection 9. Additional line differential protections: a. Phase to phase current variation b. Zero sequence current variation
4.	Current Protection	1. Over-current and earth-fault protection: Time based characteristics a. Directional b. Non-directional 2. Relay co-ordination procedure 3. Breaker failure protection 4. Stub protection 5. Broken conductor check: basics, setting calculation and testing 6. Communication aided scheme for earth-fault protection 7. Over current and earth fault setting calculation for various types of networks 8. Testing of different functions
5.	Transformer Protection	1. Types of faults in transformer 2. Magnetizing inrush of transformer 3. Thermal protection a. Oil temperature monitoring b. Winding temperature monitoring 4. Transformer differential protection 5. CT requirement for differential protection 6. Biased differential characteristics 7. Harmonics component blocking 8. Filtering zero sequence components 9. Differential stability with open CT, CT saturation, magnetizing inrush and external fault 10. Negative sequence differential protection 11. High impedance differential protection

SL	Topics	Contents
		a. Ratio correction b. Phase compensation c. Zero sequence elimination 12. Restricted earth-fault protection for different types of transformers: a. Low impedance b. High impedance i. Current operated ii. Voltage operated 13. Fault current calculation for different types of transformers in different types of faults 14. Auto transformer protection 15. Earthing transformer protection 16. Overfluxing protection 17. Oil and Gas protection: a. Pressure relief device b. Buchholz protection c. Sudden pressure rise protection 18. Neutral displacement detection 19. Balanced earth fault 20. Sensitive earth fault 21. Setting calculation for different protections 22. Transformer testing procedures 23. Testing procedures of all protection functions
6.	Busbar Protection	1. Types of busbar faults 2. Protection requirements a. Speed b. Stability c. Zone coverage 3. Types of busbar protection 4. Different bus arrangements and their protection schemes 5. Principles of bus differential protection 6. Biased characteristics of bus differential protection 7. CT requirements and location for bus differential protection 8. High impedance differential protection a. Principle b. Stability c. Setting calculation 9. Low impedance differential protection a. Principle b. Stability c. Setting calculation 10. Secondary circuit supervision 11. Stability for open CT, CT saturation, Disconnecter switch movement 12. External and internal fault discrimination

SL	Topics	Contents
		a. Amplitude measurement b. Phase angle comparison 13. Discriminating and check features 14. Numerical busbar protection relays a. Types b. Principles c. Communication principles
7.	Fault Calculation	1. Different Types of faults 2. Symmetrical component analysis of three phase network 3. Positive, negative and zero sequence network of different faults 4. Fault equations of different faults 5. Current and voltage distribution of network due to fault 6. Current distribution of different types of transformers due to different types of faults 7. Effect of earth fault in different types of earthed systems 8. Sequence equivalent circuits of different types of transformers 9. Fault current calculation of different types of networks
8.	Protective Relays	1. Brief introduction, description and overview of each supplied protective relay. 2. Setting calculation guidelines of all protection functions including examples for each supplied protective relay. 3. Procedure of parameterization of supplied relays 4. Testing procedure of the supplied relays 5. Comprehensive handling procedure of engineering software
9.	SAS	1. Basic concept 2. Description of the architecture 3. Operation and Maintenance procedure 4. Procedure of Troubleshooting 5. Procedure of Engineering 6. Procedure of reporting

For each Training, Trainers shall have a minimum of 10 years of experience in the related fields. The trainers shall be from a reputed International training Organization. For Transformer & HV substation training, the trainer shall be an experience of at least 230kV Substation & transformer design experience for at least 10 years. The CV of proposed trainers shall be submitted to employer & taken approval during execution. If the proposed trainer does not meet the minimum requirement mentioned here, the Employer shall preserve the right to ask the contractor to change the trainer as per requirement.

SCHEDULE A

(SCHEDULES OF REQUIREMENTS)

The equipment/plant to be designed, supplied, installed, tested & commissioned shall be as stipulated in bid specification, shown in bid drawings (Volume 2 of 3) and other technical requirements as described in volume 2 of 3 (Substation Part), volume 2 of 3 (Transmission Line Part) and volume 3 of 3 of bidding documents.

For detail description of supply & works, price schedules shall be read in conjunction with schedule of requirements (schedule-A), bid specification and technical requirements. The detail scope of plant, which shall have to be designed, supplied, installed, tested & commissioned, are as follows:

Section I.	Line In and Line Out (LILO) of 230 kV Transmission Line
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Two LILO of the transmission line to be supplied and constructed under this Contract includes but is not limited to the following main components:

- Construction of two temporary by-pass lines using ERS towers, demolition all when complete the transmission line: Removing of the existing tower no.75.
- Construction of two new double circuit angle lattice steel towers (named 75A, 75B) under the route of existing transmission line and one new four circuit lattice steel terminal tower (named 75C).
- Conducting of two LILO from the existing transmission line to proposed 230/33kV Substation using three above new towers (75A, 75B, 75C) with Twin ACSR Mallard conductor per phase and 7x4.00steel earthwire and 7x4.00 steel earthwire equivalent OPGW.

Detail requirements are also mentioned in Price Schedule.

Section II.	The 230/33kV Substation (part 1/2) - 230kV Station
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Item No.	Description of Equipment Requirement	Unit	Quantity				
2A	Power Transformers and Auxiliary Transformer						
2A1	230/34.5 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformer with OLTC, and RTCC Panel including transformer tap changer control, fan control & AVR. Direct Hot Spot Temperature measurement facility using fiber optic shall be available. The Transformer shall have CTs of the following specification:	Set	2				
	<table><tr><th>Item No</th><th>Requirements</th></tr><tr><td>HV BCT</td><td>245kV, 800-400A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) </td></tr></table>			Item No	Requirements	HV BCT	245kV, 800-400A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) - 800-400/1 A, 30VA, Class 5P20 (all 3 phases)
	Item No			Requirements			
HV BCT	245kV, 800-400A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) - 800-400/1 A, 30VA, Class 5P20 (all 3 phases)						

Item No.	Description of Equipment Requirement		Unit	Quantity
		- To WTI (B-Φ) (ratio, burden & class will be as per manufacturer's design) Actual CT burden shall be determined by CT sizing calculation during execution stage		
	LV BCT	36kV, 3200-2400A, 40kA/3s, single phase, 4-core, current transformer with cores as follows: - 3200-2400/1 A, 30VA, Class 5P20 (all 3 phases) - 3200-2400/1 A, 30VA, Class 5P20 (all 3 phases) - To WTI (B-Φ) (ratio, burden & class will be as per manufacturer's design) - To AVR (C-Φ) (ratio, burden & class will be as per manufacturer's design) Actual CT burden shall be determined by CT sizing calculation during execution stage		
	NCT	36kV, 3200-2400A, 40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-2400/1 A, 30VA, Class 5P20 - 3200-2400/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage		
2A2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for transformers.		Set	2
2A3	33/0.415 kV, 300kVA, Dyn1, three phase outdoor type transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.		Set	1

2B1	245kV double busbar with sections, Indoor Gas Insulated Switchgear (GIS)			
	245kV GIS Line Feeder Bays, each comprises with:		Set	4
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	245kV, 4000A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring-stored energy operating mechanism	Set	1
1.	iii.	245kV, 4000A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	1
	iv.	245kV, 4000A, 50kA/3s, three phase busbar Disconnector, complete with motor operating mechanism	Set	1
	v.	245kV, 4000A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	vi.	245kV, 50kA/3s three phase earthing switch complete with motor operating mechanism	Set	1

	vii.	245kV, 50kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	viii.	245kV, 4000-2000A, 50kA/3s, single phase, 3-core, current transformer with cores as follows: - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	ix.	245kV, 4000-2000A, 50kA/3s, single phase, 2-core, current transformer with cores as follows: - 4000-2000/1 A, 15VA, Class 0.2S - 4000-2000/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	x.	245kV single phase inductive voltage transformer with windings as follows: - $230,000/\sqrt{3}:110/\sqrt{3}:110/\sqrt{3}$ V, 30VA/30VA/30VA, Class 3P/3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage. Each VT connection shall have separate externally hand operable isolating link with auxiliary contacts for status.	No.	3
	xi.	Single phase GIS-to-Air bushing with all accessories for Line	No.	3
	xii.	Local Control Cubicle	Set	1
	xiii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIB (GIL), busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xiv.	Partial Discharge monitoring internal sensor	Lot	1
	245kV GIS Auto Transformer Feeder Bays, each comprises with:		Set	2
	i	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	Lot	1
2.	ii	245kV, 2000A, 50kA/3s, three phase, gang operated Circuit Breaker complete with spring-stored energy operating mechanism	Set	1
	iii.	245kV, 2000A, 50kA/3s, three phase busbar Disconnecter with earth switch, complete with motor operating mechanism	Set	1
	iv.	245kV, 2000A, 50kA/3s, three phase busbar Disconnecter, complete with motor operating mechanism	Set	1
	v.	245kV, 2000A, 50kA/3s, three phase line Disconnecter complete with motor operating mechanism	Set	1

	vi.	245kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vii.	245kV, 800-400A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 800-400/1 A, 30VA, Class 5P20 - 800-400/1 A, 30VA, Class 5P20 - 800-400/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	viii.	245kV, 800-400A, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 800-400/1 A, 15VA, Class 0.2S - 800-400/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	ix.	245kV single phase inductive voltage transformer with windings as follows: - $230,000/\sqrt{3}:110/\sqrt{3}:110/\sqrt{3}:110/\sqrt{3}$ V, 30VA/30VA/30VA, Class 3P/3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage. Each VT connection shall have separate externally hand operable isolating link with auxiliary contacts for status.	No.	3
	x.	Single phase GIS-to-Air bushing with all accessories for TR	No.	3
	xi.	Local Control Cubicle	Set	1
	xii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for single-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xiii.	Partial Discharge monitoring internal sensor	Lot	1
3.		245kV Bus Coupler Bays, each comprises with:	Set	01
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	245kV, 4000A, 50kA/3s, three phase, gang operated Circuit Breaker complete with spring-stored energy operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phase busbar Disconnecter with Earth Switch complete with motor operating mechanism	Set	02
	iv.	245kV, 4000-2000A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20	No.	03

	Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)		
v.	245kV, 4000-2000A, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 4000-2000/1 A, 15VA, Class 0.2S - 4000-2000/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
vi.	Local Control Cubicle	Set	01
vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
viii.	Partial Discharge monitoring internal sensor	Lot	1
4.	245kV Bus Section Bays, each comprises with:	Set	02
	i 245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii 245kV, 4000A, 50kA/3s, three phase, gang operated Circuit Breaker complete with spring-stored energy operating mechanism	Set	01
	iii. 245kV, 4000A, 50kA/3s, three phase busbar Disconnecter with Earth Switch complete with motor operating mechanism	Set	02
	iv. 245kV, 4000-2000A, 50kA/3s single phase, 3-core, current transformer with cores as follows: - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20 - 4000-2000/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	v. 245kV, 4000-2000A, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 4000-2000/1 A, 15VA, Class 0.2S - 4000-2000/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)	No.	03
	vi. Local Control Cubicle	Set	1
	vii. Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	viii. Partial Discharge monitoring internal sensor	Lot	1

5.	245kV Bus VT with Busbar FES circuit Bay, each set comprises with:		Set	4
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	245kV single phase inductive voltage transformer with windings as follows: - 230,000/√3:110/√3:110/√3: 110/√3 V, 30VA/30VA/30VA, Class 3P/3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage. Each VT connection shall have separate externally hand operable isolating link with auxiliary contacts for status.	No.	3
	iii.	245kV, 50kA/3s, three phase, make proof type Earth Switches complete with spring operating energy storage Mechanism	Set	1
	iv.	Local Control Cubicle	Lot	1
	v.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
6.	245kV Gas Insulated Bus (GIB) for four (4) Line feeders, single phase encloser, terminating chambers complete with support structure, etc. The Length of GIB may be different from each bay as per actual design (15 - 100 meter). Actual payment shall be as per final design. The Length given here is as single-phase length		m	300
7.	245kV Gas Insulated Bus (GIB) for two (2) Transformer feeders, single phase encloser, terminating chambers complete with support structure, etc. The Length of GIB maybe different from each bay as per actual design (30 - 135 meter). Actual payment shall be as per final design. The Length given here is as single-phase length		m	135
8.	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities for extensions without de-energization of complete GIS		Set	2
2B2	33kV, Compacted type, RMU switchgear (CCV Configuration) (Technical data are referred to SLD)		lot	1
AIS Switchgear, Equipment & Structure				
2B3	198kV rated voltage, 158 kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	18
2B4	Rigid tubular conductor and/or stranded flexible conductors with accessories, insulator and fittings including all necessary clamps and connectors as			

	required for completing 230kV Switchyard		
	i. Tubular Conductor and/or Flexible Conductor	Lot	1
	ii. Insulator	Lot	1
	iii. Fittings & Clamps, Connector	Lot	1
	iv. Nut-bolt	Lot	1
2B5	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard		
	i. Steel Structure for T/L with Nut & Bolts		
	a) Gantry Column	No.	5
	b) Beam	No.	4
	ii. Equipment Structure		
	a) LA	No.	18
	iii. Nut & Bolts	Lot	1
	iv. LV power & control cable tray including fitting, fixing accessories	Lot	1
2B6	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	Nos.	6

2C	Control, Protection, Substation Automation & Metering		
230kV Circuits			
2C1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	Set	4
	Each comprising		
	i. BCU and Backup Mimic panel with all accessories including monitoring		
	ii. Protection main relay (Main-1, Main-2)		
	iii. Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv. Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
2C2	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2
	Each comprising		

	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
2C3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		Set	1
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
2C4	Control, Protection, Monitoring including SAS Function for Power transformer circuits, along with Control & Protection Cubicles		Set	2
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection back-up relay (67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
2C5	Busbar Protection including SAS Function (230kV Circuit)		Set	1
		Each comprising		
	i.	Protection Relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit with HMI		
	ii.	Selector switch for switching BBP, BFP, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
2C6	Tariff metering for 230kV system, comprises with:		Lot	1

	i.	Meters (Main & Check)	set	12
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
2C7	Tariff metering for 33kV system (Incomers), comprises with:		Lot	1
	i.	Meters (Main & Check)	set	4
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
2C8	Replacement of existing Protection main relays with new Protection main relays (Main-1, Main-2) for Bhulta-Araihasar overhead line circuits at existing Bhulta Substation		Set	2
		Each comprising		
	i.	Replacement of existing Protection main relays with new Protection main relays (Main-1, Main-2) [In new Main-1 & Main-2 relays there shall have Line Differential Protection (87L) & Distance (21) protection functions as well as other protection functions as per PSLD. 87L protection shall be established through optical multiplexer.]		
	ii.	Auxiliary relays & accessories		
2C9	Digital Fault and Disturbance recorder (DFDR) to monitor complete 230kV station and 33kV incomers of 230/33kV transformers, comprises with:		Lot	01
	i.	DFDR processor and Card for each bay including A/D Converter, Digital & Analog data acquisition system	Lot	01
	ii.	Ethernet Switch	Lot	01
	iii.	GPS system	set	01
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	Lot	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables & Other Accessories	Lot	01
2C10	Substation Automation System (SAS) for complete 230kV station. Moreover, two 33kV incomer feeders and four 33kV outgoing feeders shall have control from 230kV station, NLDC and 33kV station. SAS comprises with		Lot	1
	i.	Industrial Server PC cum Operator workstation (or separate PCs) with SAS & Engineering Software and including monitors & accessories	Set	2
	ii.	Ethernet Switch for SAS & SCADA System	Lot	1
	iii.	GPS system	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1

	v.	LCD Monitor, 55" or Larger	Set	1				
	vi.	Printer, A3, A4 Laser (One black & White, Other Color)	Set	2				
	vii.	Engineering PC latest version configuration	No.	1				
	viii.	Cable (Fiber Optic, Ethernet, Copper etc.)	Lot	1				
	ix.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	Lot	1				
	x.	Gateway (server, engineering software)	Set	2				
	xii	Hardware Firewall	Set	1				
	xiv	All Other Accessories	Lot	1				
2C1 1	Integration, with necessary hardwares and accessories, of new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits with the existing SAS at existing Bhulta Substation. Existing SAS is ABB, Switzerland make.		Lot	1				
	SCADA system for Telecontrol and Telemetry							
2C12	Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetry facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation and also, hardware and necessary works required on other sides of the 230 kV transmission line (Ghorashal station, New Bhulta Substation). All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & backup station at Siddhirganj are to be carried out.		Lot	1				
2D	Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations - Necessary modules for 87L protection (through multiplexer) - 21 relay carrier signal (main-1 and main-2) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system Remote end Substations have following make multiplexer equipment <table><tr><td>SS name</td><td>Telecom Equipment</td></tr><tr><td>Ghorashal station</td><td>Hitachi Energy (ABB)</td></tr></table>		SS name	Telecom Equipment	Ghorashal station	Hitachi Energy (ABB)		
SS name	Telecom Equipment							
Ghorashal station	Hitachi Energy (ABB)							

	New Bhulta Substation	Hitachi Energy (ABB)		
1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising			
	i.	ADM with TP unit without booster with Panels (Front opening, Swing Frame type) & accessories. Necessary modules for 87L protection (through multiplexer). For Main-1 & Main-2 relays separate modules shall be provided.	Set	1
	ii.	IDF/SDF	Set	1
	iii.	Cables	Lot	1
	iv.	EOW telephone with board	Set	1
	v.	Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories	Lot	1
	vi.	All other Accessories not included above	Lot	1
2	Other Indoor equipment, at Local end SS			
	i.	PABX Card (FXO)	Set	1
	ii.	Primary phone (IP phone)	No.	2
	iii.	Secondary phone (2W phone)	No.	8
	iv.	Indoor MDF	Set	1
3	Outdoor equipment, at Local end SS			
	i.	Underground optical fiber cable, armoured, 48 core	Lot	1
	ii.	Pigtail cables	Lot	1
	iii.	Outdoor termination box	Set	1
4	Extension/Adaptation of Indoor Fibre Optic Multiplexer Equipment & system at remote end substations each comprising			
	i.	Optical STM-16 Card for each 400 kV line at remote end, if required	Lot	1
	ii.	Optical STM-16 Card for each 230 kV line at remote end	Lot	1
	iii.	Optical STM-4 Card for each 132 kV line at remote end, if required	Lot	1
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v.	Necessary modules for 87L protection (through multiplexer) at Bhulta substation. For Main-1 & Main-2 relays separate modules shall be provided.	Lot	1
	vi.	Optical Booster, if required	Lot	1
	vii.	Outdoor termination box	Set	1
	viii.	Cables, ODF, MDF, panels as required	Lot	1
5	Installation, testing & commissioning		Lot	1

2E	AC & DC system		
2E1	LVAC panels including PLC, BCU and necessary accessories AC voltage status for each bus including coupling breaker on/off status, fail with alarm, status of AC MCB/MCCB at CRB with fail alarm etc. shall be incorporated in substation automation system. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.	Lot	1
2E2	Tariff metering at LVAC system (Main & Check)	Lot	1
2E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)	Lot	1
2E4-2E10	Batteries, Chargers & DC distribution board During execution stage the battery capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The battery with higher capability, if required after calculation, shall be supplied by the Contractor within the same contract price. The DBs shall be suitable for control remotely; Multi-function meters, digital volt & Ammeter shall be available.		
2E4	AC-DC rectifier system/Charger (IGBT Type), each float charger shall not be less than 150A rating for 110 VDC	Set	2
2E5	110V Ni-Cad Battery sets, minimum 400Ah at the 5-hours rate of discharge	Set	2
2E6	110V DC Distribution panel, MCC type with Digital Display & Controller including PLC, BCU and necessary accessories	Lot	1
2E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2
2E8	AC-DC rectifier system/Charger (IGBT Type), each float charger shall not be less than 120A rating for 48 VDC	Set	2
2E9	48V Ni-cad Battery sets, minimum 200Ah at the 5-hours rate of discharge	Set	2
2E10	48V DC Distribution panel, MCC type with Digital Display & Controller including PLC, BCU and necessary accessories	Lot	1

2F	Power cables, primary and secondary cables		
2F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations (Up to incomer panel inside 33kv GIS building)	Lot	1
2F2	19/33KV, ≥ 95 sqmm copper, XLPE three phases cable with terminations to RMU	Lot	1
2F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits		

	LV Control Cable	Lot	1
	LV Power Cable	Lot	1

2G	Camera System		
2G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1
2G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥ 32 Inch) LED monitor. The camera system shall be integrated/connected to SAS.	Lot	1
2H	Civil Works, Building and Foundation		
Detail requirements are mentioned in Price Schedule			
2K	Complete civil items required for outdoor works		
Detail requirements are mentioned in Price Schedule			
2L	Fire Alarm and Fire fighting		
2L1	Fire Alarm Control Panel with accessories, connected to SAS	Nos	1
2L2	Fire resistant cables and accessories	Lot	1
2L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, Reflective Beam Detector, and Linear Heat Detector and accessories	Lot	1
2L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories	Lot	1
2L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1
2L6	Indoor Fire hydrant and hose box (at least one set per level of building) and required Piping network	Lot	1
2L7	Fire Bucket, respirator, ladder and battery type scissor lift	Lot	1
2L8	Water Spray System (WSS) type Fire Fighting System for two (2) nos. of 230/34.5 kV transformers	Lot	1

Section III.	The 230/33kV Substation (part 2/2) - 33kV Station
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Item No.	Description of Equipment Requirement	Unit	Quantity
3A	Auxiliary Transformer		
3A1	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.	Set	1

Item No	Requirements	Unit	Quantity
3B1	36kV indoor type Gas Insulated Switchgear (GIS). IEC 61850 compliant IEDs shall be used		
1.	Sixteen (16) Nos. of 36kV GIS Feeder Bays, each comprising:		
	36kV, 3000A, 40kA/3s, three phase double busbar	lot	1
	36kV, 1250A, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram.	Set	1
	36kV, 1250A, 40kA/3s, three phase busbar disconnecter complete with motor operating mechanism. Please refer to single line diagram.	Set	1
	36kV, 1250A, 40kA/3s, three phase, gang operation circuit breaker, complete with spring-stored energy operating mechanism.	Set	1
	36kV, 800-1200A, 40kA/3s single phase, 4-core, current transformer with cores as follows: - 800-1200 /1 A, 15VA, Class 0.2S - 800-1200 /1 A, 15VA, Class 0.2S - 800-1200 /1 A, 30VA, Class 5P20 - 800-1200 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage.	Nos.	3
	36kV Voltage Indicator	Set	1
	30kV rated voltage, 24kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters (GIS LA) with surge counter.	Nos.	3
	Cable test terminal with maximum 400A continuous current.	Nos.	3
	Cables termination kits, chambers, support structure, etc. for complete GIS cable termination for 36kV outgoing line feeder.	Lot	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	Local Control Panel	Sets	1
	Partial Discharge monitoring internal sensor	Lot	1
2.	Two (2) Nos. of 36kV GIS incomer Bays of 230/33kV Transformer, each comprising:		

	36kV, 3000A, 40kA/3s, three phase double busbar	lot	1
	36kV, 2500A, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram.	Sets	1
	36kV, 2500A, 40kA/3s, three phase busbar disconnecter complete with motor operating mechanism. Please refer to single line diagram.	Sets	1
	36kV, 2500A, 40kA/3s, three phase, gang operation circuit breaker, complete with spring-stored energy operating mechanism	Sets	1
	36kV, 3200-1600A, 40kA/3s single phase, 4-core, current transformer with cores as follows: - 3200-1600 /1 A, 15VA, Class 0.2S - 3200-1600 /1 A, 15VA, Class 0.2S - 3200-1600 /1 A, 30VA, Class 5P20 - 3200-1600 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage.	Nos.	3
	36kV single phase inductive voltage transformer with windings as follows: - 33,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$V, 30VA/30VA, Class 3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage.	Nos.	3
	36kV Voltage Indicator	Sets	1
	Cable test terminal with maximum 400A continuous current.	Nos.	3
	Cables termination kits, chambers, support structure, etc. for complete GIS cable termination for incoming TXR feeder.	Lot	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate.	Lot	1
3	Local Control Panel	Sets	1
	Partial Discharge monitoring internal sensor	Lot	1
	Four (04) nos. of panels (as required) for double busbar section: 36kV - 2500A - 40kA/s. Below mentioned items shall be available in these panels:		
	36kV, 3000A, 40kA/3s, three phase double busbar	lot	1
	36kV, 2500A, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram.	Sets	4
	36kV, 3200-1600A, 40kA/3s single phase, 3-core, current transformer with cores as follows: - 3200-1600/1 A, 15VA, Class 0.2S - 3200-1600 /1 A, 30VA, Class 5P20 - 3200-1600 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage	Nos.	6
	36kV, 2500A, 40kA/3s, three phase, gang operation circuit breaker complete with spring-stored energy operating mechanism	Sets	2

	Cable test terminal with maximum 400A continuous current.	Nos.	6
	Cables termination kits, chambers, support structure, etc. for complete GIS cable termination for busbar section.	Lot	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	Local Control Panel	Sets	2
	Partial Discharge monitoring internal sensor	Lot	1
4.	Two (2) Nos. of 36kV Bus Coupler Bay, each comprising:		
	36kV, 3000A, 40kA/3s, three phase busbar	lot	1
	36kV, 2500A, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). (Please refer to single line diagram)	Sets	2
	36kV, 3200-1600A, 40kA/3s single phase, 3-core, current transformer with cores as follows: - 3200-1600/1 A, 15VA, Class 0.2S - 3200-1600 /1 A, 30VA, Class 5P20 - 3200-1600 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage	Nos.	3
	36kV, 2500A, 40kA/3s, three phase, gang operation circuit breaker, complete with spring-stored energy operating mechanism	Sets	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate.	Lot	1
	Local Control Panel	Sets	1
	Partial Discharge monitoring internal sensor	Lot	1
5.	Four (04) sets of 36kV Bus VT with three phase busbar disconnecter with earth switch circuit Bay, each comprising:		
	36kV, 3000A, 40kA/3s, three phase double busbar	lot	1
	36kV, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram.	Set	1
	36kV single phase inductive voltage transformer with windings as follows: - 33,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$V: 110/$\sqrt{3}$, 30VA/30VA/30VA, Class 3P/0.2/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage.	Nos.	3
	Local Control Panel for DS ES	Lot	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as	Sets	1

	appropriate.		
	Partial Discharge monitoring internal sensor	Lot	1
6.	Two (02) Nos. of 36kV GIS Auxiliary Transformer Bays, each comprising:		
	36kV, 3000A, 40kA/3s, three phase double busbar	Lot	1
	36kV, 800A, 40kA/3s, three phase busbar disconnecter with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram.	Set	1
	36kV, 800A, 40kA/3s, three phase busbar disconnecter complete with motor operating mechanism. Please refer to single line diagram.	Set	1
	36kV, 800-400A, 40kA/3s single phase, 4-core, current transformer with cores as follows: - 800-400 /1 A, 15VA, Class 0.2S - 800-400 /1 A, 15VA, Class 0.2S - 800-400 /1 A, 30VA, Class 5P20 - 800-400 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage.	Nos.	3
	36kV Voltage Indicator	Sets	1
	30kV rated voltage, 24kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters (GIS LA) with surge counter.	Nos.	3
	Cable test terminal with maximum 400A continuous current.	Nos.	3
	Cables termination kits, chambers, support structure, etc. for complete GIS cable termination of 36kV auxiliary transformer feeders	Lot	1
	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	Local Control Panel	Set	1
	Partial Discharge monitoring internal sensor	Lot	1
7.	1 set of portable Partial Discharge analyser for GIS and Miscellaneous items		

3C	Control, Protection, Substation Automation, Metering & DFDR			
3C1	Control, Monitoring, Protection & Substation Automation System including event recording function for complete 33kV station. Moreover, two 33kV incomer feeders and four outgoing feeders shall have control from 33kV station, 230kV station and NLDC.		Lot	1
3C2	Tariff metering for 33kV system (Outgoing feeders), comprises with:		Lot	1
	i.	Meters (Main & Check)	set	32
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1

3C3	Complete Substation Automation System (SAS) for 33kV station, comprises with	Lot	1
i.	Industrial Server PC cum Operator workstation (or separate PCs) with SAS & Engineering Software and including monitors & accessories. One of the Server PC cum Operator workstations shall be used as Engineering PC as well.	Set	2
ii.	Ethernet Switch for SAS & SCADA System	Lot	1
iii.	GPS system	Set	1
iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
v.	LCD Monitor, 55" or Larger	Set	1
vi.	Printer, A3, A4 Laser (One black & White, Other Color)	Set	1
vii.	Cable (Fiber Optic, Ethernet, Copper etc.)	Lot	1
viii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	Lot	1
ix.	All Other Accessories	Lot	1

3D	Telecom for Communication and Protection		
3D1	Hardware and necessary works for connection with 230kV station (SAS, Phone). Interconnection between 230kV station SAS and 33kV station SAS shall be done by armoured fiber optic cables.	Lot	1
3D2	Fixed-line phone (3 phones)	Lot	1
3E	AC & DC system		
3E1	LVAC panels including PLC, BCU and necessary accessories	Lot	1
3E2	Tariff metering for LVAC system	Lot	1
3E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)	Lot	1
3E4-3E9	Batteries, Chargers & DC distribution board During execution stage the battery capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The battery with higher capability, if required after calculation, shall be supplied by the Contractor within the same contract price. The DBs shall be suitable for control remotely; Multi-function meters, digital volt & Ammeter shall be available.		
3E4	AC-DC rectifier system/Charger (IGBT Type), each float charger shall not be less than 150A rating for 110 VDC	Set	2
3E5	110V Ni-Cad Battery sets, minimum 400Ah at the 5-hours rate of discharge	Set	2
3E6	110V DC Distribution panel, MCC type with Digital Display & Controller including PLC, BCU and necessary accessories	Lot	1
3E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2
3E8	110V/48V DC DC Converter, 1.0kVA (If required)	Set	2

3E9	48V DC Disatribution Panel (If required)	Lot	1
3F	Power cables, primary and secondary cables		
3F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations	Lot	1
3F2	19/33KV, ≥95sqmm copper, XLPE three phases cable with terminations	Lot	1
3F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits	Lot	1
3G	Camera System		
3G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1
3G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.	Lot	1

3H	Civil Works, Building and Foundation		
Detail requirements are mentioned in Price Schedule			
3K	Complete civil items required for outdoor works		
Detail requirements are mentioned in Price Schedule			
3L	Fire Alarm and Fire fighting		
3L1	Fire Alarm Control Panel with accessories, connected to SAS	Nos	1
3L2	Fire resistant cables and accessories	Lot	1
3L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, and Linear Heat Detector and accessories	Lot	1
3L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories	Lot	1
3L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1

Miscellaneous item.: The bidder shall have to supply latest model of one new double cabin Pick-up car (Mitsubishi/NAVARA or equivalent brand) with Carry-boy to the Employer for substation O & M activity. Also, the bidder shall provide full time transport facilities to the Project Director of Employer (PGCB) by a car (equivalent to Pajero model) with fuel, driver etc. for the whole tenure of the project including defect liability period including fuel & driver up to the defect liability period of this contract. Moreover, the bidder shall provide an office of approx. size 800sqft (more or less) comprising at four Room and two bath-cum toilets equipped with complete furniture (Chair, table, cabinet, light, fan and air conditioner etc. suitable for official use) for the sole use of the Employer's Project Director and other employees of Project Management Unit of PGCB at site. Above office may be arranged on rental basis near the site

or the Contractor can construct temporarily inside site area if space is available. All kinds of utility, bill will be borne by the contractor.

All costs in connection with the above Miscellaneous items/works/services are deemed to be included in the overall Contract price whether these items are included in the price schedule or not.

Section-III Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Testing Equipment shall have to be supplied from EU, USA, UK or Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for each of the substations is as follows:

Serial No	Name	Quantity
1.	Socket Wrench Set	1 Set
2.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
3.	Ratchet Wrench Set	1 Set
4.	Open-endWrench Set	1 Set
5.	Ring/Ball Wrench Set	1 Set
6.	Pipe Wrench (12",18",24",	1 Set
7.	Allen Key Set	1 Set
8.	Hammer (1lb & 2lb)	1 Set
9.	Plier, 8 inch	1 No.
10.	Cutting Plier, 8 inch	1 No.
11.	Nose Plier, 8 inch	1 No.
12.	Screw Driver Set	1 Set
13.	Screw Driver (Star and Flat Big)	1 Set
14.	File (Flat)	1 No.
15.	File (Round)	1 No.
16.	Hakso Frame with blade	1 No.
17.	Safety Belt	4 Nos
18.	Ladder (Aluminium)	2 Nos.
19.	Helmet	6 Nos.
20.	Gas Cylinder Pipe Set	1 Set
21.	Multimeter (Fluke/Megger)	2 Nos
22.	Bucket	2 Nos.
23.	Shabol	2 Nos.
24.	Coppa	2 Nos
25.	Rope	200 m
26.	Duur Metal Box	1 No.
27.	Grinding Machine	1 No.
28.	Blower Machine	1 No.

Serial No	Name	Quantity
29.	Mechanical Jug	1 No.
30.	Compressor Jug	1 No.
31.	Wire Cutter	1 No.
32.	Steel Cutter	1 No.
33.	Chain Pulley (2 Ton)	1 No.
34.	Vice Set	1 No.
35.	Drill Machine	1 No.
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.
45.	Vacuum Cleaner	1 No.
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1"	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

**Refer to the Price Schedule for detail of other spares, testing kit, tools etc.
Tools set shall be supplied from Europe, USA or Japan.**

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Construction of 230kV Transmission Line and Substation at Araihaazar JEZ
area (Package-2)**

SCHEDULE B

BID PRICES & SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

**Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area
(Package-2)**

SCHEDULE B (PRICE SCHEDULES)

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:
 - Schedule No. B1: Plant (including Mandatory Spare Parts) Supplied from Abroad.
 - Schedule No. B2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country.
 - Schedule No. B3: Design Services
 - Schedule No. B4: Installation & other services.
 - Schedule No. B5: Grand Summery
 - Schedule No. B6: 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. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding 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 bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

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

As specified in the Bid Data Sheet and Particular 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. Bid prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.

For each item, bidders 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 Bidding 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. The bid price is inclusive of all Environmental, Health and Safety management and compliance cost.

Notes

- i. Items identified as lot in price schedule shall include all the materials required for proper completion of work against that item.
- ii. Items identified as meters, such as Cable, GIL, GIB etc. shall be deemed to be tentative & based on preliminary design which shall be variable during detail design in execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.
- iii. Items identified as Cubic feet or meters, such as land/earth filling etc. shall be deemed to be tentative & based on preliminary estimation which shall be variable during execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.

- iv. For Items under steel gantry, column & beam has been added as number basis so that payment can be made on actual basis if no. of column changes during detail engineering in Execution stage while unit price shall remain fixed.
- v. Equipment support structure & foundation for Transformer, switchgear etc. has been added on Number / set basis based on tentative & preliminary design so that payment can be made on actual basis if no. of structure changes during detail Engineering in Execution stage while unit price shall remain fixed.

Schedule B: Schedules of Rates and Prices

Schedule No. B1: Plant and Mandatory Spare Parts Supply from Abroad

Schedule No. B2: Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Schedule No. B3: Design Services

Schedule No. B4: Installation and Other Services

Schedule No. B5: Grand Summary

Schedule No. B6: Recommended Spare Parts

Please see the separate Excel file for the above.

The attached price schedules shall be filled by the Bidder, signed and stamped and shall be attached to the bid.

Please use the attached excel file

Price Schedule-Transmission Part (I)

Construction of 230kV Transmission Line and Substation at Araihaaz JEZ Area (Package-2)

Section-I

Schedule No. B1. Plant and Mandatory Spare Parts Supplied from Abroad

Item	Description	Country of origin ¹	Unit	Quantity (1)	Unit Price [Foreign Currency] CIP (2)	Total Price [Foreign Currency] CIP (1) x (2)
1	Fabrication, Galvanising and Supply of 230kV double circuit towers, complete with all stubs, nuts, bolts, locking nuts, washers, phase conductors and earthwire swivels/shackles, step bolts, tower notice and identification plates, ACDs etc.					
1.1	2DT6+6m		each	1		
1.2	2DT6+9m		each	1		
1.3	2QT6+9m		each	1		
1.4	Auxiliary cross arm for tower type "2DT6"		per set of three	2		
1.5	Auxiliary cross arm for tower type "2QT6"		per set of six	1		
2	Phase conductor and OPGW cable, complete with repair sleeves and joints					
2.1	Conductor ACSR MALLARD type (double circuit line, both circuits erected, two conductors per phase) [2]		Route km ³	0.30		
2.2	Conductor ACSR MALLARD type (Four circuit line, all circuits erected, two conductors per phase) [2]		Route km ³	0.10		
2.3	7x4.00mm equivalent OPGW inclusive of joint boxes, fixing clamps, fusion splices and connections to the joint boxes. One OPGW earthwire on the line.		Route km	0.40		
2.4	7x4.00mm earthwire. One earthwire on the line.		Route km	0.32		
3	Insulator strings, complete with insulators and all hardware fittings including suspension clamps, tension dead ends, armour rods, arcing horn, Arcing ring etc for Twin ACSR Mallard					
3.1	a) 120kN single pilot suspension Insulators set for twin ACSR."Mallard" - disc only		set	36		
	b) 120kN single pilot suspension Insulators Fittings set for twin ACSR "Mallard" - hardware fittings only		set	36		
3.2	a) 210 kN twin tension Insulators Set for twin ACSR "Mallard" - disc only		set	36		
	b) 210kN twin tension Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only		set	36		

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Schedule No. B1. Plant and Mandatory Spare Parts Supplied from Abroad

Item	Description	Country of origin ¹	Unit	Quantity (1)	Unit Price [Foreign Currency] CIP (2)	Total Price [Foreign Currency] CIP (1) x (2)
3.3	a) 120kN single upright low duty Insulators Set for twin ACSR "Mallard" - disc only		set	12		
	b) 120kN single upright low duty Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only		set	12		
3.4	a) 120kN single inverted low duty Insulators Set for twin ACSR "Mallard"- disc only		set	12		
	b) 120kN single inverted low duty Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only		set	12		
4	OPGW sets, complete with all accessories, incl. armour rods and earth bounds					
4.1	OPGW (7X4.00mm GSW type earthwire equivalent) Tension set, complete assembly		set	10		
5	Earthwire sets, complete with all accessories					
5.1	7X4.00mm GSW earthwire Tension set, complete assembly		set	8		
6	Dampers					
6.1	Vibration damper for Twin ACSR Mallard conductor		Span-Phase	24		
6.2	Spacer damper for Twin ACSR Mallard conductor		Span-Phase	24		
	**Span-phase = number of span x 6 (double circuit) or 12 (four circuit). Total quantities of spacer or spacer dampers shall be 'Span-phasesxN', where N = number of spacer dampers for each phase in each span which shall be determined by contractor based on the design of spacer or spacer dampers. The price quoted shall remain unchanged, even if the value of N increases during final design of the spacer or dampers and it's approval thereof.					
6.3	Vibration damper for 7X4.00mm GSW earthwire, One earthwire on the line.		Span	3		
6.4	Vibration damper for OPGW (7X4.00mm GSW earthwire equivalent), One OPGW on the line.		Span	2		
6.5	Vibration damper for OPGW (7X4.00mm GSW earthwire equivalent), two OPGW on the line.		Span	1		
7	Tower Earthing					

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Schedule No. B1. Plant and Mandatory Spare Parts Supplied from Abroad

Item	Description	Country of origin ¹	Unit	Quantity (1)	Unit Price [Foreign Currency] CIP (2)	Total Price [Foreign Currency] CIP (1) x (2)
7.1	Earthing type A		each	1		
7.2	Earthing type B		each	1		
7.3	Earthing type C		each	1		
7.4	Earthing type D (If required by specific soil conditions)		each	0		
8	Jumper Spacer, Tower Paint and Counterweights					
8.1	Jumper Spacer for Twin ACSR Mallard conductor		each	96		
8.2	Tower Paint					
(a)	Coal tar epoxy coatings on all tower steelwork up to 3.0m or HFL, whichever is greater in accordance with the requirements of the Technical Specification		per tower	3		
(b)	Painting of tower having total height above GL exceeds 60m for aircraft navigation in accordance with the requirements of the Technical Specification		per tower	1		
(c)	Painting of tower (Reflecting Paint) upto 3 meter above epoxy coat in submerge area in accordance with the requirements of the Technical Specification		per tower	1		
Total B1						

1 Bidders shall enter a code representing the country of origin of all imported plant and equipment.

3 Definition of Route km: Route km is the transmission line distance between two terminal points in plan view. Route km is exclusive sag and other electrical clearances, elevation differences etc. The Contractor shall incorporate all such extra costs in his unit rate.

Construction of 230kV Transmission Line and Substation at Araihaaz JEZ Area (Package-2)

Schedule No. B2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country							
Item	Description	Unit	Quantity (1)	Foreign currency		Local currency	
				EXW Unit Price ¹ (2)	EXW Total Price ¹ (1) x (2)	EXW Unit Price ¹ (3)	EXW Total Price ¹ (1) x (3)
1	Fabrication, Galvanising and Supply of 230kV double circuit towers, complete with all stubs, nuts, bolts, locking nuts, washers, phase conductors and earthwire swivels/shackles, step bolts, tower notice and identification plates, ACDs etc.						
1.1	2DT6+6m	each	1				
1.2	2DT6+9m	each	1				
1.3	2QT6+9m	each	1				
1.4	Auxiliary cross arm for tower type "2DT6"	per set of three	2				
1.5	Auxiliary cross arm for tower type "2QT6"	per set of six	1				
2	Phase conductor and OPGW cable, complete with repair sleeves and joints						
2.1	Conductor ACSR MALLARD type (double circuit line, both circuits erected, two conductors per phase) [2]	Route km ³	0.30				
2.2	Conductor ACSR MALLARD type (four circuit line, both circuits erected, two conductors per phase) [2]	Route km ³	0.10				
2.3	7x4.00mm equivalent OPGW inclusive of joint boxes, fixing clamps, fusion splices and connections to the joint boxes. One OPGW earthwire on the line.	Route km	0.40				
2.4	7x4.00mm earthwire. One earthwire on the line.	Route km	0.32				
3	Insulator strings, complete with insulators and all hardware fittings including suspension clamps, tension dead ends, armour rods, arcing horn, Arcing ring etc for ACCC Conductor equivalent of ACSR GROSBEAK						
3.1	a) 120kN single pilot suspension Insulators set for twin ACSR "Mallard" - disc only	set	36				
	b) 120kN single pilot suspension Insulators Fittings set for twin ACSR "Mallard" - hardware fittings only	set	36				
3.2	a) 210 kN twin tension Insulators Set for twin ACSR "Mallard" - disc only	set	36				
	b) 210kN twin tension Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only	set	36				
	a) 120kN single upright low duty Insulators Set for twin ACSR "Mallard" - disc only	set	12				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Schedule No. B2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country							
Item	Description	Unit	Quantity (1)	Foreign currency		Local currency	
				EXW Unit Price ¹ (2)	EXW Total Price ¹ (1) x (2)	EXW Unit Price ¹ (3)	EXW Total Price ¹ (1) x (3)
3.3	b) 120kN single upright low duty Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only	set	12				
3.4	a) 120kN single inverted low duty Insulators Set for twin ACSR "Mallard" - disc only	set	12				
	b) 120kN single inverted low duty Insulators Fittings Set for twin ACSR "Mallard" - hardware fittings only	set	12				
4	OPGW sets, complete with all accessories, incl. armour rods and earth bounds						
4.1	OPGW (7X4.00mm GSW type earthwire equivalent) Tension set, complete assembly	set	10				
5	Earthwire sets, complete with all accessories						
5.1	7X4.00mm GSW earthwire Tension set, complete assembly	set	8				
6	Dampers						
6.1	Vibration damper for Twin ACSR Mallard conductor	Span-Phase	24				
6.2	Spacer damper for Twin ACSR Mallard conductor	Span-Phase	24				
	**Span-phase = number of span x 6 (double circuit) or 12 (four circuit). Total quantities of spacer or spacer dampers shall be 'Span-phase x N', where N = number of spacer dampers for each phase in each span which shall be determined by contractor based on the design of spacer or spacer dampers. The price quoted shall remain unchanged, even if the value of N increases during final design of the spacer or dampers and it's approval thereof.						
6.3	Vibration damper for 7X4.00mm GSW earthwire, One earthwire on the line.	Span	3				
6.4	Vibration damper for OPGW (7X4.00mm GSW earthwire equivalent), One OPGW on the line.	Span	2				
6.5	Vibration damper for OPGW (7X4.00mm GSW earthwire equivalent), two OPGW on the line.	Span	1				
7	Tower Earthing						

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Schedule No. B2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country							
Item	Description	Unit	Quantity (1)	Foreign currency		Local currency	
				EXW Unit Price ¹ (2)	EXW Total Price ¹ (1) x (2)	EXW Unit Price ¹ (3)	EXW Total Price ¹ (1) x (3)
7.1	Earthing type A	each	1				-
7.2	Earthing type B	each	1				-
7.3	Earthing type C	each	1				-
7.4	Earthing type D (If required by specific soil conditions)	each	0				-
8	Jumper Spacer, Tower Paint and Counterweights						
8.1	Jumper Spacer for Twin ACSR Mallard conductor	each	96				
8.2	Tower Paint						
(a)	Coal tar epoxy coatings on all tower steelwork up to 3.0m or HFL, whichever is greater in accordance with the requirements of the Technical Specification	per tower	3				-
(b)	Painting of tower having total height above GL exceeds 60m for aircraft navigation in accordance with the requirements of the Technical Specification	per tower	1				-
(c)	Painting of tower (Reflecting Paint) upto 3 meter above epoxy coat in submerge area in accordance with the requirements of the Technical Specification	per tower	1				-
	Total B2						

Section-I: Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Schedule No. B3. Design Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
1	Detailed line design including plan and profiles; conductor, earthwire and OPGW sag tension calculations; tower spotting, establishment of line schedule; Design of insulator strings, OPGW and earthwire attachments	Lot	1			-	
2	Foundation design for soil for all soil types including additional soil investigation and additional soil resistivity measurement	Lot	1			-	
3	Bypass line	Lot	1			-	
4	Others	Lot	1			-	
Total B3						-	-

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
1	Survey and soil investigation works						
1.1	Survey Work						
1.1.1	Check survey in accordance with the requirements of the technical specification, incl. Full ground survey with change of route, if any, tower plotting and preparation and submission of route maps, profile drawings, SIMM documents, etc.	Route km	0.40				
1.1.2	Route clearance in accordance with requirements of the technical specification including payment of compensation for crops, trees, houses etc. and all other type of damage compensation	Route km	0.40				
1.2	Geotechnical Investigations incl. taking samples, logging and lab testing						
1.2.1	Boreholes for geotechnical investigation, incl. laboratory test, borehole logs, sampling and interpretive report as per geotechnical specification						
(a)	Level 2	borehole	3			-	
(b)	Level 4	borehole	0			-	
1.2.2	Soil resistivity tests (one per tower)	unit	3			-	
2	Foundations for towers including all setting out, Concrete, Reinforcement, Excavation, Pumping, Stub-Setting, Geotechnical Investigation (Level 2), Shuttering, Leveling, Timbering, supply & Installation of foundation steelwork, Earthing Materials, Backfilling, approved Protective Coating & site clearing etc.						
2.1	Tower Type 2DT6						
2.1.1	Piled Foundation for any Soil Category	Per tower	1				
2.1.2	Piled Foundation with 2.0m raised chimney for any Soil Category*	Per tower	1				
2.2	Tower type 2QT6						
2.2.1	Piled Foundation for any Soil Category	Per tower	1				
2.2.2	Piled Foundation with 2.0m raised chimney for any Soil Category*	Per tower	0				
*Additional cost due to raised chimney stub shall deem to be included in the quoted price.							

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
2.3	Individual Pile test including supply,install and test to prove compliance with technical specification, payment for successful test only (applicable for all tower types selected by the Employer's Engineer):						
2.3.1	Compression Type test	per test	2				
2.3.2	Uplift Type test	per test	1				
2.3.3	Pile Integrity test	per test	12				
3	Earthing Installation						
3.1	Earthing type A	each	1				
3.2	Earthing type B	each	1				
3.3	Earthing type C	each	1				
3.4	Earthing type D (If required by specific soil conditions)	each	0				
4	Tower erection, incl. all bolts, nuts, plates, leg extensions, safety devices, step bolts, accessories and extensions						
4.1	Tower type "2DT6"						
4.1.1	Tower type 2DT6+6m	each	1				
4.1.2	Tower type 2DT6+9m	each	1				
4.2	Tower type "2QT6"						
4.2.1	Tower type 2QT6+9m	each	1				
4.3	Auxiliary Crossarm for tower						
4.3.1	Auxiliary Crossarm for tower type 2DT6	Per set of three	2				
4.3.2	Auxiliary Crossarm for tower type 2QT6	Per set of six	1				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
4.4	Tower Paint						
(a)	Coal tar epoxy coatings on all tower steelwork up to 3.0m or HFL whichever is greater in accordance with the requirements of the Technical Specification	per tower	3				
(b)	Painting of tower having total height above GL exceeds 60m for aircraft navigation in accordance with the requirements of the Technical Specification	per tower	1				
(c)	Painting of tower (Reflecting Paint) upto 3 meter above epoxy coat in submerge area in accordance with the requirements of the Technical Specification	per tower	1				
5	Stringing of Phase Conductor, Earthwire & OPGW						
5.1	Conductor ACSR MALLARD type including necessary midspan joints, repair sleeves and any other accessories (Four circuit line, all circuits erected, two conductors per phase)	route km	0.10			-	
5.2	Conductor ACSR MALLARD type including necessary midspan joints, repair sleeves and any other accessories (double circuit line, both circuits erected, two conductors per phase)	route km	0.30				
5.3	7 x 4.00mm GSW earthwire including necessary midspan joints, repair sleeves and any other accessories. One earthwire on the line.	route km	0.32				
5.4	7 x 4.00mm GSW earthwire equivalent OPGW inclusive of joint boxes, fixing clamps, fusion splices and connections to the joint boxes. One OPGW earthwire on the line.	route km	0.40				
5.5	Erection of twin downleads (ACSR Mallard) including dropdown from terminal tower to substation gantry	set of three	4				
5.6	Erection of earthwire connection from terminal tower to substation gantry	per wire	1				
5.7	Erection of OPGW connection from terminal tower to substation gantry	per wire	2				
6.	Erection of Insulator strings, complete with insulators and all hardware fittings including suspension clamps, tension dead ends, armour rods, arcing horn, Arcing ring etc for ACSR Twin Mallard (495 mm²) conductor						
6.1	120 kN, Single pilot suspension insulator string for ACSR Twin Mallard conductor, complete assembly	set	36				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
6.2	210 kN, Twin tension insulator string for ACSR Twin Mallard conductor, complete assembly	set	36				
6.3	120 kN, Single upright low duty insulator string for ACSR Twin Mallard conductor, complete assembly	set	12				
6.4	120 kN, Single inverted low duty insulator string for ACSR Twin Mallard conductor, complete assembly	set	12				
7	Erection of Earthwire sets, complete with all accessories						
7.1	7 x 4.00mm GSW earthwire Tension set, complete assembly	Set	10				
8	Erection of OPGW sets, complete with all accessories, incl. armour rods and earth bounds						
8.1	OPGW (7 x 4.00mm GSW type earthwire equivalent) Tension set, complete assembly	Set	8				
9	Dampers & Spacers						
9.1	Vibration damper for Twin ACSR Mallard conductor	Span-Phase	24				
9.2	Spacer damper for Twin ACSR Mallard conductor	Span-Phase	24				
	**Span-phase = number of span x 6. Total quantities of spacer or spacer dampers shall be 'Span-phasesxN', where N = number of spacer dampers for each phase in each span which shall be determined by contractor based on the design of spacer or spacer dampers. The price quoted shall remain unchanged, even if the value of N increases during final design of the spacer or dampers and approval thereof.						
9.3	Vibration damper for 7 x 4.00mm GSW earthwire, one earthwire on the line.	Span	3				
9.4	Vibration damper for OPGW (7 x 4.00mm GSW earthwire equivalent), one OPGW earthwire on the line.	Span	2				
9.5	Vibration damper for OPGW (7 x 4.00mm GSW earthwire equivalent), two OPGW earthwires on the line.	Span	1				
9.6	Installation of Jumper Spacer for Twin ACSR Mallard conductor	each	96				
10	Documentation						

Construction of 230kV Transmission Line and Substation at Araihasar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
10.1	Establishment of as-built drawings, manuals and all requested documents as per specifications	Lot	1				

Construction of 230kV Transmission Line and Substation at Araihasar JEZ Area (Package-2)

Section-I: Schedule No. B4. Installation and Other Services

Item	Description	Unit	Quantity (1)	Unit Price		Total Price	
				Foreign Currency Portion [Foreign Currency] (2)	Local Currency Portion [BDT] (3)	Foreign [Foreign Currency] (1) x (2)	Local [BDT] (1) x (3)
11	Existing line dismantle & bypass line						
11.1	Dismantling of existing tower (incl. conductor, insulator & other accessories) whichever is required for turn in/out, storing the dismantled materials at PGCB store	per tower	1				
11.2	Bypass of existing double circuit line has to be constructed to facilitate in-out. Pole/ERS for bypass line shall be collected from PGCB stores. Insulators & fittings have to be used from existing facilities. All costs of removing of bypass line and storage of all materials at Employer's stores is deemed included in the quoted price.	route km	0.65				
12	Miscellaneous						
12.1	General and other works and services, not mentioned before	lump sum	1			-	
12.2	Transport of the material and equipment supplied from Employer's Country	lump sum	1			-	
12.3	Insurance of material and equipment supplied from Employer's Country during transport	lump sum	1			-	
12.8	Miscellaneous Rates for works certified by the Engineer in accordance with method of Payment					-	
(a)	Additional Excavation	cu.m	125			-	
(b)	Additional Concrete	cu.m	100			-	
(c)	Additional Reinforcement	kg	1500			-	
(d)	Extra for surface resisting cement per cu.m of concrete	cu.m	50			-	
(e)	Additional Boring (500mm diameter)	rm	50			-	
(f)	Additional Boring (600mm diameter)	rm	50			-	
(g)	Additional Boring (750mm diameter)	rm	50			-	
(h)	Sand Filling	cu.m	100			-	
12.9	Environmental and Social Services	lump sum	1			-	
Total B4 (to Schedule No. 5. Grand Summary)							

Note: Definition of route km: Route km is the transmission line distance between two terminal points in plan view. Route km is exclusive sag and other electrical clearances, elevation differences etc. The Contractor shall incorporate all such extra costs in his unit rate.

Price Schedule-Substation Part (II)

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of origin)	Unit	Quantity	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
					CIP	CIP	
				(1)	(2)	(3) = (1) x (2)	
Section II.	The 230/33kV Substation (part 1/2) - 230kV Station						
2A	Power transformer						
2A1	230/34.5 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformer with OLTC, and RTCC Panel including transformer tap changer control, fan control & AVR		Set	2			
2A2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for transformers.		Set	2			
2A3	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer		Set	1			
2B	HV Electrical Equipment and Material						
2B1	245kV double busbar with sections, Indoor Gas Insulated Switchgear (GIS)		Lot	1			
1	Four Line bays: 245kV - 4000A - 50kA/3s						
2	Two Section bays: 245kV - 4000A - 50kA/3s						
3	One Coupler bay: 245kV - 4000A - 50kA/3s						
4	Two Transformer bays: 245kV - 2000A - 50kA/3s						
5	Four busbar FES and Bus VT modules (may be integrated into others)						
6	245kV GIB for transmissison line bays						
7	245kV GIB for transformer bays						
8	Two Busbar extension module						
2B2	33kV, Compacted type, RMU switchgear (CCV Configuration)		Set	1			
2B3	198kV Surge Arrester with surge counter with support structures		Nos	18			
2B4	Rigid tubular conductor and/or stranded flexible conductors with accessories, insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard		Lot	1			
2B5	Steel gantry for each circuit of 245kV Transmission Line, Transformer& Equipment support Structure including all necessary accessories required for completing 230kV Switchyard		Lot	1			
2B6	30kV Surge Arrester with surge counter with support structures		Nos	6			
2C	Control, Protection, Substation Automation, Metering & DFDR						
2C1	Control, Monitoring, Protection & Substation Automation System including event recording function for line circuit bay		Set	4			
2C2	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus section bay		Set	2			
2C3	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus coupler bay		Set	1			
2C4	Control, Monitoring, Protection & Substation Automation System including event recording function for 230/33kV power transformer circuits		Set	2			
2C5	Busbar protection system for 245kV system		Lot	1			
2C6	Tariff metering for 230kV system		Lot	1			
2C7	Tariff metering for 33kV system (Incomers)		Lot	1			
2C8	Replacement of existing Protection main relays with new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits at existing Bhulta Substation		Set	2			
2C9	Digital Fault and Disturbance recorder (DFDR) to monitor complete 230kV station and 33kV incomers of 230/33kV transformers		Lot	1			
2C10	Complete SAS hardware & software (Server, firewall, gateway, GPS clock, switch, cable (Fiber optic, Ethernet, copper), embedded computer for tele metering - if required, HMI, engineering computer, printer, inverter & change over power supply- components depending on the detailed design)		Lot	1			
2C11	Integration, with necessary hardwares, of new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits with the existing SAS at existing Bhulta Substation. Existing SAS is ABB, Switzerland make.		Lot	1			

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of	Unit	Quantity	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
2C12	Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation and also, hardware and necessary works required on other sides of the 230 kV transmission line (Ghorashal station, New Bhulta Substation).		Lot	1			
2D	Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations - Necessary modules for 87L protection (through multiplexer) - 21 relay carrier signal (Main-1 and Main-2) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system		Lot	1			
2E	AC & DC system						
2E1	LVAC panels including PLC, BCU and necessary accessories		Lot	1			
2E2	Tariff metering for LVAC system		Lot	1			
2E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)		Lot	1			
2E4	AC-DC rectifier system for 110 VDC		set	2			
2E5	110V Ni-cad Battery sets		set	2			
2E6	110 VDC panels including PLC, BCU and necessary accessories		Lot	1			
2E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min		set	2			
2E8	AC-DC rectifier system for 48 VDC		set	2			
2E9	48V Ni-cad Battery sets		set	2			
2E10	48 VDC panels including PLC, BCU and necessary accessories		Lot	1			
2F	Power cables, primary and secondary cables						
2F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations (Up to incomer panel inside 33kV building)		Lot	1			
2F2	19/33KV, ≥ 95 sqmm copper, XLPE three phases cable with terminations to RMU		Lot	1			
2F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits		Lot	1			
2G	Camera System						
2G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera		Lot	1			
2G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥ 32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.		Lot	1			
2H	Civil Works, Building and Foundation						
2H1*	Two story 230kV Indoor GIS Building (44.5mX14.5m)		sqm	2077.13	Refer to Schedule B4.1		
2H2	_10 ton EOT crane		Lot	1			
2H3	_Elevator system (Capacity: 6 People)		Lot	1			
2K	Complete civil items required for outdoor works				Refer to Schedule B4.1		
2K1**	Approach road (pavement width 6m)		m	66			
2K2**	Internal road						
	a)_6m wide road		m	400			
2K3	Substation main gate		Nos	1			
2K4**	Security boundary wall for overall plan		m	515			
2K5**	Chain linked fencing with gate		m	100			
2K6	Guard house		Nos	1			
2K7	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.		Nos	1			
2K8	Blast wall with foundation		Nos	3			
2K9	Gravelling in switchyard area		Lot	1			
2K10	Outdoor gantry foundation in 230kV switchyard						
	a)_Gantry column		Nos	5			
2K11	Outdoor equipment foundation in 230kV switchyard						
	a)_LA		Lot	1			
	b)_GIB and Bushing		Lot	1			
2K12	Transformer foundation		Nos	2			
2K13	Auxiliary transformer foundation		Nos	1			

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of	Unit	Quantit y	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
2K14	Surface drain		Lot	1			
2K15	Cable trench/tunnel with soakpit		Lot	1			
2K16	Car port (clear span: 6.5mX6m)		Nos	1			
2K17	Septic tank (capacity: 25users for 5 years)		Nos	1			
2K18	Soakwell for septic tank		Nos	1			
2K19	Sentry Post		Nos	2			
2K20	Testing of foundation						
	a)_ Compression test of pile		Nos	2			
	b)_ Uplift test of pile		Nos	1			
	*Ground floor = 645.25sqm, Intermediate floor = 141.375sqm, 1st floor = 645.25sqm & Roof = 645.25sqm; Total Floor area = 2077.125sqm. *mesurement method = clear length x clear width x no. of story ** actual payment shall be as per actual work at site						
2L	Fire Alarm and Fire fighting						
2L1	Fire Alarm Control Panel with accessories, connected to SAS		Nos	1			
2L2	Fire resistant cables and accessories		Lot	1			
2L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, Reflective Beam Detector, and Linear Heat Detector and accessories		Lot	1			
2L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories		Lot	1			
2L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher		Lot	1			
2L6	Indoor Fire hydrant and hose box (at least one set per level of building) and required Piping network		Lot	1			
2L7	Fire Bucket, respirator, ladder and battery type scissor lift		Lot	1			
2L8	Water Spray System (WSS) type Fire Fighting System for two (2) nos. of 230/34.5 kV transformers		Lot	1			
2M	Earthing and Lightning Protection system and Portable Eathing Equipment						
2M1	_ Earthing system for complete substation		lot	1			
2M2	_ Lighting Protection System for complete substation		lot	1			
2M3	Portable(maintenance) earthing equipment device		set	2			
2N	Lighting, Small Power, Air Conditioning and Ventilation						
2N1	Indoor lighting (LED type), LV power supply and emergency DC lighting for the GIS Hall, local Control Houses, outdoor lighting (LED Type), security, roadway, switchyard and emergency DC lighting at strategic locations		Lot	1			
2N2	Air conditioning system and ventilation system for the GIS Hall, Control Houses		Lot	1			
2O	Miscellaneous items						
2O1	Latest model of new double cabin Pick-up car (Mitsubishi/NAVARA or equivalent brand) with Carry-boy		No.	1			
	Subtotal of Section-II						
Section III.	The 230/33kV Substation (part 2/2) - 33kV Station						
3A	Auxiliary Transformer						
3A1	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer		Set	1			
3B	MV Electrical Equipment and Material						
3B1	36kV double busbar, Indoor Gas Insulated Switchgear (GIS) IEC 61850 compliant IEDs shall be used		Lot	1			
1	16 Outgoing feeder: 36kV-1250A - 40 kA/s						
2	02 incomer feeder: 36kV - 2500A - 40kA/s						
3	04 panels (as required) for double busbar section: 36kV - 2500A - 40kA/s						
4	02 coupler feeder: 36kV - 2500A - 40kA/s						
5	04 sets of VT with three phase busbar disconnecter with earth switch: 36kV						
6	02 Aux transformer feeder: 36kV-800A - 40 kA/s						
7	1 set portable Partial Discharge analyser for GIS and Miscellaneous items						
3C	Control, Protection, Substation Automation, Metering & DFDR						

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of	Unit	Quantit y	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
3C1	Control, Monitoring, Protection & Substation Automation System including event recording function for 33kV station		Lot	1			
3C2	Tariff metering for 33kV system		Lot	1			
3C3	Complete SAS system: hardware (Server, GPS clock, switch, cable (Fiber optic, Ethernet, copper), HMI, engineering computer, printer, inverter and change over power supply - components depending on the detailed design) & software.		Set	1			
3D	Telecom for Communication and Protection						
3D1	Hardware and necessary works for connection with 230kV station (SAS, Phone). Interconnection between 230kV station SAS and 33kV station SAS shall be done by armoured fiber optic cables.		Lot	1			
3D2	Fixed-line phone (3 phones)		Lot	1			
3E	AC & DC system						
3E1	LVAC panels including PLC, BCU and necessary accessories		Lot	1			
3E2	Tariff metering for LVAC system		Lot	1			
3E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)		Lot	1			
3E4	AC-DC rectifier system for 110 VDC		Set	2			
3E5	110V Ni-cad Battery sets		Set	2			
3E6	110 VDC panels including PLC, BCU and necessary accessories		Lot	1			
3E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min		set	2			
3E8	110V/48V DC DC Converter, 1.0kVA (If required)		Set	2			
3E9	48V DC Disattribution Panel (If required)		Lot	1			
3F	Power cables, primary and secondary cables						
3F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations		Lot	1			
3F2	19/33KV, ≥ 95 sqmm copper, XLPE three phases cable with terminations		Lot	1			
3F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits		Lot	1			
3G	Camera System						
3G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera		Lot	1			
3G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥ 32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.		Lot	1			
3H	Civil Works, Building and Foundation						
3H1*	One story 33kV Building (34.5mx12m)		sqm	828	Refer to Schedule B4.1		
3H2	_5 ton EOT crane		Lot	1			
3K	Complete civil items required for outdoor works				Refer to Schedule B4.1		
3K1	Substation main gate		Nos	1			
3K2	Guard house		Nos	1			
3K3*	Internal road						
	a)_6m wide road		m	100			
3K4	Aux transformer foundation		Nos	1			
3K5	Surface drain		Lot	1			
3K6	Cable trenche/tunnel with soakpit		Lot	1			
3K7	Car port (clear span: 6.5mX6m)		Nos	1			
3K8	Septic tank (capacity: 25users for 5 years)		Nos	1			
3K9	Soakwell for septic tank		Nos	1			
3K10	Testing of foundation						
	a)_Compression test of pile		Nos	1			
	* Ground floor = 414sqm & Roof = 414sqm; Total Floor area = 828sqm. *mesurement method = clear length x clear width x no. of story ** actual payment shall be as per actual work at site						
3L	Fire Alarm and Fire fighting						
3L1	Fire Alarm Control Panel with accessories, connects to SAS		Nos	1			
3L2	Fire resistant cables and accessories		Lot	1			
3L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, and Linear Heat Detector and accessories		Lot	1			
3L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories		Lot	1			
3L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher		Lot	1			

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of	Unit	Quantity	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
3M	Earthing and Lightning Protection system and Portable Earthing Equipment						
3M1	Earthing system for complete substation		lot	1			
3M2	Lighting Protection System for complete substation		lot	1			
3M3	Portable(maintenance) earthing equipment device		set	2			
3N	Lighting, Small Power, Air Conditioning and Ventilation						
3N1	Indoor lighting (LED type), LV power supply and emergency DC lighting for the GIS Hall, local Control Houses, outdoor lighting (LED Type), security, roadway, switchyard and emergency DC lighting at strategic locations		Lot	1			
3N2	Air conditioning system and ventilation system for the GIS Hall, Control Houses		Lot	1			
	Subtotal of Section-III						
Section IV.	Mandatory Spare Parts for 230/33kV Substation						
4A	Mandatory Spare Parts for 230kV Station						
4A1	230/33kV transformer		Lot	1			
	Bushings: 2 set of 245kV bushings, 1 set of 36kV bushing						
	Others: 1 set of Gasket of each type, 1 set of WTI, 1 set of OTI, 1 nos of Buchholz relay, 1 nos of tap changer control mechanism motor, Silica Gel [20kg for each substation] , Spare transformer oil [20,000kg for each substation], 1 Set of special tools, gauges and spanners [as per recommendation from the manufacturer], 1 no Transformer oil treatment plant [8000litre/hr], 1 set pressure relief device						
4A2	245kV GIS		Lot	1			
	Operating mechanism for CB, DS-ES, ES, DS, FES and auxiliary contacts - 1 nos for each type device and contact						
	8 nos of Tripping coils, 4 nos of closing coils, 1 no. motor for CB and 1 no. of motor for DS						
	3 nos of Gas pressure monitor with gauge and pressure switch						
	1 nos of Pressure Relief Device						
	1 set of complete Voltage transformer module (each set comprises one no. of 3 phase VT module or 3 nos. of single phase VT modules)						
	3 nos of Supporting insulator with barrier						
	1 set of each type of Rubber gaskets "O" rings and seals for SF6 gas						
	1 set of each type of control valves for SF6 gas						
	1 Set of special tools (as per recommendation from the manufacturer)						
4A3	198kV Surge arrester (AIS)		Nos	6			
4A4	30kV Surge arrester (AIS)		Nos	6			
4A5	Related Control, Protection, SAS, Metering & DFDR		Lot	1			
	One nos. for each type of relay, 2 nos. of BCU						
	One nos for each type of tripping relay and trip supervision relay, 3 nos for each type of auxiliary relay						
	Two nos test block and socket, one nos of each type MCB, Switch						
	10 nos for each type lamp, heater, humidity sensor, thermostat, annunciator bulb and accessories						
	5 nos of multi function meter, 2 nos of tariff meter						
4A6	Related AC, DC, Charger		Lot	1			
	2nos of Battery MCB/MCCB, 2nos. of DCDB incoming MCCB, 4nos. of outgoing MCBs						
	2nos 3-phase LVAC board incoming MCCB/ACB, 2 nos. of 3-phase outgoing MCCBs, 4nos. of 1-phase outgoing MCBs						
4A7	Cables		Lot	1			
	Power cables (36kV), 300m of each type						
	LV cables, 200m of each type						
4A9	Testing instruments / special tools for operation and maintenance		Lot	1			

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B1 : Plant, Equipment & Mandatory Spares Supplied from Outside the Employer's Country

Item	Description	Code ¹ (Country of	Unit	Quantity	Foreign Currency (in.....)		Remark
					Unit Price	Total Price	
	1 set of SF6 evacuation and filling and gas Treatment Plant with all accessories (DILO, Germany make), 2 set of SF6 cylinder, 1 set of SF6 leakage detector, 1 set o Offline Partial Discharge monitoring Device for GIS, 1 set of Oxygen anylyzer, 1 set of GIS gas Analyzer, 1 set of Moisture Meter						
	1 set of Circuit breaker operational analyzer with accessories including connecting lead, 1 set of Contact resistance measurement test set (suitable for measurement down to 1 μ ohm at 10A d.c.) , 1 set of 5 kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV), 1 set of Earth resistance test set (range 10-100-1000 ohm: min scale division 0.1 ohm), 1 set Clip-on mA meter (for spill current), 1set thermovision camera, 1 set Portable Lightning Arrester Diagnostic System (PLADS)						
4A10	Complete setup for office, manager office: Workstation, printer,		Lot	1			
4A11	Set of Tools for each substation (as per table of section III, schedule A: SCHEDULES OF REQUIREMENTS of volume 3 of 3 of tender document)		Lot	1			
4B	Mandatory Spare Parts for 33kV Station						
4B1	Related 36kV GIS		Lot	1			
	Operating mechanism for CB, DS-ES, ES, DS and auxiliary contacts - 1 nos for each type device and contact						
	8 nos. of Tripping coils, 4 nos. of closing coils, 1 nos. of motor for CB and 1 no. of motor for DS						
	3 nos of Gas pressure monitor with gauge and pressure switch						
	1 no. of Pressure Relief Device						
	1 set of each type of Rubber gaskets “O” rings and seals for SF6 gas						
	1 set of each type of control valves for SF6 gas						
4B2	Related Control, Protection, SAS, Metering & DFDR		Lot	1			
	One no. for each type of relay, 2 nos of BCU						
	One no. for each type of tripping relay and trip supervision relay, 3 nos for each type of auxiliary relay						
	Two nos test block and socket, one no. of each type MCB, Switch						
	10 nos for each type lamp, heater, humidity sensor, thermostat, annunciator bulb, and accessories						
	10 nos of multi function meter, 5 nos of tariff meter						
4B3	Related AC, DC, Charger		Lot	1			
	2nos of Battery MCB/MCCB, 2nos. of DCDB incoming MCCB, 4nos. of outgoing MCBs						
	2nos 3-phase LVAC board incoming MCCB/ACB, 2 nos. of 3-phase outgoing MCCBs, 4nos. of 1-phase outgoing MCBs						
4B4	Cables: 200m for each type of cable		Lot	1			
4B5	One set of special tools for operation and maintenance (as per		Lot	1			
4B6	Complete setup for office, manager office: Workstation, printer,		Lot	1			
	Subtotal of Section-IV						
	Total of Schedule B1 (carried forward to Grand Summary)						
Total (carried forward to Grand Summary)							

Name of Bidder _____

Signature of Bidder _____

Notes:

¹ Bidders shall enter a code representing the country of origin of all imported plant and equipment.

²Specify currency in accordance with Bid Data

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B2 : Plant, Equipment and Mandatory Spares Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
				(2)	(3) = (1) x (2)	
Section II.	The 230/33kV Substation (part 1/2) - 230kV Station		(1)			
2A	Power transformer					
2A1	230/34.5 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformer with OLTC, and RTCC Panel including transformer tap changer control, fan control & AVR	Set	2			
2A2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for transformers.	Set	2			
2A3	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer	Set	1			
2B	HV Electrical Equipment and Material					
2B1	245kV double busbar with sections, Indoor Gas Insulated Switchgear (GIS)	Lot	1			
1	Four Line bays: 245kV - 4000A - 50kA/3s					
2	Two Section bays: 245kV - 4000A - 50kA/3s					
3	One Coupler bay: 245kV - 4000A - 50kA/3s					
4	Two Transformer bays: 245kV - 2000A - 50kA/3s					
5	Four busbar FES and Bus VT modules (may be integrated into others)					
6	245kV GIB for transmisison line bays					
7	245kV GIB for transformer bays					
8	Two Busbar extension module					
2B2	33kV, Compacted type, RMU switchgear (CCV Configuration)	Set	1			
2B3	198kV Surge Arrester with surge counter with support structures	Nos	18			
2B4	Rigid tubular conductor and/or stranded flexible conductors with accessories, insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard	Lot	1			
2B5	Steel gantry for each circuit of 245kV Transmission Line, Transformer& Equipment support Structure including all necessary accessories required for completing 230kV Switchyard	Lot	1			
2B6	30kV Surge Arrester with surge counter with support structures	Nos	6			
2C	Control, Protection, Substation Automation, Metering & DFDR					
2C1	Control, Monitoring, Protection & Substation Automation System including event recording function for line circuit bay	Set	4			
2C2	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus section bay	Set	2			
2C3	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus coupler bay	Set	1			
2C4	Control, Monitoring, Protection & Substation Automation System including event recording function for 230/33kV power transformer circuits	Set	2			
2C5	Busbar protection system for 245kV system	Lot	1			
2C6	Tariff metering for 230kV system	Lot	1			
2C7	Tariff metering for 33kV system (Incomers)	Lot	1			
2C8	Replacement of existing Protection main relays with new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits at existing Bhulta Substation.	Set	2			
2C9	Digital Fault and Disturbance recorder (DFDR) to monitor complete 230kV station and 33kV incomers of 230/33kV transformers	Lot	1			
2C10	Complete SAS hardware & software (Server, firewall, gateway, GPS clock, switch, cable (Fiber optic, Ethernet, copper), embedded computer for tele metering - if required, HMI, engineering computer, printer, inverter & change over power supply- components depending on the detailed design)	Lot	1			

2C11	Integration, with necessary hardwares, of new Protection main relays (Main-1, Main-2) for Bhulta-Araihasar overhead line circuits with the existing SAS at existing Bhulta Substation. Existing SAS is ABB, Switzerland make.	Lot	1			
2C12	Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation and also, hardware and necessary works required on other sides of the 230 kV transmission line (Ghorashal station, New Bhulta Substation).	Lot	1			
2D	Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations - Necessary modules for 87L protection (through multiplexer) - 21 relay carrier signal (main-1 and main-2) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	Lot	1			
2E	AC & DC system					
2E1	LVAC panels including PLC, BCU and necessary accessories	Lot	1			
2E2	Tariff metering for LVAC system	Lot	1			
2E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)	Lot	1			
2E4	AC-DC rectifier system for 110 VDC	set	2			
2E5	110V Ni-cad Battery sets	set	2			
2E6	110 VDC panels including PLC, BCU and necessary accessories	Lot	1			
2E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2			
2E8	AC-DC rectifier system for 48 VDC	set	2			
2E9	48V Ni-cad Battery sets	set	2			
2E10	48 VDC panels including PLC, BCU and necessary accessories	Lot	1			
2F	Power cables, primary and secondary cables					
2F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations (Up to incomer panel inside 33kV building)	Lot	1			
2F2	19/33KV, ≥ 95 sqmm copper, XLPE three phases cable with terminations to RMU	Lot	1			
2F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits	Lot	1			
2G	Camera System					
2G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1			
2G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥ 32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.	Lot	1			
2H	Civil Works, Building and Foundation					
2H1*	Two story 230kV Indoor GIS Building (44.5mX14.5m)	sqm	2077.125	Refer to Schedule B4.1		
2H2	_10 ton EOT crane	Lot	1			
2H3	_Elevator system (Capacity: 6 People)	Lot	1			
2K	Complete civil items required for outdoor works			Refer to Schedule B4.1		
2K1**	Approach road (pavement width 6m)	m	66			
2K2**	Internal road					
	a)_6m wide road	m	400			
2K3	Substation main gate	Nos	1			
2K4**	Security boundary wall for overall plan	m	515			
2K5**	Chain linked fencing with gate	m	100			
2K6	Guard house	Nos	1			
2K7	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	Nos	1			
2K8	Blast wall with foundation	Nos	3			
2K9	Gravelling in switchyard area	Lot	1			
2K10	Outdoor gantry foundation in 230kV switchyard					
	a)_Gantry column	Nos	5			
2K11	Outdoor equipment foundation in 230kV switchyard					
	a)_LA	Lot	1			

	b)_GIB and Bushing	Lot	1			
2K12	Transformer foundation	Nos	2			
2K13	Auxiliary transformer foundation	Nos	1			
2K14	Surface drain	Lot	1			
2K15	Cable trench/tunnel with soakpit	Lot	1			
2K16	Car port (clear span: 6.5mX6m)	Nos	1			
2K17	Septic tank (capacity: 25users for 5 years)	Nos	1			
2K18	Soakwell for septic tank	Nos	1			
2K19	Sentry Post	Nos	2			
2K20	Testing of foundation					
	a)_Compression test of pile	Nos	2			
	b)_Uplift test of pile	Nos	1			
	*Ground floor = 645.25sqm, Intermediate floor = 141.375sqm, 1st floor = 645.25sqm & Roof = 645.25sqm; Total Floor area = 2077.125sqm. *mesurement method = clear length x clear width x no. of story ** actual payment shall be as per actual work at site					
2L	Fire Alarm and Fire fighting					
2L1	Fire Alarm Control Panel with accessories, connected to SAS	Nos	1			
2L2	Fire resistant cables and accessories	Lot	1			
2L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, Reflective Beam Detector, and Linear Heat Detector and accessories	Lot	1			
2L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories	Lot	1			
2L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1			
2L6	Indoor Fire hydrant and hose box (at least one set per level of building) and required Piping network	Lot	1			
2L7	Fire Bucket, respirator, ladder and battery type scissor lift	Lot	1			
2L8	Water Spray System (WSS) type Fire Fighting System for two (2) nos. of 230/34.5 kV transformers	Lot	1			
2M	Earthing and Lightning Protection system and Portable Eathing Equipment					
2M1	_Earthing system for complete substation	lot	1			
2M2	_Lighting Protection System for complete substation	lot	1			
2M3	Portable(maintenance) earthing equipment device	set	2			
2N	Lighting, Small Power, Air Conditioning and Ventilation					
2N1	Indoor lighting (LED type), LV power supply and emergency DC lighting for the GIS Hall, local Control Houses, outdoor lighting (LED Type), security, roadway, switchyard and emergency DC lighting at strategic locations	Lot	1			
2N2	Air conditioning system and ventilation system for the GIS Hall, Control Houses	Lot	1			
2O	Miscellaneous items					
2O1	Latest model of new double cabin Pick-up car (Mitsubishi/NAVARA or equivalent brand) with Carry-boy	No.	1			
	Subtotal of Section-II					
Section III.	The 230/33kV Substation (part 2/2) - 33kV Station					
3A	Auxiliary Transformer					
3A1	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer	Set	1			
3B	MV Electrical Equipment and Material					
3B1	36kV double busbar, Indoor Gas Insulated Switchgear (GIS) IEC 61850 compliant IEDs shall be used	Lot	1			
1	16 Outgoing feeder: 36kV-1250A - 40 kA/s					
2	02 incomer feeder: 36kV - 2500A - 40kA/s					
3	04 panels (as required) for double busbar section: 36kV - 2500A - 40kA/s					
4	02 coupler feeder: 36kV - 2500A - 40kA/s					
5	04 sets of VT with three phase busbar disconnecter with earth switch: 36kV					
6	02 Aux transformer feeder: 36kV-800A - 40 kA/s					
7	1 set portable Partial Discharge analyser for GIS and Miscellaneous items					

3C	Control, Protection, Substation Automation, Metering & DFDR					
3C1	Control, Monitoring, Protection & Substation Automation System including event recording function for 33kV station	Lot	1			
3C2	Tariff metering for 33kV system	Lot	1			
3C3	Complete SAS system: hardware (Server, GPS clock, switch, cable (Fiber optic, Ethernet, copper), HMI, engineering computer, printer, inverter and change over power supply - components depending on the detailed design) & software.	Set	1			
3D	Telecom for Communication and Protection					
3D1	Hardware and necessary works for connection with 230kV station (SAS, Phone). Interconnection between 230kV station SAS and 33kV station SAS shall be done by armoured fiber optic cables.	Lot	1			
3D2	Fixed-line phone (3 phones)	Lot	1			
3E	AC & DC system					
3E1	LVAC panels including PLC, BCU and necessary accessories	Lot	1			
3E2	Tariff metering for LVAC system	Lot	1			
3E3	Automatic power factor correction (PFC) panel (≥ 150 kVAr)	Lot	1			
3E4	AC-DC rectifier system for 110 VDC	Set	2			
3E5	110V Ni-cad Battery sets	Set	2			
3E6	110 VDC panels including PLC, BCU and necessary accessories	Lot	1			
3E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2			
3E8	110V/48V DC DC Converter, 1.0kVA (If required)	Set	2			
3E9	48V DC Disattribution Panel (If required)	Lot	1			
3F	Power cables, primary and secondary cables					
3F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations	Lot	1			
3F2	19/33KV, ≥ 95 sqmm copper, XLPE three phases cable with terminations	Lot	1			
3F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits	Lot	1			
3G	Camera System					
3G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1			
3G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥ 32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.	Lot	1			
3H	Civil Works, Building and Foundation					
3H1*	One story 33kV Building (34.5mx12m)	sqm	828	Refer to Schedule B4.1		
3H2	_5 ton EOT crane	Lot	1			
3K	Complete civil items required for outdoor works			Refer to Schedule B4.1		
3K1	Substation main gate	Nos	1			
3K2	Guard house	Nos	1			
3K3*	Internal road					
	a)_6m wide road	m	100			
3K4	Aux transformer foundation	Nos	1			
3K5	Surface drain	Lot	1			
3K6	Cable trenche/tunnel with soakpit	Lot	1			
3K7	Car port (clear span: 6.5mX6m)	Nos	1			
3K8	Septic tank (capacity: 25users for 5 years)	Nos	1			
3K9	Soakwell for septic tank	Nos	1			
3K10	Testing of foundation					
	a)_Compression test of pile	Nos	1			
	* Ground floor = 414sqm & Roof = 414sqm; Total Floor area = 828sqm.					
	*mesurement method = clear length x clear width x no. of story					
	** actual payment shall be as per actual work at site					
3L	Fire Alarm and Fire fighting					
3L1	Fire Alarm Control Panel with accessories, connects to SAS	Nos	1			
3L2	Fire resistant cables and accessories	Lot	1			
3L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, and Linear Heat Detector and accessories	Lot	1			
3L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency	Lot	1			

3L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1			
3M	Earthing and Lightning Protection system and Portable Earthing Equipment					
3M1	_Earthing system for complete substation	lot	1			
3M2	_Lighting Protection System for complete substation	lot	1			
3M3	Portable(maintenance) earthing equipment device	set	2			
3N	Lighting, Small Power, Air Conditioning and Ventilation					
3N1	Indoor lighting (LED type), LV power supply and emergency DC	Lot	1			
3N2	Air conditioning system and ventilation system for the GIS Hall,	Lot	1			
	Subtotal of Section-III					
Section IV.	Mandatory Spare Parts for 230/33kV Substation					
4A	Mandatory Spare Parts for 230kV Station					
4A1	230/33kV transformer	Lot	1			
	Bushings: 2 set of 245kV bushings, 1 set of 36kV bushing					
	Others: 1 set of Gasket of each type, 1 set of WTI, 1 set of OTI, 1 nos					
4A2	245kV GIS	Lot	1			
	Operating mechanism for CB, DS-ES, ES, DS, FES and auxiliary					
	8 nos of Tripping coils, 4 nos of closing coils, 1 no. motor for CB and 1 no. of motor for DS					
	3 nos of Gas pressure monitor with gauge and pressure switch					
	1 nos of Pressure Relief Device					
	1 set of complete Voltage transformer module (each set comprises one no. of 3 phase VT module or 3 nos. of single phase VT modules)					
	3 nos of Supporting insulator with barrier					
	1 set of each type of Rubber gaskets “O” rings and seals for SF6 gas					
	1 set of each type of control valves for SF6 gas					
	1 Set of special tools (as per recommendation from the manufacturer)					
4A3	198kV Surge arrester (AIS)	Nos	6			
4A4	30kV Surge arrester (AIS)	Nos	6			
4A5	Related Control, Protection, SAS, Metering & DFDR	Lot	1			
	One nos. for each type of relay, 2 nos. of BCU					
	One nos for each type of tripping relay and trip supervision relay, 3					
	Two nos test block and socket, one nos of each type MCB, Switch					
	10 nos for each type lamp, heater, humidity sensor, thermostat, annunciator bulb and accessories					
	5 nos of multi function meter, 2 nos of tariff meter					
4A6	Related AC, DC, Charger	Lot	1			
	2nos of Battery MCB/MCCB, 2nos. of DCDB incoming MCCB,					
	2nos 3-phase LVAC board incoming MCCB/ACB, 2 nos. of 3-phase					
4A7	Cables	Lot	1			
	Power cables (36kV), 300m of each type					
	LV cables, 200m of each type					
4A9	Testing instruments / special tools for operation and maintenance	Lot	1			
	1 set of SF6 evacuation and filling and gas Treatment Plant with all					
	1 set of Circuit breaker operational analyzer with accessories					
4A10	Complete setup for office, manager office: Workstation, printer, UPS,..	Lot	1			
4A11	Set of Tools for each substation (as per table of section III, schedule A: SCHEDULES OF REQUIREMENTS of volume 3 of 3 of tender	Lot	1			
4B	Mandatory Spare Parts for 33kV Station					
4B1	Related 36kV GIS	Lot	1			

	Operating mechanism for CB, DS-ES, ES, DS and auxiliary contacts - 1 nos for each type device and contact					
	8 nos. of Tripping coils, 4 nos. of closing coils, 1 nos. of motor for					
	3 nos of Gas pressure monitor with gauge and pressure switch					
	1 no. of Pressure Relief Device					
	1 set of each type of Rubber gaskets “O” rings and seals for SF6 gas					
	1 set of each type of control valves for SF6 gas					
4B2	Related Control, Protection, SAS, Metering & DFDR	Lot	1			
	One no. for each type of relay, 2 nos of BCU					
	One no. for each type of tripping relay and trip supervision relay, 3 nos for each type of auxiliary relay					
	Two nos test block and socket, one no. of each type MCB, Switch					
	10 nos for each type lamp, heater, humidity sensor, thermostat, annunciator bulb, and accessories					
	10 nos of multi function meter, 5 nos of tariff meter					
4B3	Related AC, DC, Charger	Lot	1			
	2nos of Battery MCB/MCCB, 2nos. of DCDB incoming MCCB, 4nos. of outgoing MCBs					
	2nos 3-phase LVAC board incoming MCCB/ACB, 2 nos. of 3-phase outgoing MCCBs, 4nos. of 1-phase outgoing MCBs					
4B4	Cables: 200m for each type of cable	Lot	1			
4B5	One set of special tools for operation and maintenance (as per recommendation from the manufacturer)	Lot	1			
4B6	Complete setup for office, manager office: Workstation, printer, UPS,..	Lot	1			
	Subtotal of Section-IV					
	Total of Schedule B1 (carried forward to Grand Summary)					
Total (carried forward to Grand Summary)						

Name of Bidder _____

Signature of Bidder _____

Notes:

¹ Bidders shall enter a code representing the country of origin of all imported plant and equipment.

²Specify currency in accordance with Bid Data

Construction of 230kV Transmission Line and Substation at Araihasar JEZ area (Package-2)

Schedule B3: Design Services

No.	Description	Unit	Quantity	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
				foreign portion	foreign portion	local portion	local portion
			(1)	(2)	(3) = (1) x (2)	(4)	(5)=(1) x (4)
1	Design and engineering services for general items	Lump sum	1				
3	Design and engineering services, local and foreign part (The 230/33kV Substation (1/2): 230kV Station)	Lump sum	1				
4	Design and engineering services, local and foreign part (The 230/33kV Substation (2/2): 33kV Station)	Lump sum	1				
Total (carried forward to Grand Summary)							

Name of Bidder

Signature of Bidder

Notes:

¹ Specify currency in accordance with Bid Data

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B4.1 : Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	(2)	(3) = (1) x (2)	(4)	(5) = (1) x (4)
Section II.	The 230/33kV Substation (part 1/2) - 230kV Station						
2A	Power transformer						
2A1	230/34.5 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformer with OLTC, and RTCC Panel including transformer tap changer control, fan control & AVR	Set	2				
2A2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for transformers.	Set	2				
2A3	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer	Set	1				
2B	HV Electrical Equipment and Material						
2B1	245kV double busbar with sections, Indoor Gas Insulated Switchgear (GIS)	Lot	1				
1	Four Line bays: 245kV - 4000A - 50kA/3s						
2	Two Section bays: 245kV - 4000A - 50kA/3s						
3	One Coupler bay: 245kV - 4000A - 50kA/3s						
4	Two Transformer bays: 245kV - 2000A - 50kA/3s						
5	Four busbar FES and Bus VT modules (may be integrated into others)						
6	245kV GIB for transmissison line bays						
7	245kV GIB for transformer bays						
8	Two Busbar extension module						
2B2	33kV, Compacted type, RMU switchgear (CCV Configuration)	Set	1				
2B3	198kV Surge Arrester with surge counter with support structures	Nos	18				
2B4	Rigid tubular conductor and/or stranded flexible conductors with accessories, insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard	Lot	1				
2B5	Steel gantry for each circuit of 245kV Transmission Line, Transformer& Equipment support Structure including all necessary accessories required for completing 230kV Switchyard	Lot	1				
2B6	30kV Surge Arrester with surge counter with support structures	Nos	6				
2C	Control, Protection, Substation Automation, Metering & DFDR						
2C1	Control, Monitoring, Protection & Substation Automation System including event recording function for line circuit bay	Set	4				
2C2	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus section bay	Set	2				
2C3	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus coupler bay	Set	1				
2C4	Control, Monitoring, Protection & Substation Automation System including event recording function for 230/33kV power transformer circuits	Set	2				
2C5	Busbar protection system for 245kV system	Lot	1				
2C6	Tariff metering for 230kV system	Lot	1				
2C7	Tariff metering for 33kV system (Incomers)	Lot	1				
2C8	Replacement of existing Protection main relays with new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits at existing Bhulta Substation	Set	2				
2C9	Digital Fault and Disturbance recorder (DFDR) to monitor complete 230kV station and 33kV incomers of 230/33kV transformers	Lot	1				
2C10	Complete SAS hardware & software (Server, firewall, gateway, GPS clock, switch, cable (Fiber optic, Ethernet, copper), embedded computer for tele metering - if required, HMI, engineering computer, printer, inverter & change over power supply- components depending on the detailed design)	Lot	1				
2C11	Integration, with necessary hardwares, of new Protection main relays (Main-1, Main-2) for Bhulta-Araihaazar overhead line circuits with the existing SAS at existing Bhulta Substation. Existing SAS is ABB, Switzerland make.	Lot	1				
2C12	Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation and also, hardware and necessary works required on other sides of the 230 kV transmission line (Ghorashal station, New Bhulta Substation).	Lot	1				
2D	Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations - Necessary modules for 87L protection (through multiplexer) - 21 relay carrier signal (Main-1 and Main-2) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	Lot	1				
2E	AC & DC system						
2E1	LVAC panels including PLC, BCU and necessary accessories	Lot	1				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B4.1 : Installation and Other Services

Item	Description	Unit	Quantit y	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
2E2	Tariff metering for LVAC system	Lot	1				
2E3	Automatic power factor correction (PFC) panel (≥150 kVAr)	Lot	1				
2E4	AC-DC rectifier system for 110 VDC	set	2				
2E5	110V Ni-cad Battery sets	set	2				
2E6	110 VDC panels including PLC, BCU and necessary accessories	Lot	1				
2E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2				
2E8	AC-DC rectifier system for 48 VDC	set	2				
2E9	48V Ni-cad Battery sets	set	2				
2E10	48 VDC panels including PLC, BCU and necessary accessories	Lot	1				
2F	Power cables, primary and secondary cables						
2F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations (Up to incomer panel inside 33kV building)	Lot	1				
2F2	19/33KV, ≥95sqmm copper, XLPE three phases cable with terminations to RMU	Lot	1				
2F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits	Lot	1				
2G	Camera System						
2G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1				
2G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.	Lot	1				
2H	Civil Works, Building and Foundation						
2H1*	Two story 230kV Indoor GIS Building (44.5mX14.5m)	sqm	2077.13				
2H2	_10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1				
2H3	_Elevator system (Capacity: 6 People)	Lot	1				
2K	Complete civil items required for outdoor works						
2K1**	Approach road (pavement width 6m)	m	66				
2K2**	Internal road						
	a)_6m wide road	m	400				
2K3	Substation main gate	Nos	1				
2K4**	Security boundary wall for overall plan	m	515				
2K5**	Chain linked fencing with gate	m	100				
2K6	Guard house	Nos	1				
2K7	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	Nos	1				
2K8	Blast wall with foundation	Nos	3				
2K9	Gravelling in switchyard area	Lot	1				
2K10	Outdoor gantry foundation in 230kV switchyard						
	a)_Gantry column	Nos	5				
2K11	Outdoor equipment foundation in 230kV switchyard						
	a)_LA	Lot	1				
	b)_GIB and Bushing	Lot	1				
2K12	Transformer foundation	Nos	2				
2K13	Auxilary transformer foundation	Nos	1				
2K14	Surface drain	Lot	1				
2K15	Cable trench/tunnel with soakpit	Lot	1				
2K16	Car port (clear span: 6.5mX6m)	Nos	1				
2K17	Septic tank (capacity: 25users for 5 years)	Nos	1				
2K18	Soakwell for septic tank	Nos	1				
2K19	Sentry Post	Nos	2				
2K20	Testing of foundation						
	a)_Compression test of pile	Nos	2				
	b)_Uplift test of pile	Nos	1				
	*Ground floor = 645.25sqm, Intermediate floor = 141.375sqm, 1st floor = 645.25sqm & Roof = 645.25sqm; Total Floor area = 2077.125sqm. *mesurement						
2L	Fire Alarm and Fire fighting						
2L1	Fire Alarm Control Panel with accessories, connected to SAS	Nos	1				
2L2	Fire resistant cables and accessories	Lot	1				
2L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, Reflective Beam Detector, and Linear Heat Detector and accessories	Lot	1				
2L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit Sign Light and accessories	Lot	1				
2L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1				
2L6	Indoor Fire hydrant and hose box (at least one set per level of building) and required Piping network	Lot	1				
2L7	Fire Bucket, respirator, ladder and battery type scissor lift	Lot	1				
2L8	Water Spray System (WSS) type Fire Fighting System for two (2) nos. of 230/34.5 kV transformers	Lot	1				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B4.1 : Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
2M	Earthing and Lightning Protection system and Portable Eathing Equipment						
2M1	Earthing system for complete substation	lot	1				
2M2	Lighting Protection System for complete substation	lot	1				
2M3	Portable(maintenance) earthing equipment device	set	2				
2N	Lighting, Small Power, Air Conditioning and Ventilation						
2N1	Indoor lighting (LED type), LV power supply and emergency DC lighting for the GIS Hall, local Control Houses, outdoor lighting (LED Type), security, roadway, switchyard and emergency DC lighting at strategic locations	Lot	1				
2N2	Air conditioning system and ventilation system for the GIS Hall, Control Houses	Lot	1				
2O	Miscellaneous items						
2O1	Latest model of new double cabin Pick-up car (Mitsubishi/NAVARA or equivalent brand) with Carry-boy	No.	1				
	Subtotal of Section-II						
Section III.	The 230/33kV Substation (part 2/2) - 33kV Station						
3A	Auxiliary Transformer						
3A1	33/0.415 kV, 300kVA, Dyn1 three phase outdoor type transformer	Set	1				
3B	MV Electrical Equipment and Material						
3B1	36kV double busbar, Indoor Gas Insulated Switchgear (GIS) IEC 61850 compliant IEDs shall be used	Lot	1				
1	16 Outgoing feeder: 36kV-1250A - 40 kA/s						
2	02 incomer feeder: 36kV - 2500A - 40kA/s						
3	04 panels (as required) for double busbar section: 36kV - 2500A - 40kA/s						
4	02 coupler feeder: 36kV - 2500A - 40kA/s						
5	04 sets of VT with three phase busbar disconnecter with earth switch: 36kV						
6	02 Aux transformer feeder: 36kV-800A - 40 kA/s						
7	1 set portable Partial Discharge analyser for GIS and Miscellaneous items						
3C	Control, Protection, Substation Automation, Metering & DFDR						
3C1	Control, Monitoring, Protection & Substation Automation System including event recording function for 33kV station	Lot	1				
3C2	Tariff metering for 33kV system	Lot	1				
3C3	Complete SAS system: hardware (Server, GPS clock, switch, cable (Fiber optic, Ethernet, copper), HMI, engineering computer, printer, inverter and change over power supply - components depending on the detailed design) & software.	Set	1				
3D	Telecom for Communication and Protection						
3D1	Hardware and necessary works for connection with 230kV station (SAS, Phone). Interconnection between 230kV station SAS and 33kV station SAS shall be done by armoured fiber optic cables.	Lot	1				
3D2	Fixed-line phone (3 phones)	Lot	1				
3E	AC & DC system						
3E1	LVAC panels including PLC, BCU and necessary accessories	Lot	1				
3E2	Tariff metering for LVAC system	Lot	1				
3E3	Automatic power factor correction (PFC) panel (≥150 kVAr)	Lot	1				
3E4	AC-DC rectifier system for 110 VDC	Set	2				
3E5	110V Ni-cad Battery sets	Set	2				
3E6	110 VDC panels including PLC, BCU and necessary accessories	Lot	1				
3E7	Inverter, Input- AC & DC, output -AC 230V, 5kVA 60min	set	2				
3E8	110V/48V DC DC Converter,1.0kVA (If required)	Set	2				
3E9	48V DC Disatribution Panel (If required)	Lot	1				
3F	Power cables, primary and secondary cables						
3F1	19/33KV, 1x800sqmm copper, XLPE, single core cable with terminations	Lot	1				
3F2	19/33KV, ≥95sqmm copper, XLPE three phases cable with terminations	Lot	1				
3F3	Single core and Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits	Lot	1				
3G	Camera System						
3G1	Indoor and outdoor PoE IP (bullet, dome) motion detection night vision Camera	Lot	1				
3G2	Network Video Recorder, PoE switch, online UPS and wall mounted (≥32 Inch) LED monitor. The camera system shall Integrated/connects to SAS.	Lot	1				
3H	Civil Works, Building and Foundation						
3H1*	One story 33kV Building (34.5mx12m)	sqm	828				
3H2	5 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1				
3K	Complete civil items required for outdoor works						
3K1	Substation main gate	Nos	1				
3K2	Guard house	Nos	1				
3K3*	Internal road						
	a) 6m wide road	m	100				
3K4	Aux transformer foundation	Nos	1				

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B4.1 : Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
3K5	Surface drain	Lot	1				
3K6	Cable trenche/tunnel with soakpit	Lot	1				
3K7	Car port (clear span: 6.5mX6m)	Nos	1				
3K8	Septic tank (capacity: 25users for 5 years)	Nos	1				
3K9	Soakwell for septic tank	Nos	1				
3K10	Testing of foundation						
	a)_Compression test of pile	Nos	1				
	* Ground floor = 414sqm & Roof = 414sqm; Total Floor area = 828sqm. *mesurement						
	method = clear length x clear width x no. of story ** actual						
	payment shall be as per actual work at site						
3L	Fire Alarm and Fire fighting						
3L1	Fire Alarm Control Panel with accessories, connects to SAS	Nos	1				
3L2	Fire resistant cables and accessories	Lot	1				
3L3	Smoke detector, Heat detector, Explosion-Proof Heat Detector, and Linear Heat Detector and accessories	Lot	1				
3L4	Alarm sounder, pushbutton fire alarm, Alert Lamp, Emergency Lamp, and Exit	Lot	1				
3L5	CO2 fire extinguisher, CO2 Wheel type extinguisher, ABC Wheel type extinguisher, ABC fire extinguisher, and Portable Clean Agent Fire Extinguisher	Lot	1				
3M	Earthing and Lightning Protection system and Portable Eathing Equipment						
3M1	_Earthing system for complete substation	lot	1				
3M2	_Lighting Protection System for complete substation	lot	1				
3M3	Portable(maintenance) earthing equipment device	set	2				
3N	Lighting, Small Power, Air Conditioning and Ventilation						
3N1	Indoor lighting (LED type), LV power supply and emergency DC lighting for the	Lot	1				
3N2	Air conditioning system and ventilation system for the GIS Hall, Control Houses	Lot	1				
	Subtotal of Section-IV						
	Total of Schedule B1 (carried forward to Grand Summary)						

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)
Schedule B4.2: Installation and Other Services

Item	Description	Unit	Quantit y	Foreign Currency (in.....)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	(2)	(3) = (1) x (2)	(4)	(5) = (1) x (4)
1	Factory Acceptance Test and Training						
(a)	International Training for the Employer	Lot	1				
(b)	Factory Acceptance Test witness by the Employer	Lot	1				
(c)	Local Training for the Employer	Lot	1				
Total (carried forward to Grand Summary)							

Name of Bidder _____

Signature of Bidder _____

Notes:
¹Specify currency in accordance with Bid Data

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)

Schedule of Specified Provisional Sums

Item	Description	Amount	
		Local	Foreign*
1	Cost of Dispute Board (DB)		JPY30,000,000
2	Covid-19		JPY400000
	Total (carried forward Grand Summary)		

Name of Bidder _____

Signature of Bidder _____

* Specify currency in accordance with Bid Data

Notes for the Bidders

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)			
Schedule B5: Grand Summary			
		Total price	
		Foreign Currency (in.....)	Local Currency (in BDT)
Section-I:Line In and Line Out (LILO) of 230 kV Transmission Line			
Schedule No. B1:	Plant & Equipment Supplied from within the Employer’s Country		
Schedule No.B2:	Plant & Equipment Supplied from within the Employer’s Country		
Schedule No. B3:	Design Services		
Schedule No. B4:	Installation and Other Services		
Total of Section -I			
Section-(II , III & IV): 230/33kV Substation including Spares & Tools			
Schedule No. B1:	Plant & Equipment Supplied from outside the Employer’s Country		
Schedule No.B2:	Plant & Equipment Supplied from within the Employer’s Country		
Schedule No. B3:	Design Services		
Schedule No. B4.1:	Installation and Other Services		
Schedule No. B4.2:	Installation and Other Services (Factory Acceptance Test and Training)		
Total Section-(II + III + IV)			
Schedule No. B4.3: Specified Provisional Sums		JPY30,400,000	
Grand Total			

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area
(Package-2)**

SCHEDULE C

COMPLETION TIME SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)

SCHEDULE C

TIMES FOR DELIVERY AND COMPLETION

The individual dates are all contractually binding.

The times given under Column D are the commissioning target dates at present planned to be achieved and may be the subject of mutual adjustment.

Column A details the earliest dates by which access to site can be given for storage purposes. The times entered under column B are to be the dates guaranteed for arrival at Site of the first shipment of parts for the circuits in question being also the dates when the contract requires access to the Site for plant erection, to the extent necessary to enable him to proceed with work to meet the dates under column C guaranteed for complete delivery, erection and commissioning of the shipment.

The times include all necessary control, relay, metering, auxiliary power ancillary equipment to enable the respective circuit or item of plant to be completely commissioned and put into commercial operation, together with such other associated equipment, e.g., busbars, etc as will ensure that subsequent shutdown are unnecessary or at least only of a temporary or short time nature.

The dates assume an order is placed by
(to be advised or stated by Bidder)

Site	A* Latest Access Permitted	B* Guaranteed Arrival of first shipment	C* Guaranteed Completion	D* Target Completion
Araihaazar	7 days from the contract effective date		540 days	

* Time in days, from contract effective date.

Preliminary SLD, overall layout and control building drawings of the Technical Specifications shall be provided within 2.0 months of the contract commencing date.

Schedule D: Manufacturers, Places of Manufacture and Testing

The following form shall be filled and attached to the bid. Bidders are free to propose/list more than one Manufacturer for each item.

Quoted rates and prices shall be deemed to apply to whichever Manufacturer is appointed, and no adjustment of the rates and prices will be permitted.

Their participation shall be confirmed with the Manufacturer's Authorization letter(s), as required.

In case that more than one Manufacturer has been proposed, the Employer have right to choose one or more of them, or can ask for replacement.

Prior to signing the Contract, the corresponding Appendix to the Deed of Agreement shall be completed, listing the approved manufacturers for each (major) item concerned. For the items not listed in Appendix to the Deed of Agreement, manufacturers shall be selected from the list in this schedule-D.

Manufacturers

The following Manufacturers are proposed for carrying out the facilities: (this is a general format, put 'Not Applicable' against any item which is outside scope)

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
1. Power Transformer					
1.1	Transformer 230/33 kV				
i.	Complete				
ii.	Tap Changer				
iii.	Bushing: HV/LV/NV				
iv.	Silicon Core				
v.	Copper Winding				
vi.	Winding Insulation Material				
vii.	Oil				
viii.	Tank				
ix.	Radiator				
x.	Fan				
xi.	Motor				
xii.	Temperature Indicator (Oil Temperature, Winding temperature)				

xiii.	PRD				
xiv.	Oil Valve				
xv.	Silica Gel				
xvi.	Gas/Oil actuated relay				
xvii.	AVR				
xviii.	Indicating Instruments				
xix.	Cooler control Equipment				
xx.	Remote control panel				
xxi.	Magnetic Shunt				
xxii.	Clamp				
xxiii.	Buchholz Relay				
xxiv.	Membrane				
1.3	Auxiliary Power Transformer				
i.	Auxiliary power transformer 300kVA, 33/0.415 kV				
4. 245 kV Equipment					
4.1	230kV GIS				
	GIS 230 kV Complete				
	Enclosure				
	SF ₆				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnecter				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				

4.2	230kV AIS				
4.2.5	Surge arresters 230 kV				
	ZnO Resistor Block				
	Housing				
	Surge Counter				
6. 33 kV Equipment					
6.1	Surge arresters 33 kV				
6.2	33kV GIS				
	GIS 33kV Complete				
	Enclosure				
	SF6				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnecter				
	Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				
7.Control, Protection, and Metering Equipment					
7.1	Control & monitoring equipment				
7.2	Relay protection equipment				
7.3.	Control & protection panels				
7.4.	Metering equipment				
7.5.	Metering panels				
7.6	Auxiliary Switches				
7.7.	Auxiliary Relays				
7.8.	Trip Relays				
7.9.	TCS Relays				
7.10.	Relay Test Block				

7.12	Humidity Sensor				
8. Substation Automation System					
8.1	Bay Control Unit				
8.2	Industrial Server				
8.3	Server Processor				
8.4	Firewall				
8.5	Gateway Server				
8.6	GPS system				
8.7	Ethernet Switch				
8.8	Modem				
8.9	LCD Monitor				
8.10	Monitor & Keyboard				
8.11	Printer				
8.12	55" LCD Monitor				
8.13	Cables (FO, EC,CC)				
9.Digital Fault & Disturbance Recorder					
9.1	Control Card				
9.2	Data Acquisition material				
9.3	Panel				
9.4	Processor				
9.5	Copper cable				
9.6	Fibre optic Cable				
9.7	Engineering PC				
10.Telecommunication Equipment					
10.1	Communication equipment				
10.2	Multiplexer				
10.3	Fibre Optic cable				
10.4	PLC Communication	NA	NA	NA	NA
10.5	Complete				
10.6	Panel				
11. XLPE Cable & Cable Termination Kit & Cable Trays					
XLPE Cable					
11.4	33kV				
Cable Sealing End/ Cable Termination Kit (AIS)					
11.8	33kV				

12.Auxiliary Power Supply Equipment					
12.1	Battery				
12.2	Charger				
12.3	DC distribution Panel & Switchboard				
12.4	AC distribution Panel & Switchboard				
12.5	Inverter				
13.Conductors, Insulators & Fittings					
13.1	Conductors				
	Flexible Conductor				
13.2	Insulators				
	Post Insulator				
	Disk Insulator				
13.3	Fittings, Clamps & connectors				
14. Earthing & Lightning					
14.1	Copper Conductor				
14.2	Insulated Copper Conductor				
14.3	Earthing Wire				
15. Multicore LV Auxiliary Power and Control Cables					
15.1	LV Cables				
15.2	Cable Trays				
16. For Transmission Line					
16.1	TOWER Nut, Bolts and Washers etc				
16.2	Conductor				
16.3	Conductor fittings				
16.4	Disk Insulator unit				
16.5	Insulator fittings				
16.6	OPGW				
	OPGW fittings				
	Joint/Splice Boxes				
Name of Bidder:					

Signature of Bidder:

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

Construction of 230kV Transmission Line and Substation at Araihasar JEZ area (Package-2)

SCHEDULE E

TECHNICAL PARTICULARS AND GUARANTEES

Schedule E: Guaranteed Technical Particular (GTP)

Title No.	Description of the Title
PART 1 - 230 kV & 33kV GIS	
1.1A	230kV INDOOR TYPE GIS SWITCHGEAR:
1.1B	230kV OUTDOOR TYPE GIS SWITCHGEAR: (out of scope)
1.1C	33kV INDOOR TYPE GIS SWITCHGEAR
1.1d	33kV OUTDOOR TYPE GIS SWITCHGEAR: (out of scope)
PART 2 – Outdoor Type Switchgear (AIS)	
2.1	33kV VACUUM CIRCUIT BREAKERS: (out of scope)
2.2	33kV DISCONNECTORS:: (out of scope)
2.3	33kV CURRENT TRANSFORMERS : (out of scope)
2.4	33kV INDUCTIVE VOLTAGE TRANSFORMER: (out of scope)
2.5	SURGE ARRESTERS
	A. 230kV SURGE ARRESTERS
	C. 33kV SURGE ARRESTERS
2.6	CONDUCTOR STEEL STRUCTURES, CONDUCTOR, INSULATOR SETS & FITTINGS
PART 3– Power Transformer & Auxiliary Transformer	
3.1	230/33 kV, 120/140 MVA, 3-PHASE TRANSFORMER
3.2	33/0.415 kV AUXILARY TRANSFORMERS
PART 4 – AUXILIARY POWER AND MULTICORE CONTROL CABLES	
PART 5-DC EQUIPMENT	
4.1	110 V & 48V CHARGERS
4.2	BATTERIES
PART 6 - LVAC EQUIPMENT	
5.1	ACDB
PART- 7: Control, Relay Protection, Substation Automation System & Metering	

PART 8 - FIBRE OPTIC MULTIPLEXER EQUIPMENT	
PART 10 – Digital Fault and Disturbance Recorder (DFDR).	
PART-11: HV Power Cables and Accessories	
11.1	33kV XLPE CABLE

The technical data schedules hereafter provides more details on the specific technical criteria and complement the Information given in the Bidding documents. The data in the “Minimum requirement” Column indicates Employer’s requirement and shall be read in conjunction with Schedule of requirement Appendices in Volume II. If discrepancy occurs between the values of “Drawings” and “Schedule of requirement Appendices” and “Minimum requirement” column of Technical data schedule mentioned here, the highest rating shall prevail. In that case, Bidders shall clarify and re-produce these data from the confirmed one. Bidders shall submit all the Guaranteed Technical Particulars of all equipment and materials, which will be needed for this Construction project according to Volume II, even if there is not in Schedule E forms.

They form an essential part of bid submission and will be used in bid evaluation. They should be fully completed and submitted with the bid.

Note:

1. The GTP (Guaranteed Technical Particulars) shall be provided by the respective Vendor in their letterhead pad mentioning contractor/supplier Name, Users’ name as PGCB and Consultant Name (if any) as per provision of contract between PGCB & Contractor. GTP must have Revision No. & date of submission. Responsible personnel of Manufacturer (prepared by, checked by & approved by, as appropriate) shall sign the GTP. The Project Manager/Design & Quality Control Personnel of Contractor shall also sign the GTP before submission to PGCB.
2. The items that require detail design of the offered equipment, may be kept unfilled mentioning TBA during detailed design. All other data shall be filled during bidding.

GTP & Requirement Form: 230kV GIS Switchgear

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
1.	GIS Switchgear 230 kV – General & Electrical			
1.1.	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type: - GIS type - Type of busbars - Model designation	- - -	Indoor Double, passive Insert	
1.4	Enclosure: -Bus bar -Bay -Enclosure material		Three Phase Single Phase Insert	
1.5	Nominal system voltage	kV _{rms}	230	
1.6	Highest voltage for equipment U _n	kV _{rms}	245	
1.7	Rated lightning impulse withstand voltage - phase to earth - phase to phase - across open isolator - across open gap c.b.	kV _{peak}	1050 Insert Insert Insert Insert	
1.8	Rated short duration power frequency voltage (rms value for 1 minute) - phase to earth - phase to phase - across open isolator - across open gap c.b	kV _{rms}	460 Insert Insert Insert Insert	
1.9	Rated frequency f _r	Hz	50	
1.10	Rated current I _r • Busbars • Line bay • Transformer bay • Bus Coupler Bay • Bus Section Bay	A A A A A	[As per SLD & Schedule A of Volume 3]	
1.11	Rated short-circuit breaking current I _{sc}	kA _{rms}	≥ 50	
1.12	Duration of short-circuit	s	≥ 3	
1.13	Rated peak withstand current I _p (equal short-circuit making current)	kA _p	≥ 125	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
1.14	Standard	-	IEC	
2	Solid Insulator			
2.1	Type of Solid Insulator		Disc type	
2.2	Material of Solid Insulator		Epoxy cast resin	
2.3	Discharge level at 110% of the rated voltage	pc	10	
2.4	Gas tight disc type insulator	Bar	Insert	
	- Bursting pressure	Bar	Insert	
	- Routine test pressure			
3	Insulation Medium			
3.1	Insulation Medium		SF ₆	
3.2	Max. Permissible moisture content			
	- For circuit breaker	ppm	≤300	
	- For other compartments	ppm	≤700	
3.3	Max. Permissible air content	Vol %	5	
4	Gas Compartments			
4.1	No. of gas compartment per feeder	pcs.	Insert	
4.2	Max. Gas losses per gas compartment per year	pc	< 0.1	
4.3	Min operating period to 1 recharge of SF ₆ gas	Years	10	
4.4	Material of filter employed for moisture absorption		Al ₂ O ₃	
4.5	SF ₆ filling pressure at 20°C ambient temp.	Bar	Insert	
	Min. SF ₆ service pressure at 40°C ambient temp.	Bar	Insert	
	Min. SF ₆ service pressure at 25°C ambient temp.	Bar	Insert	
4.6	Type of gas monitoring		Density Monitor	
	Signal: "Loss of SF ₆ Gas" at 20°C ambient temp.		Insert	
	Signal: "Min. SF ₆ Density" at 20°C ambient temp.		Insert	
4.7	Type of pressure relief device		Rupturing diaphragm	
4.8	Material of pressure relief device		Stainless steel	
4.9	Setting of pressure relief device		Insert	
5	Enclosure			
5.1	Temperature rise of enclosure at rated current			
	- which have to be touched during operation	°C	Max. 30	
	- which need not to be touched during operation	°C	Max. 40	
	- which are not accessible to the operator	°C	Max. 55	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
5.2	Mechanical strength of enclosure - Design pressure - Min. bursting pressure	bar bar	Insert Insert	
6.	Circuit Breaker			
6.1	Type of circuit breaker		GIS, Indoor	
6.2	Isolating and quenching medium		SF ₆	
6.3	Enclosure		Single Phase	
6.4	Enclosure Material		Insert	
6.5	Material of Contacts		Silver plated copper	
6.6	Design		Single breaking	
6.7	Operating mechanism		Spring Motor charged	
6.8	Number of poles	pcs.	3	
6.9	No. of breaks per phase	pcs	1	
6.11	Number of operating mechanisms per circuit breaker: For double busbar: • Line bay CB • Transformer bay CB • Bus Coupler Bay CB • Bus section bay CB	pcs. pcs. pcs. pcs.	3 1 1 1	
6.12	D.C. component of the rated short-circuit breaking current	%	> 30	
6.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
6.13.1	Rated continuous current (at 40°C ambient temperature) I _r • Line feeder • Bus coupler • Bus section • Transformer feeder • Transformer incomer feeder • 33kV outgoing feeder	A A A A A A	[As per SLD & Schedule A of Volume 3]	
6.14	Rated short time breaking current (for 3 sec)	kA	50	
6.15	Rated short time making current	kA	125	
6.16	Rated peak withstand current	kA	125	
6.17	Auto reclosing For double busbar: • Line bay CB • Transformer bay CB • Bus coupler bay CB • Bus section bay CB		1p+3p N/A N/A N/A	

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
6.18	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
6.19	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
6.20	Total opening time (max)	ms	Insert	
6.21	Total dead time (max)	ms	≤ 300	
6.22	Total closing time (max)	ms	≤ 90	
6.23	Restrike performance during capacitive current switching	Class	C2	
6.24	Number of operations without maintenance - CO at no-load - CO at rated current - CO at rated breaking current I_{sc}		≥ 10000 ≥ 2500 insert	
6.25	The frequency of mechanical operations	Class	M2	
6.26	Rated electrical endurance	Class	E2	
6.27	Making coil - number per operating mechanism - rated power each	Pcs W	1 Insert	
6.28	Tripping coil - number per operating mechanism - rated power each - voltage tolerances	pcs. W %	2 Insert -30 / +10	
6.29	Minimum number of available contacts (NO/NC/wiping)		12NO+12NC+2	
6.30	Accessories in central control panel			
6.30.1	Anti-pumping relay		Yes	
6.30.2	Local/remote control selector switch		Yes	
6.30.3	Local operation push buttons		Yes	
6.30.4	Minimum pressure lock-out and alarm relays		Yes	
6.30.5	Operation counter		Yes	
6.31	First-pole-to-clear-factor		1.3	
6.32	Rated breaking current, small capacitive currents - Line charging - Cable charging - Capacitor bank	A A A	125 250 400	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
6.33	Rated breaking current, small inductive currents - Unloaded transformers - Transformer loaded with reactor - Shunt reactors	A A A	25 >200 >250	
6.34	Switching overvoltage	p.u.	2.5	
6.35	Rated motor voltage	V d.c.	110	
6.36	Rated motor power	W	Insert	
7.	Disconnecter without earth switch			
7.1	Type		GIS, Indoor (As per SLD & Schedule A of volume 3)	
7.2	Enclosure		Single Phase	
7.3	Enclosure Material		Insert	
7.4	Material of Contacts		Silver plated copper	
7.5	Gas quantity (3-phase) for disconnector	kg	Insert	
7.6	Type of disconnector • Three poles, motor operated • Three pole, make-proof, motor operated earthing switch • Three pole, disconnector link, hand operated		Yes No Yes	
7.7	Number of poles	pcs.	3	
7.8	Number of operating mechanisms	pcs.	1	
7.9	Type of operating mechanism • Three poles, motor operated • Three poles, make-proof • Disconnector Link		Motor driven N/A Manual/Lever	
7.10	No. of breaks in series (per phase)	pcs.	1	
7.11	Rated breaking current (capacitive)	A	Insert	
7.11.1	Rated continuous current (at 40°C ambient temperature) I _r • Line feeder • Transformer incomer feeder • 33kV outgoing feeder	A A A	[As per SLD & Schedule A of Volume 3]	
7.12	Operating mechanism - for closing - for opening		Motor Motor	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
7.13	Max. operating time - for closing - for opening	sec sec	Insert Insert	
7.14	Auxiliary contacts number (NC/NO/wiping)	pcs.	12 / 12 / 2	
7.15	Rated motor voltage	V d.c.	110	
7.16	Rated motor power	W	Insert	
7.17	Hand operating facilities		Yes	
8.	Disconnecter with Earth switch			
8.1	Type		GIS, Indoor	
8.2	Enclosure		Single Phase	
8.3	Enclosure Material		Insert	
8.4	Material of Contacts • Disconnecter • Earth Switch		Silver plated copper Insert	
8.5	Gas quantity (3-phase) for disconnector with earth switch	kg	Insert	
8.6	Type of disconnector • Three poles, three position (close/open/earthed), motor operated, insulated, with earthing switch • Three pole, make-proof, motor operated earthing switch • Three pole, disconnector link, hand operated		Yes Yes No	
8.7	Number of poles	pcs.	3	
8.8	Number of operating mechanisms	pcs.	1	
8.9	Type of operating mechanism • Three poles, three positions • Three poles, make-proof • Disconnecter Link		Motor driven Motor wound spring N/A	
8.10	No. of breaks in series (per phase)	pcs.	1	
8.11	Rated breaking current for DS (capacitive)	A	Insert	
8.11.1	Rated continuous current of DS (at 40°C ambient temperature) I _r • Line feeder • Bus coupler • Bus section • Transformer feeder	A A A A	[As per SLD & Schedule A of Volume 3]	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
8.12	Operating mechanism - for closing - for opening		Motor Motor	
8.13	Max. operating time for DS - for closing - for opening	sec sec	Insert Insert	
8.13	Max. operating time for ES - for closing - for opening	sec sec	Insert Insert	
8.14	Auxiliary contacts number - DS (NC/NO/wiping) - ES (NC/NO)	pcs. pcs	12 / 12 / 2 6 / 6	
8.15	Rated motor voltage	V d.c.	110	
8.16	Rated motor power	W	Insert	
8.17	Hand operating facilities		Yes	
9	Maintenance earthing switch			
9.1	Design		GIS, Indoor, three phase gang operation	
9.2	Enclosure		Single Phase	
9.3	Enclosure Material		Insert	
9.4	Gas quantity (3-phase) for earthing switch	kg	Insert	
9.5	Operating mechanism - for closing - for opening		Motor Motor	
9.6	Max. operating time - for closing - for opening	sec sec	Insert Insert	
9.7	Auxiliary contacts - number (NC / NO)	pcs.	6 / 6	
9.8	Rated motor voltage	V d.c.	110	
9.9	Rated motor power	W	Insert	
9.10	Hand operating facilities		Yes	
10	High speed earthing switch			
10.1	Design		GIS, Indoor, three phase gang operation	
10.2	Enclosure		Single phase	
10.3	Enclosure Material		Insert	
10.4	Gas quantity (3-phase) for earthing switching	kg	Insert	

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
10.5	Rated short circuit making current	kA	Insert	
	Rated capacitive breaking current (at 6 kV eff.)	A	Insert	
	Rated inductive breaking current (at 10 kV eff.)	A	Insert	
10.6	Operating mechanism - for closing - for opening		Spring Motor charged Spring Motor charged	
10.7	Max. charging time	sec	Insert	
10.8	Max. operating time - for closing - for opening	ms	Insert	
		ms	Insert	
10.9	Auxiliary contacts - number (NC / NO / wiping)	pcs.	6 / 6 / 2	
10.10	Rated motor voltage	V d.c.	110	
10.11	Rated motor power	W	Insert	
10.12	Hand operating facilities		Yes	
10.13	Insulated / Non-insulated		Insert	
11.	Current Transformer			
11.1	Type		GIS, Indoor	
11.2	Characteristics of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and provide detail calculation and detail design, which will be subject to the PGCB's approval		Yes	
11.3	Rated continuous thermal current (40°C): • I core • II core • III core • IV core • V core • V I core	% In % In % In % In % In % In	120 for protection cores & 200 for metering cores	

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
11.4	Current Transformer Rating: Secondary current, class, burden Line, Transformer feeders, Bus coupler, Bus section CT Cores: - I core - II core - III core - IV core - V core	A/A, CL, VA	(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
11.5	Security factor metering core		Fs = 5	
12.	Voltage Transformer			
12.1	Type		GIS, Indoor	
12.2	Rated primary voltage	kV	230/ $\sqrt{3}$	
12.3	Voltage Transformer Rating: Secondary voltage, class, burden Line, Transformer feeders, Busbars VT Cores: - I core - II core - III core	V/V, CL, VA	(VT type, number, ratio, burden & class of VT cores shall be as per SLD & Schedule A of Volume 3. All VT parameters shall be finalized by calculation during the execution stage)	
12.4	Load		Simultaneously	
13	Surge Arresters (Not applicable)			
13.1	Type		GIS, Indoor	
	Quantity, Position & Characteristic of Surge Arresters are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design, which will be subject of the PGCB's approval		Yes	
13.2	Rated voltage of surge arrester U_r	kV _{rms}	216 (Shall be finalized by calculation)	
13.3	Max. continuous operating voltage U_c	kV _{rms}	186 (Shall be finalized by calculation)	
13.4	Nominal discharge current I_n (8/20 μ s)	kA _{peak}	10	
13.5	High current impulse of an arrester (4/10 μ s)	kA _{peak}	100	
13.6	Line discharge class	Class	3	
13.7	Energy dissipation capacity (per kV of rated voltage)	kJ/ kV	≥ 6.5	
13.8	Long duration current impulse (2000 μ s)	A	Insert	

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
13.9	Maximum residual voltage U_{res}			
	For switching impulse current 30/60 μs at 0,5 kA	kV _{peak}	Insert	
	For switching impulse current 30/60 μs at 1 kA	kV _{peak}	Insert	
	For switching impulse current 30/60 μs at 2 kA	kV _{peak}	Insert	
	For lightning impulse current 8/20 μs at 5 kA	kV _{peak}	Insert	
	For lightning impulse current 8/20 μs at 10 kA	kV _{peak}	Insert	
	For lightning impulse current 8/20 μs at 20 kA	kV _{peak}	Insert	
14	Site Condition			
14.1	Max. altitude above sea level	m	not more than 1000	
14.2	Max. ambient temperature, outdoor	°C	+45	
14.3	Min. ambient temperature, indoor	°C	+4	
14.4	Max. ambient relative humidity	%	100	
14.5	Max. seismic accelertion at floor level			
	- horizontal	g	0.2	
	- vertical	g	0.2	
15	Secondary circuits			
15.1	Auxiliary voltages:			
	- for controlling and signalling	V d.c.	110	
	- for remote control	V d.c.	110	
	- for heating	V a.c.	415 /240, 50Hz	
	- tolerance	%	-15 / +10	
16	Connection			
16.1	Type: GIB - Gas Insulated Busbars, Indoor		Yes	
16.2	Type: Single phase or Three phase, according to the design		Yes	
16.3	Insulator, Single phase, SF6 / Air		Yes	
16.3.1	Manufacturer of SF6 to Air Bushing		Insert	
16.3.2	Enclosure		Single Phase	
16.3.3	Enclosure material		Insert	
16.3.4	Insulating material		Composite/Silicon	
16.3.5	Minimum creepage distance	mm/ kV	≥ 25 mm/ kV	
16.3.6	Flashover distance	mm	Insert	
17	Circuit Breaker Control Cubicle			

No.	Description	Unit	Minimum Requirements	Guaranteed By bidder
			Data	Data
			230kV	230kV
17.1	Material		Insert	
17.2	Material thickness	mm	Insert	
17.3	Dimensions			
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height	mm	Insert	
18	Separate Local Control Cubicle			
18.1	Material (Steel)		Yes	
18.2	Material thickness	mm	Insert	
18.3	Dimensions			
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height	mm	Insert	
18.4	Total weight	kg	Insert	
19	Maintenance requirement			
19.1	Compliance with maintenance, repair or extension (MRE) and HV testing requirements		As per attached MRE & testing scheme	
19.2	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GIS Switchgear 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Switchgear 33 kV - General			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Nominal system voltage	kV _{rms}	33	
1.6	Highest voltage for equipment U _n	kV _{rms}	36	
1.7	Rated lightning impulse withstand voltage	kV _{peak}	170	
1.8	Rated short duration power frequency voltage	kV	70	
1.9	Rated frequency f _r	Hz	50	
1.10	Rated current I _r			
	• Busbars	A	≥ 3000	
	• Line bay	A	≥ 1250	
	• Transformer bay	A	≥ 2500	
	• Bus Coupler bay	A	≥ 2500	
	• Bus Sectionalizer bay	A	≥ 2500	
	• Aux Trafo bay	A	≥ 800	
1.11	Rated short-circuit breaking current I _{sc}	kA _{rms}	≥ 40	
1.12	Duration of short-circuit	s	≥ 3	
1.13	Rated peak withstand current I _p (equal short-circuit making current)	kA	≥ 100	
	Control voltage	V. DC	110	
	Motor - auxiliary supply voltage	V. DC	110	
	Heater supply voltage	V. Hz	230. 50	
1.14	Type of busbars	-	Double, sectionalize	
2.	Circuit Breaker			
2.1	Isolating and quenching medium		Vacuum	
2.2	Type of circuit breaker		GIS /Indoor	
2.3	Design		Single breaking	
2.4	Operating mechanism		Motor-wound spring	
2.5	Number of poles	pcs.	3	
2.6	Number of operating mechanisms per circuit breaker			
	• Line bay	pcs.	1	
	• Transformer bay	pcs.	1	
	• Bus Coupler bay	pcs.	1	
2.7a	D.C. component of the rated short-circuit breaking current	%	> 30	
2.7b	First-pole-to-clear factor	p.u.	1.3	
	• Terminal fault	p.u.	N.A.	
	• Short-line fault	p.u.	N.A	
	• Out-of-phase			
2.8	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.9	Auto reclosing			
	• Line bay		3p	
2.10	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 100	
2.11	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.12	Restrike performance during capacitive current switching	Class	C2	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13	Number of operations without maintenance - CO at no-load - CO at rated current - CO at rated breaking current I_{sc}		≥ 10000 ≥ 2500 ≥ 5	
2.14	The frequency of mechanical operations	Class	Min M1	
2.15a	Rated electrical endurance	Class	Min E1	
2.15b	Operating mechanism			
2.13	Number of making coils	pcs.	1	
2.14	Number of breaking coils	pcs.	2	
2.15	Minimum number of available contacts (NO/NC)		Min 6NO+6NC	
	Accessories in central control panel			
2.16	Anti-pumping relay		Yes	
2.17	Local/remote control selector switch		Yes	
2.18	Local operation push buttons		Yes	
2.19	Minimum pressure lock-out and alarm relays		Yes	
2.20	Operation counter		Yes	
3.	Disconnecter			
3.1	Type		GIS /Indoor	
3.2	Type of disconnector			
	Three pole, three position (close/open/earthed), motor operated, insulated, with earthing switch		Yes	
	Three pole, Disconnector, Motor operated		Yes	
3.3	Number of poles	pcs.	3	
3.4	Number of operating mechanism	pcs.	1	
3.5	Type of operating mechanism			
	Three position		Motor driven	
	Disconnector		Motor driven	
4.	Current Transformer			
4.1	Type		GIS /Indoor	
	Characteristics of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design, which will be subject of the PGCB's approval		Yes	
4.2	Rated continuous thermal current (40°C): - I core - II core - III core - IV core - V core	% I _n % I _n % I _n % I _n % I _n	120 for protection cores & 200 for metering cores	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.3	Current Transformer Rating: Secondary current, class, burden Line, Transformer feeders, Bus coupler, Bus section CT Cores: - I core - II core - III core - IV core - V core	A/A A/A A/A A/A A/A	(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
4.5	Security factor metering core		Fs=5	
4.6	Rated power: - I core - II core - III core - IV core - V core	VA VA VA VA VA	30 VA for protection cores & 15VA for metering cores (CT rated burden shall be finalized by calculation during the execution stage)	
5.	Voltage Transformer			
5.1	Type		GIS /Outdoor	
5.2	Rated primary voltage	kV	33/√3	
5.3	Rated secondary voltage - I winding - II winding - III winding	V V V	110/√3 110/√3 110/√3	
5.4	Accuracy class: - I winding - II winding - III winding		0.2 0.2 1/3P	
5.5	Rated power: - I winding - II winding - III winding	VA VA VA	15 15 30 (VT rated burden shall be finalized by calculation during the execution stage)	
5.6	Load		Simultaneously	
6.	Surge Arresters - Characteristics			
6.1	Nominal system voltage	kV _{rms}	33	
6.2	Highest voltage for equipment U _n	kV _{rms}	36	
6.4	Rated voltage of surge arrester U _r	kV _{rms}	30	
6.5	Max. continuous operating voltage U _c	kV _{rms}	24	
6.8	Rated frequency	Hz	50	
6.9	Nominal discharge current I _n (8/20 μs)	kA _{peak}	10	
6.10	High current impulse of an arrester (4/10 μs)	kA _{peak}	100	
6.11	Type		GIS/Indoor	
6.12	Surge Counter with Leakage Meter		Yes	
7	Connection			
7.1	Type: Cable Connection , Indoor		Yes	
7.2	Type: Single phase or Three phase, according to the design		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.3	Outgoing feeder shall be provided with dummy plug		Yes	
8	Maintenance requirement			
8.1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays		Yes	
	Overall compliance with the requirements (yes/no)			

Surge Arrester 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Surge Arresters - General			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
2.	Surge Arresters - Characteristics			
2.1	Nominal system voltage	kV rms	33	
2.2	Highest voltage for equipment U_n	kV rms	36	
2.4	Rated voltage of surge arrester U_r	kV rms	30	
2.5	Max. continuous operating voltage U_c	kV rms	24	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current I_n (8/20 μs)	kA peak	10	
2.10	High current impulse of an arrester (4/10 μs)	kA peak	100	
3.	Surge Arresters - Design and Construction			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 μs)	A	≥ 850	
3.4	Maximum residual voltage U_{res}			
3.4.1	For switching impulse current 30/60 μs at 0,5 kA	kV peak	≤ 65	
3.4.2	For switching impulse current 30/60 μs at 1 kA	kV peak	≤ 67.5	
3.4.3	For switching impulse current 30/60 μs at 2 kA	kV peak	≤ 70	
3.4.4	For lightning impulse current 8/20 μs at 5 kA	kV peak	≤ 75	
3.4.5	For lightning impulse current 8/20 μs at 10 kA	kV peak	≤ 80	
3.4.6	For lightning impulse current 8/20 μs at 20 kA	kV peak	≤ 90	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 μs)	kV	≥ 235	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 105	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F_{dyn})	N	≥ 7500	
3.6.2	Specified long-term load SSL (F_{stat})	N	≥ 5000	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		Composite/Silicone	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	
3.11	Surge arrester weight	kg	Insert	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	Min 100 x 100	
3.14.3	Number of holes		Min 2	
3.14.4	Distance between holes	Mm	50	
3.14.5	Material suitable for		Al terminal	
	Overall compliance with the requirements (yes/no)			

Surge Arrester 230 kV (AIS)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Surge Arresters - General			
1.1	Manufacturer		Insert	
1.2	Type		SM	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
1.9	Type Test Report Reference		Insert	
2	Surge Arresters - Characteristics			
2.1	Voltage			
2.1.1	Nominal System Voltage	kV rms	230	
2.1.2	Highest voltage for equipment Um	kV rms	245	
2.1.3	Rated voltage of surge arrester Ur	kV rms	198	
2.1.4	Max. continuous operating voltage Uc	kV rms	158	
2.1.5	Reference Voltage	KVrms	Insert	
2.1.6	Gap between Vref & MCOV	% of MCOV	Insert	
2.1.7	TOV [Curve to be attached]			
	0.1s	pu [of MCOV]	Insert	
	1s	pu [of MCOV]	Insert	
	3s	pu [of MCOV]	Insert	
	10s	pu [of MCOV]	Insert	
2.1.8	Maximum residual voltage Ures			
	For switching impulse current 30/60 μ s	kV peak	≤ 390	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	at 0,5 kA			
	For switching impulse current 30/60 μ s at 1 kA	kV peak	≤ 400	
	For switching impulse current 30/60 μ s at 2 kA	kV peak	≤ 415	
	For lightning impulse current 8/20 μ s at 5 kA	kV peak	≤ 455	
	For lightning impulse current 8/20 μ s at 10 kA	kV peak	≤ 480	
	For lightning impulse current 8/20 μ s at 20 kA	kV peak	≤ 535	
2.1.9	Dielectric endurance of arrester housing			
	Lightning impulse withstand voltage of arrester housing up (1.2/50 μ s)	kV	Insert	
	Power frequency withstand voltage of arrester housing (1 min wet)	kV	Insert	
2.1.10	Arrester Protection Margin/level			
	Lightning Impulse Protection Margin/level		Min 2.2	
	Switching Impulse Protection Margin/level		Min 1.5	
	Steep current impulse protection Margin/level		Min 2.0	
2.2	Current			
2.2.1	Reference Current	mA	Insert	
2.2.2	Long duration current impulse (2000 μ s)	A	≥ 850	
2.2.3	Nominal discharge current I_n (8/20 μ s)	kA peak	10	
2.2.4	High current impulse of an arrester (4/10 μ s)	kA peak	100	
2.3	Others			
2.3.1	Line discharge class	Class		
2.3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 7	
2.3.3	Thermal Charge Transfer Rating, Q_{th}	Coulombs	Insert	
2.3.4	Repetitive Charge Transfer Rating, Q_{rs}	Coulombs	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3.5	Rated frequency	Hz	50	
2.3.6	Partial Discharge Level	pC	≤ 10	
3	Surge Arresters - Design and Construction			
3.1	Designed Life	Years	Insert	
3.2	MTBF		Insert	
3.3	MTTR		Insert	
3.4	Resistor Block			
3.4.1	Diameter	mm	Insert	
3.4.2	No. of ZnO Block in series at One unit	No.	Insert	
3.4.3	No. of separately housed arrester unit	No.		
3.4.4	Housing design			
	Open or Case Design Closed or Wrap Design Hollow Tube Design		Insert	
	Pressure relief device No. & Location		Insert	
	Highest pressure developed during rated discharge current	kPa	Insert	
	Pressure Relief Class		Insert	
	Alternate shed housing	Yes/No	Insert	
	Color of housing		Insert	
	Material of housing	SIR	Insert	
	Volcanizing Technology		Insert	
3.4.5	Design Considerations			
	Designed for Ambient Temperature	°C	-40 to +40	
	Solar Radiation	kW/m2	≥1.1	
	Altitude	m	1000	
	Frequency of AC Power Supply	Hz	48-62	
	Wind Velocity	m/s	≤ 34 m/s	
3.4.6	Similar Model that passed Short Circuit			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Test			
	100% fault current	kA	Insert	
	50% fault current	kA	Insert	
	25% fault current	kA	Insert	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (Fdyn)	N	Insert	
3.6.2	Specified long-term load SSL (Fstat)	N	Insert	
3.6.3	Maximum cantilever strength	Nm	Insert	
3.6.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		Composite/ Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	
	Total leakage distance across outer insulator shedding for the complete arrester	mm	Insert	
	Protected leakage distance across outer insulator shedding for the complete arrester	mm	Insert	
	Clearance			
	phase to earth (from center line)	mm	Insert	
	phase to phase (center line to center line)	mm	Insert	
3.11	Surge arrester weight	kg	Insert	
3.12	Voltage distribution ring present	Yes/No	Yes	
3.12.1	Ring Diameter	mm		
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	Min 100 x 100	
3.14.3	Number of holes		Min 4	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.14.4	Distance between holes	mm x mm	50 x 50	
3.14.5	Material suitable for		Al terminal	
3.15	Arrester Grounding	Yes/No	Yes	
3.16	Surge Counter		Insert	
3.16.1	Manufacturer		Insert	
3.16.2	Type		Insert	
3.16.3	Model designation		Insert	
3.16.4	Country of origin		Insert	
3.16.5	Leakage Current Measurement		Insert	
3.16.5	Range of Measurement	μA-mA	Insert	
3.16.6	Sensitivity of surge counter peak at a wave shape of micro sec		Insert	
3.16.7	Minimum counted Surge Ampere		Insert	
3.16.8	Error		Insert	
3.16.9	Grounding of Counter		Insert	
	Separate Insulated (from Counter housing) terminal at bottom of Counter		Insert	
	Separate Insulated (from Counter housing) terminal at top of Counter		Insert	
	Counter Body Earthing		Insert	
	Earthing Conductor Material		Copper	
	Conductor Size	mm ²	Insert	
	Conductor Insulation		Insert	
3.16.10	Short Circuit Test of Counter		Yes	
3.16.10.1	Test Authority		Insert	
4	Drawings			
4.1	GA Drawing with All dimension & clearance clearly marked		Yes	
4.2	Sectional Drawing to show internal blocks, PRD etc.		Yes	
4.3	HV terminal Drawing		Yes	
4.4	Surge Counter Drawing		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.5	Surge Counter installation Drawing		Yes	
4.6	Earthing Terminal Drawing		Yes	
4.7	Quality & FAT/Routine Test Plan Attached		Yes	
Overall compliance with the requirements (yes/no)				

GTP of Conductor, steel structures and others

No	Description	Unit	Minimum Requirements	Guaranteed
1	Structural Steel			
1.1	Type and standard specification		Insert	
1.2	Manufacturer and country		Insert	
1.3	Minimum yield strength	kg/mm2	Insert	
1.4	Ultimate tensile strength	kg/mm2	Insert	
	Copper Conductors for Earthing system			
2.1	Type and standard specification		Insert	
2.2	Manufacturer and country		Insert	
2.3	Conductor material		Insert	
2.4	Size of conductors (Solid copper rods)	mm2	Insert	
2.5	Size of conductors (Flat copper bars) (Width×Thickness×Bundles)	mm	Insert	
2.6	Rated current	A	Insert	
2.7	Short time withstand current	kA rms	Insert	
2.8	Peak withstand current	kA pk	Insert	
3	High Voltage Bus Work			
3.1	Switchyard Conductor			
3.1.1	Copper Tubular Conductors for Busbar			
3.1.1.1	Type and standard specification		Insert	
3.1.1.2	Manufacturer and country		Insert	
3.1.1.3	Inner diameter	mm	Insert	
3.1.1.4	Outer diameter	mm	Insert	
3.1.1.5	Rated continuous current (site rating)	A rms	Insert	
3.1.1.6	Temperature rise at rated current	oC	Insert	
3.1.1.7	Rated short time current	kA rms	Insert	
3.1.1.8	Peak withstand current	kA pk	Insert	
3.1.1.9	Weight	kg/m	Insert	
3.1.1.10	Moment of inertia	kg-m2	Insert	
3.1.2	Aluminium Tubular Conductors for Busbar			
3.1.2.1	Type and standard specification		Insert	
3.1.2.2	Manufacturer and country		Insert	
3.1.2.3	Inner diameter	mm	Insert	
3.1.2.4	Outer diameter	mm	Insert	
3.1.2.5	Rated continuous current (site rating)	A rms	Insert	
3.1.2.6	Temperature rise at rated current	oC	Insert	
3.1.2.7	Rated short time current	kA rms	Insert	
3.1.2.8	Peak withstand current	kA pk	Insert	
3.1.2.9	Weight	kg/m	Insert	
3.1.2.10	Moment of inertia	kg-m2	Insert	
3.1.2.11	Temperature rise at rated current	oC	Insert	
3.1.2.12	Rated short time current	kA rms	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
3.1.2.13	Peak withstand current	kA pk	Insert	
3.1.2.14	Rated ultimate tensile strength	kN	Insert	
3.1.2.15	Mass, nominal	kg/m	Insert	
3.1.2.16	No. of conductors per bundle		Insert	
3.1.2.17	Bundle configuration		Insert	
3.1.2.18	Bundle spacing			
3.1.3	Flexible Bus Conductor			
3.1.3.1	Type and standard specification		Insert	
3.1.3.2	Manufacturer and country		Insert	
3.1.3.3	Conductor type		Insert	
3.1.3.4	Conductor size		Insert	
3.1.3.5	Standing No. of Al wires Dia. Of each wire	mm	Insert	
3.1.3.6	Overall conductor dia.	mm	Insert	
3.1.3.7	Cross-sectional area	mm ²	Insert	
3.1.3.8	Rated continuous current (site rating)	A rms	Insert	
3.1.3.9	Temperature rise at rated current	oC	Insert	
3.1.3.10	Rated short time current	kA rms	Insert	
3.1.3.11	Peak withstand current	kA pk	Insert	
3.1.3.12	Rated ultimate tensile strength	kN	Insert	
3.1.3.13	Mass, nominal	kg/m	Insert	
3.1.3.14	No. of conductors per bundle		Insert	
3.1.3.15	Bundle configuration		Insert	
3.1.3.16	Bundle spacing		Insert	
3.1.4	Shield Wire			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Dia. of galvanized steel wire	mm	Insert	
	Stranding No. of Al wires Dia. Of each wire	mm	Insert	
	Grade of wire		Insert	
	Weight of wire	kg/km	Insert	
	Minimum breaking strength of wire	kN	Insert	
3.2	Insulators			
3.2.1	Station Post Type (for rigid Busbar)			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Insulator unit, length/height	mm	Insert	
	No. of units in each insulator		Insert	
	Power frequency flashover voltage Dry Wet	kV kV	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
	Impulse flashover voltage Positive Negative	kV kV	Insert	
	Power frequency withstand voltage 1 min. dry 10 sec. wet	kV kV	Insert	
	Power frequency puncture voltage	kV	Insert	
	Switching impulse withstand voltage, wet	kV pk	Insert	
	Lightning impulse withstand voltage	kV pk	Insert	
	Radio interference voltage Test voltage to ground Max. RIV at 1.1xUr//3 line to ground voltage, when tested as per IEC 60694	kV rms micro V	Insert	
	Leakage distance	mm	Insert	
	Mechanical values, failing load (min.) Cantilever strength Tensile strength Torsional strength Compressional strength Combined electrical and mechanical strength Impact strength	N N N-m N N N-m	Insert	
3.2.2	String Type		Insert	
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Insulator unit, length	mm	Insert	
	No. of units in each insulator		Insert	
	No. of insulator strings per conductor (at each end)		Insert	
	Dia. of disc	mm	Insert	
	Disc spacing	mm	Insert	
	Power frequency flashover voltage Dry Wet	kV kV	Insert	
	Impulse flashover voltage Positive Negative	kV kV	Insert	
	Power frequency withstand voltage 1 min. dry 10 sec. wet	kV kV	Insert	
	Power frequency puncture voltage	kV	Insert	
	Switching impulse withstand voltage, wet	kV pk	Insert	
	Lightning impulse withstand voltage	kV pk	Insert	
	Dry arcing distance	mm	Insert	
	Radio interference voltage Test voltage to ground	kV rms	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
	Max. RIV at 1.1xUr//3 line to ground voltage, when tested as per IEC 60694	micro V		
	Leakage distance	mm	Insert	
	Mechanical values, failing load (min.) Tensile strength Torsional strength Compressional strength Combined electrical and mechanical strength Impact strength	N N-m N N N-m	Insert	
3.3	Clamps and Fittings			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Maximum working stresses		Insert	
	All accessories for installation (bolts, nuts, etc.)		Insert	

GTP & requirement Form: Transformer**230/34.5kV, 120/140MVA, 3-Phase Power Transformer**

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, hermetically sealed, with on-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044, IEC 60076 IEC 60137, IEC 60214 IEC 60354, IEC 60529 IEC 60815, IEC 60947 NEMA TR-1 CENELEC EN 50216	
1.6	Quality control		ISO 9001	
1.7	Number of phases		3	
1.8	Number of windings		2 windings / phase	
1.9	Tertiary winding function		NA	
1.10	Thermal insulation class		105 (A)	
1.11	Installation requirement		Outdoor	
2	Ratings and properties			
2.1	Voltage ratio at no load and at principle tap HV/LV	kV/kV	230/34.5kV	
2.2	Rated voltage of windings: a) HV winding b) LV winding	kV kV	230 34.5	
2.3	Rated power: a) Primary / secondary winding Tertiary - minimum	MVA MVA	140 / 140 NA	
2.4	Rated power by cooling ONAN / ONAF b) Primary / secondary winding Tertiary – minimum	MVA MVA	120/140 NA	
2.5	Rated current on HV/ LV windings at CMR a) HV at Highest Voltage Tap b) HV at Nominal Voltage Tap c) HV at Lowest Voltage Tap d) LV	A A A A		
2.6	Tap changer:			
	Manufacturer		Insert	
	Country of origin		Insert	
	Model designation		insert	
	Type of tap changing		On-load Local, remote, supervisory electrical and hand operation	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	DS Type and Number		Vacuum Tap Insert	
	Tap changer location		At High voltage side	
	Type of voltage regulation		C.F.V.V.	
	Tapping range	%	±10	
	Tapping step size	%	1.25	
	Number of tapping steps	Nos.	Insert	
	Rating		Rated power 140 MVA, all taps	
	c) Power frequency withstand test voltage (BS.4571)		Insert	
	- between first and last contacts of the selector switch			
	- between any two adjacent contacts of the selector			
	- between open diverter switch contacts			
	Type test certificate reference		Insert	
	Motor Drive Unit Make /Type Number		Insert	
2.7	AVR relay			
	Manufacturer's Name		Shall be from tap changer manufacturer	
	Country of Origin		Insert	
	Hardware / Software Version		Insert	
2.8	Frequency	Hz	50	
2.9	Corresponding lowest system frequency	Hz	Insert	
2.10	Connection of three-phase windings (group of vector IEC 60076)		Dyn1	
2.11	Low voltage winding connection (LV)		Insert	
2.12	Type of cooling		ONAN/ONAF	
2.13	Line drop compensation	Yes/No	Yes	
2.14	Whether automatic control required and referenced voltage		Yes, 110V, 50Hz	
2.15	Whether separate remote-control panel required	Yes/No	Yes	
2.16	Whether provision for supervisory control required, including AVR setting	Yes/No	Yes	
2.17	Whether marshalling kiosk required	Yes/No	Yes (Tank Side, Cubicle)	
3	Special technical requirements			
3.1	Short circuit impedance corrected to reference temperature of 75°C at rated frequency and rated power			
3.1.1	HV – LV, on the basis of rated power with on-load tap changer • in middle position • in extreme plus position • in extreme minus position	% % %	Insert	
3.1.2	Maximum Impedance between HV – LV over tapping range Corresponding tap	%	Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2	Zero-sequence impedance, with tap changer in middle position at 120MVA base: HV/LV	%	Insert	
3.3	Power transformer capacity to withstand external short circuits			
3.3.1	Short-circuit duration	s	2	
3.3.2	Symmetrical short-circuit withstand capacity during indicated period: a) HV winding b) LV winding Pre-fault voltage	kA kA p.u.	50 40 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: a) HV winding b) LV winding Pre-fault voltage	kA kA p.u.	Insert Insert	
3.4	Guaranteed losses			
3.4.1	No-load losses with tap changer in nominal tap position: a) at rated voltage and rated frequency b) at 110 % of rated voltage, at rated frequency c) at 90 % of rated voltage, at rated frequency	kW kW kW	Insert Insert Insert	
	Average No-Load Loss (this value will be evaluated)	kW	(a+b+c)/3	
3.4.2	No-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C and rated frequency			
	a) On-load losses at 75°C and rated frequency, with tap changer in nominal tap position and at rated current of that tap position	kW	Insert	
	b) On-load losses at 75°C and rated frequency, with tap changer in plus (+) extreme tap position and at rated current of that tap position	kW	Insert	
	c) On-load losses at 75°C and rated frequency, with tap changer in minus (-) extreme tap position and at rated current of that tap position	kW	Insert	
	Average On-load losses (this value will be evaluated)	kW	(a+b+c)/3	
3.4.5	On-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.6	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.4.7	Ancillary equipment (fans, pumps, heaters, etc.)			
3.4.8	Load of ancillary equipment (<u>this value will be evaluated</u>)	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.4.9	Capitalized valued of ancillary equipment load	BDT/kW	As per Tender Requirement	
3.4.10	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	10	
3.5	Total loss at 75°C and normal ratio	kW	Insert	
3.6	Insulation level			
3.6.1	High voltage (HV)		LI 1050, AC 460	
3.6.2	Low voltage (LV)		LI 170, AC 70	
3.6.3	Neutral		LI 95, AC 38	
3.6.4	Induced voltage (ACSD, ACLD)	kV	In acc. To IEC 60076-3	
3.7	The highest voltage for equipment (effective value)			
3.7.1	High voltage (HV)	kV	245	
3.7.2	Low voltage (LV)	kV	36	
3.7.3	Neutral	kV	17.5	
3.8	Regulation at 75°C and normal ratio – (A) At unity power factor (B) At 0.8 lagging powerfactor	% %		
3.9	Efficiencies			
3.9.1	If $\cos\phi = 1.0$ and: d) 25 % load of the rated value e) 50 % load of the rated value f) 75 % load of the rated value 100 % load of the rated value		Insert Insert Insert Insert	
3.9.2	If $\cos\phi = 0.8$ (inductive) and: g) 25 % load of the rated value h) 50 % load of the rated value i) 75 % load of the rated value 100 % load of the rated value		Insert Insert Insert Insert	
3.10	Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position			
3.10.1	$\cos\phi = 1.00$		Insert	
3.10.2	$\cos\phi = 0.95$ (inductive)		Insert	
3.10.3	$\cos\phi = 0.90$ (inductive)		Insert	
3.10.4	$\cos\phi = 0.80$ (inductive)		Insert	
3.11	No-load current at rated frequency			
3.11.1	At 0.90 Un		Insert	
3.11.2	At 1.00 Un		Insert	
3.11.3	At 1.05 Un		Insert	
3.12	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.12.1	Top oil temperature under service conditions stated in Schedule of Technical Requirement: a) CMR ONAN rating	°C °C	≤ 55 ≤ 55	
3.12.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement:	°C	≤ 60	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12.3	Hottest spot rise in core, metallic parts and adjacent Parts in contact with oil at rated power	°C	≤ 65	
3.12.4	Hottest spot rise in copper (winding) at rated power	°C	≤ 75	
3.12.5	Winding insulation temperature capacity	°C	Insert	
3.12.6	Winding hot spot temperature on emergency overload not exceeding	°C	≤ 120 (may be fixed during final design at execution stage)	
3.12.7	Tank Surface temperature (amb+Top oil rise+Core surface temperature)		Insert	
3.12.8	Temperature gradient at rating specified	°C	Insert	
3.12.9	Temperature rise of metallic parts			
	Tank walls	°C	Insert	
	Tie plate	°C	Insert	
	Top clamp	°C	Insert	
	Bottom clamp	°C	Insert	
3.13	At the emergency cases it is allowed: j) Continuous overload at the highest winding temperature which exceeds by 2.5°C the guaranteed limit value Continuous voltage increase when the top oil temperature exceeds the guaranteed limit by 2.5°C at rated power (in % of the rated voltage)	MVA %	Compliant to IEC 60076-7	
3.14	Guaranteed value of overloads in % of the rated power			
3.14.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.14.1.1	After operation under 15 min k) full rated power l) ¾ rated power ½ rated power		Insert Insert Insert	
3.14.1.2	After operation under 20 min m) full rated power n) ¾ rated power ½ rated power		Insert Insert Insert	
3.14.1.3	After operation under 120 min o) full rated power p) ¾ rated power ½ rated power		Insert Insert Insert	
3.14.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.14.2.1	After operation under 15 min q) full rated power r) ¾ rated power ½ rated power		Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.14.2.2	After operation under 20 min s) full rated power t) $\frac{3}{4}$ rated power $\frac{1}{2}$ rated power		Insert Insert Insert	
3.14.2.3	After operation under 120 min u) full rated power v) $\frac{3}{4}$ rated power $\frac{1}{2}$ rated power		Insert Insert Insert	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: w) with all cooling groups in operation (excluding stand-by cooling group) x) with one cooling group out of operation with two cooling groups out of operation		Insert Insert Insert	
4	Oil			
4.1	New		Yes	
4.2	Manufacturer & country		Insert	
4.3	Type Class		Insert Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Maximum dielectric strength	kV/cm	Insert	
4.8	Data sheet attached		Insert	
4.9	Corrosive Sulphur		No	
4.10	PCB content		Without PCB	
5	Bushing			
5.1	HV bushing			
5.1.1	Quantity		3	
5.1.2	Class	kV	245	
5.1.3	Manufacturer & country make		Insert	
5.1.4	Type		RIP with Composite Silicon Rubber Housing	
5.1.4.1	Single Flange or Double Flange		Insert	
5.1.4.2	Draw lead type or Solid Type		Insert	
5.1.4.3	Type: Oil to Oil or Oil to Air or Oil to SF6		Insert	
5.1.5	Rated current	A	≥ 2000	
5.1.6	Rated short circuit current (3 s)	kA rms	≥ 50	
5.1.7	Rated lightning impulse withstand voltage	kV peak	1050	
5.1.8	Rated switching impulse withstand voltage	kV peak	N/A	
5.1.9	Rated power frequency withstand voltage	kV rms	460	
5.1.10	Connectors			
5.1.10.1	Shape		Flat	
5.1.10.2	Dimension (L x W)	mm x mm	125x125	
5.1.10.3	Suitable for		Al wire	
5.1.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.1.12	Total Creepage distance of outdoor shedding	mm	Insert	
5.1.13	Protective Creepage distance of shedding	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.1.14	Full vacuum withstands of complete bushing		YES	
5.1.15	Total length of insulator	mm	Insert	
5.1.16	Weight of insulator	kg	Insert	
5.1.17	Electrostatic capacity of complete bushings	pF	Insert	
5.1.18	Manufacturer of composite silicon rubber		Insert	
5.1.19	De-rating Factor		Insert	
5.3	LV bushings			
5.3.1	Quantity		3	
5.3.2	Class	kV	36	
5.3.3	Manufacturer & country make		Insert	
5.3.4	Type:		RIP with Composite Silicon Rubber Housing	
5.3.4.1	Single Flange or Double Flange		Insert	
5.3.4.2	Draw lead type or Solid Type		Insert	
5.3.4.3	Type: Oil to Oil or Oil to Air or Oil to SF6		Insert	
5.3.5	Rated current	A	≥ 2500	
5.3.6	Rated short-circuit current (3 s)	kA rms	≥ 40	
5.3.7	Rated lightning impulse withstand voltage	kV peak	170	
5.3.8	Rated switching impulse withstand voltage	kV peak	-	
5.3.9	Rated power frequency withstand voltage	kV rms	70	
5.3.10	Connectors			
5.3.10.1	Shape		Flat	
5.3.10.2	Dimension	mm x mm	125x125	
5.3.10.3	Suitable for		Al wire	
5.3.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.3.12	Total Creepage distance of outdoor shedding	mm	Insert	
5.3.13	Protective Creepage distance of shedding	mm	Insert	
5.3.14	Full vacuum withstand of complete bushing		YES	
5.3.15	Total length of insulator	mm	Insert	
5.3.16	Weight of insulator	kg	Insert	
5.3.17	Electrostatic capacity of complete bushings	pF	Insert	
5.3.18	Manufacturer of composite silicon rubber		Insert	
5.3.19	De-rating Factor		Insert	
5.2	Neutral bushing (identical as LV bushing)			
5.2.1	Quantity		1	
5.2.2	Class	kV	36	
5.2.3	Manufacturer & country make		Insert	
5.2.4	Type: RIP		RIP with Composite Silicon Rubber Housing	
5.2.4.1	Single Flange or Double Flange		Insert	
5.2.4.2	Draw lead type or Solid Type		Insert	
5.2.4.3	Type: Oil to Oil or Oil to Air or Oil to SF6		Insert	
5.2.5	Rated current	A	≥ 2500	
5.2.6	Rated short-circuit current (3 s)	kA rms	≥ 40	
5.2.7	Rated lightning impulse withstand voltage	kV peak	170	
5.2.8	Rated switching impulse withstand voltage	kV peak	-	
5.2.9	Rated power frequency withstand voltage	kV rms	70	
5.2.10	Connectors			
5.2.10.1	Shape	mm	Flat	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.10.2	Length	mm	Insert	
5.2.10.3	Suitable for		Cu wire	
5.2.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2.12	Total Creepage distance of outdoor shedding	mm	Insert	
5.2.13	Protective Creepage distance of shedding	mm	Insert	
5.2.14	Full vacuum withstand of complete bushing		YES	
5.2.15	Total length of insulator	mm	Insert	
5.2.16	Weight of insulator	kg	Insert	
5.2.17	Electrostatic capacity of complete bushings	pF	Insert	
5.2.18	Manufacturer of composite silicon rubber		Insert	
5.2.19	De-rating Factor		Insert	
6	Design Data			
6.1	Maximum flux density in the legs			
	y) At rated voltage, frequency & normal ratio	T	Insert	
	z) At 105 % of the rated voltage	T	Insert	
6.2	Volts/turn	V	Insert	
	Maximum flux density in the yokes:			
	aa) At rated voltage, frequency & normal ratio	T	Insert	
6.3	bb) At 105 % of the rated voltage	T	Insert	
	Volts/turn	V	Insert	
6.3	Maximum current density in windings at rated power and normal tap changer position:			
	cc) HV winding	A/mm ²	Insert	
	LV winding	A/mm ²	Insert	
6.3.1	Magnetising current at nominal ratio and			
	at 0.9 x nominal voltage	%	Insert	
	at 1.0 x nominal voltage	%	Insert	
	at 1.1 x nominal voltage	%	Insert	
6.3.2	at 1.2 x nominal voltage	%	Insert	
	Harmonic component of magnetizing current at rated voltage as percentage of fundamental			
	2 nd harmonic	%	Insert	
	3 rd harmonic	%	Insert	
6.3.2	4 th harmonic	%	Insert	
	5 th harmonic	%	Insert	
	6 th harmonic	%	Insert	
	7 th harmonic	%	Insert	
6.4	Winding resistance at 75°C and middle tap changer position:			
	dd) HV winding	Ω	Insert	
	LV winding	Ω	Insert	
6.5	For fault with zero impedance external to the transformer and infinite system	kN	Insert	
	(a) Maximum axial force	N/m ²	Insert	
	(b) Maximum tensile stress in winding	KN	Insert	
	(c) Free buckling force			
6.6	Designed safety margin	%	Insert	
6.7	ZnO block to limit distributed impulse [tap winding/other]		No	
6.8	X/R ratio		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.9	Core construction			
6.9.1	Type of transformer		Core	
6.9.2	Method of joining of legs		Insert	
6.9.3	Method of joining of yokes		Insert	
6.9.4	Joining material		Insert	
6.9.5	Number of legs		Insert	
6.9.6	Type of core steel		Insert	
6.9.7	Steel Manufacturer		Insert	
6.9.8	Steel Grade	Grade	Insert	
6.9.9	Core Loss at W17/50	Watts/kg	< 0.85	
6.9.10	Irradiation method (Core graining method)		Laser beam or Plasma jet	
6.9.11	Insulation of (A) Yoke bolts (B) Side plates		Insert Insert	
6.9.12	Safe working temperature of core plate insulation		Insert	
6.9.13	Whether core is pre-cut or cut at factory		Insert	
6.10	Winding & Winding conductor			
6.10.1	Types of winding (A) HV (B) LV		Insert Insert	
6.10.2	Insulation of (a) HV windings (b) LV windings		Thermally upgraded insulation paper Thermally upgraded insulation paper	
6.10.3	Type of Winding connections (brazed or crimped or others)			
	Between windings		Insert	
	Between main & tap windings		Insert	
	Between windings & leads		Insert	
6.10.4	The individual winding sets clamped separately from each other and separately from the core		Yes	
6.10.5	HV winding		Cu – Interleaved / Cu-continuous/ disc – transposed cured in epoxy coating	
6.10.5	LV winding		Cu – Interleaved / Cu-continuous/ disc – transposed/ Cu-transposed/ helix, cured in epoxy coating	
6.10.6	Type of Insulation of Tapping Connections		Insert	
7	Weights and dimensions			
7.1	Core and winding assembly	kg	Insert*	
7.2	Tank, conservator, cooler banks & cooling assembly & other accessories	kg	Insert*	
7.3	Total mass excluding oil	kg	Insert*	
7.4	Oil mass in tank & conservator	kg	Insert*	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.5	Oil mass in coolers	kg	Insert*	
7.6	Total mass of Oil	kg	Insert*	
7.7	Total weight of transformer, with oil, equipped for service	kg	Insert*	
7.8	Maximum shipping weight (the heaviest item)	kg	Insert*	
7.9	Height from foundation to:			
	a) Highest point of HV bushing	mm	Insert*	
	b) Highest point of tank	mm	Insert*	
	c) Highest point of conservator	mm	Insert*	
	d) Highest point of lifting hook for removal of core and oil assembly	mm	Insert*	
7.10	Outer dimensions:			
	a) Length	mm	Insert*	
	b) Width	mm	Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	
7.12	Maximum shipping dimensions of tank:			
	a) Outside height	mm	Insert	
	b) Outside width	mm	Insert	
	c) Outside length	mm	Insert	
7.13	Transportation drawing		To be enclosed with bid	
8	Tap changer			
8.1	Manufacturer		Insert	
8.2	Type		Insert	
8.3	Insulation level	kV	Insert	
8.4	Rated current	A	≥ 800	
8.5	Number of steps		Insert	
8.6	Regulating coil		Insert	
8.7	Short-circuit withstand	kA rms	Insert	
8.8	BIL to ground through the regulating coil	kV peak	Insert	
8.9	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
8.10	Tap position indicator		Digital code matrix (BCD)	
8.11	Auxiliary supply		3x400 V / 230 V, 50 Hz	
9	Auxiliary power supply			
9.1	Motors		3x400 V / 50 Hz	
9.2	Heaters		230 V / 50 Hz	
9.3	Control voltage		110 V DC	
10	Current transformer incorporated into the power transformer			
10.1	CT in HV bushings, for protection, WTI and/or Tap Changer		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2	CT in LV bushings, for protection, WTI and/or Tap Changer		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
10.3	CT in neutral bushing, for protection		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
11	Layout			
11.1	Primary winding bushings		Longitudinal axis	
11.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	
11.3	Conservator tank		To be defined in design stage	
11.4	Tap changer		To be defined in design stage	
11.5	Control cabinet		To be defined in design stage	
11.6	Coolers		To be defined in design stage	
11.7	Connection drawing, block diagram		To be enclosed with bid	
12	Cooling fan groups, Radiator banks & Valves			
12.1	No of radiator bank		Insert	
12.2	No of fins/plates in each radiator		Insert	
12.3	Number of cooling fan groups (for rated power)	Qty.	Minimum 02 (may be fixed during final design at execution stage)	
12.4	Number of coolers (fans) in each cooling group (for rated power)	Qty.	Insert	
12.5	Number of stand-by cooling fans in each cooling group (for rated power)	Qty.	Insert	
12.7	Rating of each cooler (fan)	kW	Insert	
12.8	Starting current of each fan motor	A	Insert	
12.9	Speed of air blowers/fans	rpm	Insert	
12.10	IP Class of Fan Motor		Insert	
12.11	Full vacuum withstand of complete cooler	mbar	Yes	
12.12	Thickness of radiator plates	mm	Insert	
12.13	Valve type/material: (A) 100mm and below (B) Above 100mm		Insert Insert	
12.14	Gate /Ball Valve	Nos.	Insert	
12.15	Radiator Valve	Nos.	Insert	
12.16	Buchholz relay bypass valve	Nos.	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
13	Oil Preservation system & Dehydrating breather			
13.1	Main Tank		Air Bag with dehydrating breather (maintenance-free) Refer: section-4, volume-2	
13.2	On-load Tap Changer		Dehydrating breather (maintenance-free) Refer: section-4, volume-2	
13.3	Type of dehydrating breather		Insert	
13.4	Dehumidifying agent	kg	Insert	
13.5	Type of Dehumidifying agent		Environment friendly	
14	Power transformer tank			
14.1	Type of design			
14.2	Thickness of transformer tank: a) Sides b) Bottom c) Top	mm mm mm	Insert Insert Insert	
14.3	Material of the transformer tank		Insert	
14.4	Wheels			
14.4.1	Wheel number for each rail of two pair rails		Two pairs	
14.4.2	Axial inter space in transversal direction between two pairs of rails	mm	Insert	
14.4.3	Transversal distance between wheels in pair	mm	Insert	
14.4.4	Distance between wheels in longitudinal direction	mm	Insert	
14.5	Corrosion protection of the tank		Yes	
14.6	Vacuum withstand of the complete tank with cooler	mbar	1	
14.7	Over-pressure withstand of the complete transformer	bar	Insert	
14.8	Oil Sealing System (Type) a) Main Tank b) Other parts		Gasket/Welded Gasket	
14.9	Oil Sealing System (Gasket Material: Material used for gaskets for oil tight joints) a) Main Tank b) Bushings c) Other Parts d) Temperature Class / Grade		Insert Insert Insert Insert	
14.10	Maximum Operating Pressure a) At Top of Tank b) At Bottom of Tank	kN/m2 kN/m2	Insert Insert	
14.11	Permanent Deflection of Tank plates or Stiffeners: a) At Maximum Operating Pressure b) At Design Hydraulic Pressure for which the tank is Designed c) At Full Vacuum	mm mm mm	< IEC < IEC < IEC	
15	Conservator			
15.1	Type		With diaphragm	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.2	Number of compartments	pcs.	2	
15.3	Total volume of conservator	m ³	Insert	
15.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters:		Insert	
	a) Maximum diagraph stress at highest working pressure		Insert	
	b) Diagraph construction details		Insert	
	c) Type of diagraph material		Insert	
15.7	Corrosion protection of conservator		Insert	
15.8	Oil level indicators with alarm for minimum oil level	pcs.	2	
16	Marshaling Kiosk			
16.1	Type of Mounting		Tank mounted	
16.2	IP Class		Insert	
16.3	Mounted on tank with/ without anti-vibration packing		Insert	
17	Operating Pressure of Pressure Relief Device			
17.1	Main Tank	kN/m ²	Insert	
17.2	OLTC	kN/m ²	Insert	
18	Noise level & interference			
18.1	Audible noise level (acc. To NEMA TR1), at 105 % of rated voltage, at maximum power and with complete cooling system in service	dB	Insert	
18.2	Radio Interference Voltage at 0.5 MHz as specified in IEC 60694	µV	2500 max	
19	Operating conditions			
19.1	At the altitude (above sea level)	m	≤ 1000	
19.2	Maximum ambient temperature	°C	+ 45	
19.3	Average daily temperature	°C	+ 35	
19.4	Average annual temperature	°C	+ 25	
19.5	Minimum ambient temperature	°C	– 5	
19.7	Parallel operation		Yes	
19.8	External cooling medium		Air	
19.9	Average air temperature in anyone year not exceeding:			
	- In any one day	°C	+ 45	
	- Average in one year	°C	+ 35	
19.10	Consideration for Exposure to Sunshine	°C	+ 35	
19.11	Consideration for Restricted Air Circulation		Required	
20	Test & Short Circuit Withstand Requirement			
20.1	Brief description of transformer or parts thereof subjected to short-circuit test		Test Reference	
20.2	Similar Design Transformer (as per IEC 60076-5, Annex A) type test reference			
20.2.1	Testing Authority		STL Lab, insert Name	
20.2.2	certificate reference		Insert	
20.2.3	Contact address of test Lab		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
20.2.4	Validity of test certificate		Insert	
21	Make of major accessories with country of origin			
	Below Items shall be offered from Approved Vendor List. New Makes are Acceptable Subject to Approval Separately. Note: The Country of Origin including sub-assembly items from USA, Europe or Japan Origin is preferred.			
	Name of Accessories	Make	Country of Origin	Guaranteed make & Country of Origin
21.1	Buchholz Relay			
21.2	Oil Surge Relay for OLTC			
21.3	Air Bag Rupture Relay			
21.4	Pressure Relief Device			
21.4.1	Pressure Relief Device for OLTC			
21.4.2	Pressure Relief Device for main tank			
21.5	Air Bag for Conservator			
21.6	Magnetic Oil Level Gauge			
21.7	Oil Temperature Indicator			
21.8	Winding Temperature Indicator			
21.9	Radiator			
21.10	Cooling Fan			
21.11	Bushing Current Transformer			
21.12	Neutral Current Transformer			
21.13	Anti-Vibration Pad			
21.14	AVR Panel			
21.15	Dehydrating breather			
21.16	Control cable			
21.17	Marshalling cubicle			
21.18	control cubicle			
21.19	Gasket			
	Name of Raw Material	Make	Country of Origin	Guaranteed make & Country of Origin
21.20	Copper Conductor			
21.21	CRGO			
21.22	Insulating Paper			
21.23	Press Boards			
21.24	Steel Plate			
	Overall compliance with the requirements & detail specification described in volume-2	(yes/no)	Yes	

** These are estimated values only. Actual values shall be measured during execution of the contract (manufacturing of the equipment) and shall be included on the name plate.*

33/0.415 kV, 300kVA, Dyn11, Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, two windings, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	Ratings and properties			
2.1	Rated power:	kVA	300	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage	kV/V	34.5/ 415	
2.4	Percent Impedance	%	5	
2.5	Tap changer: Type of tap changing Tapping range Tapping step Rating	% %	Off-load ±5 2.5 Rated power 300 kVA, all taps	
2.6	Frequency	Hz	50	
2.7	Connection of three-phase windings (group of vector IEC 60076)		Dyn11	
3	Special technical requirements			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	2	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: HV winding LV winding	kA kA	40 15	
3.2	Guaranteed losses			
3.2.1	No-load losses with tap changer in normal position, at rated voltage and rated frequency	kW	Insert	
3.2.2	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.2.3	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.3	Insulation level			
3.3.1	Medium voltage (MV)	kV	LI 170 AC 70	
3.3.2	Low voltage (LV)	kV	LI - AC 3	
3.4	The highest voltage for equipment (effective value)			
3.4.1	Medium voltage (MV)	kV	36	
3.4.2	Low voltage (LV)	kV	1.1	
3.5	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.5.1	Top oil	K	≤ 60	
3.5.2	Winding	K	≤ 65	
3.5.3	Hottest spot	K	≤ 65	
4	Oil			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	Bushing			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3	
5.1.2	Class	kV	36/170/70	
5.1.3	Manufacturer		Insert	
5.1.4	Type		RIP (Composite/silicone)	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 100	
5.1.7	Rated Short Circuit Current	kA,3s	40	
5.1.8	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2	LV bushings (3 kV)			
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Porcelain	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 500	
5.2.7	Rated Short Circuit Current	kA,3s	15	
5.2.8	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	Weights and dimensions			
6.1	Total weight of transformer, ready for service	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.2	Outer dimensions:			
	Length	mm	Insert	
	Width	mm	Insert	
6.3	Informative dimensional sketch		To be enclosed with bid	
7	Dehydrating breather			
7.1	Type of dehydrating breather		Insert	
7.2	Dehumidifying agent	kg	Insert	
8	Conservator			
8.1	Type		With dehydrating breather	
8.2	Number of compartments	pcs.	1	
8.3	Oil level indicators with alarm for minimum oil level	pcs.	1	
9	Operating conditions			
9.1	At the altitude (above sea level)	m	≤ 1000	
9.2	Maximum ambient temperature	°C	+ 40	
9.3	Average daily temperature	°C	+ 35	
9.4	Average annual temperature	°C	+ 30	
9.5	Minimum ambient temperature	°C	– 5	
	Overall compliance with the requirements (yes/no)			

AUXILIARY POWER AND MULTICORE CONTROL CABLES

[illegible]

Schedule-E: Battery

GTP & requirement Form: 110V & 48V Battery

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	110 V & 48 V Battery units			
1.1	Manufacturer		Insert	
1.2	Type designation		Insert	
1.3	Country of origin		USA/Japan/Europe	
1.4	Standards		IEC	
1.5	Quality control		ISO 9001	
1.6	Rated voltage	V	110 (for 110 V DC) 48 (for 48 V DC)	
1.7	Number of cells per battery unit	pcs	-Not less than 94 nos. for 110V -Not less than 42 nos. for 48V (To be verified by calculation)	
1.8	Type of cell		Ni-Cd	
1.9	Operating voltage per cell	V	1.2	
1.10	Floating voltage per cell	V	1.40 – 1.42	
1.11	Equalizing voltage per cell	V	1.55 – 1.65	
1.13	Rated capacity at 20°C			
	• For 3h discharge time	Ah	Insert	
	• For 5h discharge time	Ah	400 (for 110 V DC) 200 (for 48 V DC) (Based on BoQ & calculation)	
	• For 10h discharge time	Ah	Insert	
1.15	ECV	V/Cell	1.11	
1.16	Normal charging rate	A	Insert	
1.17	Maximum charging rate	A	Insert	
1.18	Electrolyte		Insert	
1.19	Spec. gravity of electrolyte	1	1.19±1%	
1.20	Sp. gravity of electrolyte (Charged)	1	1.23 ±0.01	
1.21	Vent plug		Anti-corrosive & fire proof	
1.22	Positive plate	-	Tubular	
1.23	Negative plate	-	Pasted	
1.24	Type of container	-	Plastic polymer	
1.26	Cell condition	-	Pre-charged	
1.27	The battery stands steel frame		Yes	
1.28	The battery stands earth-quake endurance type		Yes	
1.29	Overall dimensions of one cell	mm	Insert	
1.30	Quantity of electrolyte per one cell	litre	Insert	
1.31	Length/width/height of assembled battery	mm	Insert	
1.32	Weight of battery and stands in service	kg	Insert	
1.33	Weight of cell complete with electrolyte	kg	Insert	
1.34	Internal resistance per cell when fully charged	ohms	Insert	
1.35	Material of battery case		Insert	
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & requirement Form: Charger

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Charger			
1	General			
1.1	Manufacturer			
1.2	Type designation			
1.3	Type		Thyristor controlled	
1.4	Country of origin		USA/Japan/Europe	
1.5	Standards		IEC	
1.6	Rated input voltage	V	3 x 400 / 230	
1.7	Rated input current (at rated output)	A	Insert	
1.8	Input voltage variation	%	±5	
1.9	Power factor	1	> 0,80	
1.10	Efficiency	%	> 85	
1.11	Degree of protection		IP42	
1.12	Noise level	dB	< 65 dB max	
1.13	Type of rectifiers		IGBT controlled	
1.14	Number of modules (n+2)	pcs	Insert	
1.15	Module rated output current	A	Insert	
1.16	MCU protocol		IEC 61850	
1.21	Charging characteristic		Both constant current & constant voltage	
1.22	Rated frequency	Hz	50	
1.23	Insulation - HV, between input and output/ground	V AC, min	1000 V AC, 1 min	
1.24	Insulation resistance at 500 V DC, 1 min	MΩ	Insert	
1.26	Rated output voltage	V d.c.	110 (for 110 V DC) 48 (for 48 V DC)	
1.27	Rated output current	A	150 (for 110 V DC) 120 (for 48 V DC) (Based on BoQ & calculation)	
1.28	Cooling System		Self & natural air cooled	
1.29	Relative humidity	%	Up to 98%	
1.30	Ambient temperature	°C	40 (max.)	
1.31	Installation		Indoor	
2	AC Input			
2.1	Voltage	V	415	
2.2	Phase		3	
2.3	Frequency variation	Hz	47 to 51	
2.4	Allowable Input AC voltage variation At Charger input terminal	V	±15%	
2.5	Power factor	1	>0.8	
2.6	Efficiency (Full load)	%	>85%	
2.7	Charge Characteristics		Constant current /Constant voltage (During float charge)	
2.8	Current limitation	%	110%	
3	DC Output			
3.1	Voltage	V	110±5%	

Schedule-E: Charger

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
			48±5%	
3.2	Voltage ripple	%	±3	
3.3	Ripple frequency	Hz	±2	
3.4	Charge modes	-	3 levels: charge, float & boost	
3.5	Float voltage per cell	V	1.42	
3.6	Boost voltage per cell	V	1.53	
3.7	Float & Boost voltage adjustable	-	Yes	
4	Measurement		Input voltage Input current Output voltage Output current Battery voltage Battery current Load voltage Load current Earth-fault voltage	
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & requirement Form: LVAC Distribution

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	AC Distribution Panel			
1.1	Manufacturer		Insert	
1.2	Country of Origin		Insert	
1.3	Manufacturer's type designation		Insert	
1.4	Protection Degree		IP4X	
1.5	Busbar		3P+N	
1.7	Rated AC Voltage	V AC	400/230	
1.8	Rated Frequency	Hz	50	
1.9	Rated Current	A	≥500 (shall be finalized and revise if needed during detail design)	
1.10	Switching Interlocking Device		Yes	
1.11	Auto-Transfer Source and Integrated to SAS		Yes	
1.12	Fault Rating for 1 sec	kA	Insert	
1.13	Incomer Breaker Rating	Amps	Insert	
1.14	Thickness of sheet steel	mm	Insert	
2	Miniature Circuit Breakers			
2.1	Manufacturer		Insert	
2.2	Type		Insert	
2.3	Rating	Amps	Insert	
2.4	Fault Rating for 1 sec	kA	Insert	
Overall compliance with the requirements & detail specification described in Vol-2		Yes/No	Yes	

GTP & requirement Form: Automatic Power Factor Correction Panel

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Power Factor Correction Panel			
1	General			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Standards		IEC 60831 IEC 60076-6	
1.4	LVAC system voltage, frequency		415V, 50Hz	
1.5	Total weight	kg	Insert	
1.6	Total losses (including capacitors, reactors, resistors & accessories)	W/kVAR	Insert	
1.7	MTBF	hours	Insert	
2	Capacitors			
2.1	Manufacturer		Insert	
2.2	Country of origin		Insert	
2.3	Type		Dry type	
2.4	Self-healing type	Yes/No	Insert	
2.5	Shape		Cylindrical	
2.6	Permissible temporary over voltages		Insert	
2.7	Withstand time for permissible temporary over voltages	hours	Insert	
2.8	Permissible permanent overcurrent	%In	Insert	
2.9	Total losses (including discharge resistors)	Watt/kVAR	Insert	
3	Reactors			
3.1	Manufacturer		Insert	
3.2	Country of origin		Insert	
3.3	Type		Insert	
3.4	Reactance @50Hz (as % of capacitor reactance)	%	Insert	
3.5	Detuning frequency	Hz	Insert	
3.6	Core material		Insert	
3.7	Winding material		Insert	
3.8	Temperature Class (IEC)		Insert	
4	Discharge resistor			
4.1	Manufacturer		Insert	
4.2	Country of origin		Insert	
4.3	Resistance	ohm	Insert	
4.4	Discharge capacity (Voltage after 1 minute of switching off)	v	≤ 50	
5	Switching Controller			
5.1	Manufacturer		Insert	
5.2	Country of origin		Insert	
5.3	Power factor range		Insert	
5.4	Operation: Auto/manual/off	Yes/no	Yes	
5.5	Progammable switching sequence & timing	Yes/no	Yes	
5.6	Measurement accuracy		Insert	
5.7	Power outage release	Yes/no	Yes	
5.8	Input connection for temperature probes	Yes/no	Insert	

Schedule-E: Automatic PFC Panel

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.9	Ethernet port availability	Yes/no	Yes	
5.10	Fan & alarm relays	Yes/no	Insert	
6	Panel			
6.1	Manufacturer		Insert	
6.2	Country of origin		Insert	
6.3	Type		Indoor, floor mounted	
6.4	Dimension (LxWxH)	mm x mm x mm	Insert	
6.5	Protection (IP rating)		Insert	
6.6	Ventilation		Forced	
6.7	Front LED Indications		Insert	
6.8	Number of fans	Nos	Insert	
7	Protection device			
7.1	Type of protection (Fuse or MCB/MCCB)		MCB/MCCB	
7.2	Manufacturer		Insert	
7.3	Country of origin		Insert	
7.4	Breaking capacity of MCB/MCCB	kA	Insert	
7.5	Auxiliary contacts (NO/NC) with MCB/MCCB	Yes/No	Yes	
8	Switching device			
8.1	Type (Contactor or thyristor)		Thyristor	
8.2	Manufacturer		Insert	
8.3	Country of origin		Insert	
9	Other			
9.1	Busbar material		Copper	
9.2	Temperature probes	Yes/No	No	
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP of IP camera surveillance system

1. 4 MP OUTDOOR FIXED TYPE BULLET IP CAMERA HAVING ONVIF WITH SMART/AI:				
Sl. No.	Items	Unit	Data	Guranteed by bidder
1	Item Name		Outdoor Fixed Type Bullet IP CAMERA having ONVIF with Smart/AI Features	
2	Brand Name		Insert	
3	Model No		Insert	
4	Country of origin		Insert	
5	Country of Manufacturing		Insert	
6	CAMERA			
6.1	Application/working Environment		Outdoor Type / Day-Night	
6.2	Image sensor		Insert	
6.3	Sensitivity / Illumination	lux	Insert	
6.4	IR Working Distance	m	Minimum 30	
6.5	Horizontal Viewing Angle	degrees	95°-135° or Higher range of View Angle	
6.6	Memory	MB	Insert	
7	VIDEO			
7.1	Video compression		Ultra 265 / H.265 / H.264 / MJPEG	
7.2	Resolutions	MP	Min. 4MP (2592×1520) / 4MP (2560×1440)	
7.3	Frame Rate	fps	4MP (2560×1440): Min. 25 fps / (2592×1520): Min. 20 fps or Better	
7.4	ICR function		Insert	
8	IMAGE SETTING			
8.1	Day Night		Auto (ICR) / Color / B/W	
8.2	White Balance		Auto / Sunny / Night /outdoor / Customized	
8.3	Gain Control		Auto / Manual	
9	Network			
9.1	Security		Password Protection ,IP address filtering	
9.2	Supported protocols		Insert	
10	GENERAL			
10.1	Power	W	PoE Supported, Max 10 W	
10.2	Local Storage	GB	Insert	
10.3	Connectors		1 RJ45 10M/100M Base-TX Ethernet	
10.4	Environmental Casing/housing		IP66 or higher	
10.5	Accessories		Mounting bracket, Drill template etc.	
11	FEATURES			
11.1	Object Detection		Yes	
11.2	Alarm		Yes (Through the NVR)	
11.2	ONVIF		Yes	

Sl. No.	Items	Unit	Data	Guranteed by bidder
2. 4 MP DOME TYPE IP CAMERA WITH ONVIF:				
1	Item Name		Outdoor Fixed Type Bullet IP CAMERA having ONVIF with Smart/AI Features	
2	Brand Name		Insert	
3	Model No		Insert	
4	Country of origin		Insert	
5	Country of Manufacturing		Insert	
6	CAMERA			
6.1	Application/Working Environment		Indoor/Day-Night	
6.2	Image sensor		Insert	
6.3	Sensitivity / Illumination	lux	Insert	
6.4	IR Working Distance	m	Minimum 30 Meter	
6.5	Horizontal Viewing Angle	degrees	95°-135° or Higher range of View Angle	
6.6	Memory	MB	Insert	
7	VIDEO			
7.1	Video compression		Ultra 265, H.264, MJPEG	
7.2	Minimum Resolutions		Min. 4MP (2592×1520) / 4MP (2560×1440)	
7.3	Frame Rate		4MP (2560×1440): Min. 25 fps & (2592×1520): Min. 20 fps or Better	
8	IMAGE SETTING			
8.1	Day Night		Auto / Color / B/W	
8.2	White Balance		Auto/ Sunny/Night / outdoor /Customize	
8.3	Gain Control		Auto/Manual	
9	NETWORK			
9.1	Security		Password Protection, IP address filtering.	
9.2	Supported protocols		Insert	
10	GENERAL			
10.1	Power	W	PoE Supported, Max 10 W	
10.2	Local Storage	GB	SDXC/SDHC/SD/ Micro SD card slots having min 256 GB Expandable option	
10.3	Connectors		1 RJ45 10M/100M Base-TX Ethernet	
10.4	Environmental Casing/housing		IP66 or higher	
11	FEATURES			
11.1	Object Detection		Yes	
11.2	Alarm		Yes (Through the NVR)	
11.3	ONVIF		Yes	
3. 32-Channel Network Video Recorder having ONVIF & Smart/AI Features Supporting FEATURED:				
1	Item Name		32 Channel Network Video Reciever having ONVIF with Smart/AI Features Supporting	
2	Brand Name		Insert	

Sl. No.	Items	Unit	Data	Guranteed by bidder
3	Model No		Insert	
4	Country of origin		Insert	
5	Country of Manufacturing		Insert	
6	NVR			
6.1	Main Processor		Intel Quad/Dual-core/ His3536 embedded processor or equivalent	
6.2	Operating System		Embedded Linux or Microsoft windows professional.	
6.3	Licenses		Min. 32 station parmanent licenses included	
6.4	IP Camera Input		Minimum 32 channel	
6.5	Memory	GB	Min. 2 GB	
6.6	Storage/HDD Capability		4 SATA interfaces, up to 6TB for each HDD or Better	
6.7	External storage interface		eSATA/USB	
6.8	HDD capacity (Inserted)	TB	storage for 15 days continuous recorindg (4MP @ 30fps) on all channels or higher	
6.9	Compression		Ultra 265, H.265, H.264	
6.10	Live view/Playback		8MP/6MP/5MP/4MP/3MP/1080p/960p/720p/D1/2CIF/CIF or Better	
6.11	Capability		8 x 4MP@30, 16 x 1080p@30, 32 x 960p@25 or Better	
6.12	Maximum Bandwidth (Incoming & Outgoing)		Total 320 Mbps or Better	
6.13	Alarm Actions		Insert	
6.14	Video Detection		Video Motion Detection, Video Loss & Camera Blank	
6.15	External Network/interface connector			
6.15.1	RJ-45		2 RJ45 10M/100M/1000M self-adaptive Ethernet Interfaces	
6.15.2	HDMI Port	Nos	Min. 2	
6.15.3	USB Port	Nos	Insert	
6.15.4	Alarm In	nos	Insert	
6.15.5	Alarm Out	nos	Insert	
6.15.6	VGA		Yes	
6.16	Network Function		HTTP, TCP/IP, IPv4/IPv6, UPnP, RTSP, UDP, SMTP, NTP, DHCP, DNS, IP Filter, PPPoE, DDNS, FTP, Alarm Server, IP Search	
6.17	Max. User Access	Nos	Insert	
6.18	Remote Access		Web client, Smartphone (iPhone, iPad, Android app)	
6.19	Safety / EMS Standard		CE/IEC/EN standard	
6.20	Power consumption	W	Insert	
6.21	Cooling system		Insert	
6.22	Accessories		Installation guide, Keyboard, Computer mouse, power cable etc. and other necessary materials	

Sl. No.	Items	Unit	Data	Guranteed by bidder
6.23	Software		Genuine permanent Camera station license from the manufacturer	
7	FEATURES			
7.1	Object Detection		Yes	
7.2	Alarm (Buzzer)		Yes	
7.3	ONVIF		Yes	
4. Core Switch :				
1	Brand Name		Insert	
2	Model No		Insert	
3	Country of origin		Insert	
4	Country of Manufacturing		Insert	
5	Device Type		Min. 12 ports Gigabit Fiber & 12 ports Gigabit Ethernet (Combo) + 4 Port PoE+ Layer 2+ Managed	
6	Enclosure Type		Insert	
7	Ports		12 x Gigabit SFP+ 12 x Gigabit Combo Ethernet or Higher	
8	Switching capacity	Gbps	Min 20 Gbps	
9	Forwarding performance (64-byte packet size)	Mpps	Min. 15.0 Mpps	
10	Routing Protocol		Static IPv4 routing	
11	Remote Management Protocol		SNMP 1, RMON 1, RMON 2, RMON 3, RMON 9, Telnet, SNMP 3, SNMP 2c, HTTP, HTTPS, SSH, CLI	
12	Authentication Method		Secure Shell (SSH), RADIUS, TACACS+	
13	Compliant Standards		IEEE 802.3	
14	RAM	MB	Min. 128	
15	Flash Memory	MB	Min. 16	
16	Status Indicators		Link activity, port transmission speed, system	
17	Interfaces	Nos	12 x 10/100/1000 RJ-45	
		Nos	1 x console - DB-9 - management	
		Nos	12 x Shared SFP Fiber 100/1000	
18	Power Device		External power adapter or 1 fixed PSU	
19	Voltage Input	V	AC 230 V (50 Hz)	
20	Miscellaneous			
21	Rack Mounting Kit		Included	
22	MTBF	hours	Min. 5,00,000 hours	
23	Compliant Standards		UL listed (UL 1950)/cUL IEC 950/EN 60950	
5. Access Switch:				
1	Brand Name		Insert	
2	Model No		Insert	
3	Country of origin		Insert	
4	Country of Manufacturing		Insert	

Sl. No.	Items	Unit	Data	Guranteed by bidder
5	Device type		8 x 10/100/1000 (PoE) + 2 x Combo Gigabit SFP	
6	Enclosure Type		Insert	
7	Routing Protocol		Static Ipv4 routing	
8	Compliant Standards		IEEE 802.1D	
9	Remote Management Protocol		CLI, HTTP, SSH, Telnet, HTTPS, RMON 1, RMON 2, RMON 3, RMON 9, SNMP 1, SNMP 2c, SNMP 3	
6. SFP Modular:				
1	Brand Name		Insert	
2	Model No		Insert	
3	Country of origin		Insert	
4	Country of Manufacturing		Insert	
5	Device Type		LC(Local Connector) / SM(Single Mode)/SF(Single Fibre) 1.25Gbit/s, 20km	
7. Ethernet Lightning Arrester (Outdoor type):				
1	Brand Name		Insert	
2	Model No		Insert	
3	Country of origin		Insert	
4	Country of manufacturing		Insert	
5	Type		Outdoor RJ-45 Bulkhead Mount/Pole mount or wall mount	
6	Data Rate	Mbps	1000	
7	Nominal Operating Voltage	Vdc	48	
8	Maximum Continuous Operating Voltage	Vdc	90	
9	Surge Current		Min. 1.5 kA, 10/1000us	
10	Input/output Connector		Two x RJ-45	
11	Protection		Min. IP54	
8. 40" LED TV:				
1	Brand Name		Insert	
2	Model No		Insert	
3	Country of origin		Insert	
4	Country of MFR		Insert	
5	Resolution		Min. 1920x1080	
6	Screen Size (Diagonal)	inch	Min. 40	
7	Dynamic Contrast Enhancer		Yes	
8	Display Type		LCD with Direct LED Backlight	
9	Viewing Angle	degrees	Insert	
10	HDCP		Yes	
11	Dolby Sound System		Yes	

Sl. No.	Items	Unit	Data	Guranteed by bidder
12	Video Signal Support		1080/24p (HDMI only), 1080/60i,1080/60p (HDMI/ Component), 1080/50i, 1080/50p(HDMI/ Component), 480/60i, 480/60p, 576/50i, 576/50p, 720/60p, 576/50p, 1080/30p or better	
13	Operating Voltage		AC 150-250 V, 50 Hz	
14	VGA Port		Yes	
15	HDMI Port (1.3/1.4 or higher)		Min. 2	
16	USB 2.0	Nos	Insert	
17	Operating System		Insert	
18	Accessories		Insert	
9. Offline UPS:				
1	Brand Name		Insert	
2	Model		Insert	
3	Country of manufacturing		Insert	
4	Output Power	VA	Min. 2000	
5	Input range	V	220V AC (Cover range 170-270V AC)	
6	Output range	V	220V AC (Must be compatible with offered IP cameras)	
7	Other features		Built –in- AVR	
8	Back-up time		Minimum 30 minutes at full load.	
10. 22U FLOOR MOUNT RACK :				
1	Brand		Insert	
2	Model		Insert	
3	Country of Origin		Insert	
4	Country of Manufacturing		Insert	
5	Size		22U	
6	Dimension(Width*Depth)		600mm*600mm	
7	Maximum Static Load Capacity	kg	1000 KG or higher	
8	Ventilation Percentage		>70% High density ventilation door	
9	Material		RAL 7021 Black	
10	Max. Open Angel		180 degree	
11	Surface Treatment		Powder coated	
12	19" Profile		Galvanized coated (2.0mm)	
13	Side Panel		Powder coating (1.2mm), removable side panel 4 part with Steel locking system for each part.	
14	Rear Door		High-density ventilation door, SPCC 1.2mm with lock system	
15	Front Door		Tempered glass door, SPCC 1.2mm with lock system	
16	Raw Material		SPCC	
17	Power Distribution Unit		13 Amp 6 way PDU UK type with 3 meter power cable length.	
18	Heavy Duty Castor & Adjustable Feet		Four M12 adjustable feet & four heavy duty castor	
19	Top Beam with fans		(1.5mm) SPCC with 4 nos fan.	
20	Standards		ANSI/EIA RS-310-D, IEC60297-2	

Sl. No.	Items	Unit	Data	Guranteed by bidder
11. Fiber Optic Cable-(6 core Single mode , Armored):				
1	Brand		Insert	
2	Model		Insert	
3	Country of Origin		Insert	
4	Country of Manufacturing		Insert	
5	Type		Armored Optical Fiber Cable, 6core, Single Mode	
6	Standards		ISO/IEC 11801:2008, ANSI/EIA-568-C.3, TIA-598-C, EN50173:2002, TIA/EIA-526-7	
7	Cable Diameter	mm	8.2(±0.2)	
8	Strength Member		Steel	
9	Aarmor Material		Steel strip	
10	Tube Filling		Gel	
11	Water Blocking Material		Waterproof tape	
12	Dynamic / Static Min. Bend Radius (D)		20 D	
13	Wavelength	nm	1310	
14	Attenuation (max.)	dB/km	≤0.38	
15	Cutoff Wavelength	nm	≤1260	
12. CAT6 Network Cable : STP Type				
1	Brand Name		Insert	
2	Part No.		Insert	
3	Country of origin		Insert	
4	Country of manufacturing		Insert	
5	ANSI/TIA Category		6	
6	Conductor		Stranding: Solid, Material: Bare Copper, 23 AWG, 4 pairs	
7	Insulation Material		Insert	
8	Outer Shield Material		Material: Aluminium/Poly, Coverage: 100%,	
9	Outer Jacket Material		Material: PVC - Polyvinyl Chloride, Low Smoke Zero Halogen (LSZH)	
10				
11	Max. Conductor DCR	Ohm/km	Insert	
12	Max. Capacitance Unbalance	pF/100m	Insert	
13	Nominal Mutual Capacitance	pF/ft	Insert	
14	Nominal Velocity of Propogation	c	Insert	
15	Others Compliance:		Flammability / Fire Resistance: NFPA 262, UL 910 (Plenum), FT6, FT6, IEC 60332-1-2. IEEE Compliance: IEEE 802.3bt Type 1, Type 2, Type 3, Type 4. TIA/EIA Compliance: ANSI/TIA-568.2-D Category 6.	
13. Surveillance Cabinet:				
1	Brand Name		Insert	

Sl. No.	Items	Unit	Data	Guranteed by bidder
2	Model No.		Insert	
3	Country of manufacturer		Insert	
4	Casing Sheet (Material)		Weather proof stainless steel/ G.I Sheet 14 AWG or Equivalent, Color: Silver/Gray	
5	Environment		Outdoor	
6	Rack		Yes (Mounting for 19" PoE switch, Power supply, Optical fibre, LA, junction box, holes for different cables etc.)	
7	Dimension		24"x18"x16" (As per attached Drawing)	
8	Painting		Powder Coating	
9	Ventilation		2 Nos (As per attached Drawing)	
10	Cooling Fan		Yes (As per attached Drawing)	
11	Heat Insulation		Yes	
12	Cable Grand		Yes (as per attached Drawing)	
13	Door Lock		Yes	
14	Earting Plate/Strip		Yes (Mesh connected or individual as required)	
15	Foundation		Yes (as per attached Drawing)	
16	Included accessories		Different dia Cable glands, High Quality Power socket, Internal standard wiring with Terminal (if needed), Earthing Terminal & all necessary accessories	
14. Power Cable-NYFGBY (4.0 RM):				
1	Brand Name		Insert	
2	Country of origin		Insert	
3	Country of manufacturing		Insert	
4	Specification		for 4 RM cable: 2* 4.0 RM for 2.5 RM cable: 2.5 RM 1000V, VDE 0271-3.69 & IEC: 60502-1, PVC Insulated, Steel Wire Armoured & PVC Sheathed Cable	
5	Material		Copper	
15. uPVC pipes & fittings with sizes: 37/25/19/12 mm dia				
1	Size		24"x18"x16" (As per attached Drawing)	
2	Specification		uPVC pipe having specific gravity 1.35 - 1.45, and other physical, chemical, themal, fire resistivity properties etc. as per BSTI, ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as round grating/domed roof grating, bends, sockets etc.	
3	Size		for dia 37mm, wall thickness 3.7mm-4.3mm for 25 mm dia, wall thickness 3.4 mm-4.0 mm for 19mm dia, wall thickness 2.9mm-3.4mm for 12mm dia, wall thickness 2.8mm-3.3mm	
16. Poles				

Sl. No.	Items	Unit	Data	Guranteed by bidder
1	Material of pole		Stainless Steel	
2	Height	feet	Min. 15 (as per attached Drawing)	
3	Thikness	mm	Min. 1.5	
4	Based plate dimension		As per attached drawing	
5	Based casting & anchoring of the pole		As per attached drawing	
17. Main Distribution Board (MDB):				
1	Brand Name		Insert	
2	Model No.		Insert	
3	Country of manufacturer		Insert	
4	Casing Sheet (Material)		Weather proof stainless steel / G.I Sheet 16 AWG or Better, Color: Silver/Gray	
5	Environment		Indoor	
6	Mounting On		Wall	
7	No of Busbar Plate	Nos	2	
8	Material of Busbar Plate		Copper	
9	Size of Busbar Plate		As required	
10	Grounding Strip/Plate		Yes	
11	Mountain Channel of CB & SPD & Fuse		Yes	
12	Grounding Cable Size (External)		Min. 25 RM	
13	Grounding Cable Size (Internal)		Min. 16 RM	
14	Dimension		16"x14"x7" or higher	
15	Painting		Powder Coating	
16	Cable Grand		Yes	
17	Door Lock		Yes	
18	Including / Fitted Following Accessories as per attached Drawing			

Sl. No.	Items	Unit	Data	Guranteed by bidder
19	SPD (Surge Protection Device) Type-1		Against: Indirect lightning strikes causing induced or conducted overvoltages on the power distribution network. Protected Number of Poles: 2, Version: Plug-in Nominal AC Voltage of the System (U): 230 / 400 V Arrester Class: I Discharge Current: Nominal (kA) : Insert I (max, kA) : Insert Impulse Current:I (imp, 10 / 350 μ s) : Insert Maximum Continuous Operating Voltage (Uc): (L-PE) V : Insert (N-L) V : Insert Voltage Protection Level (Up, kV): NSERT Short Circuit Withstand Icc (kA) : Insert Short-Circuit Protective Devices: Curve B Breakers $\leq$ 125 A or Better Curve C Breakers $\leq$ 125 A or Better gL Type Fuses $\leq$ 125 A or Better gG Type Fuses $\leq$ 125 A or Better Width in Number of Modular Spacings: 2, Indicator: Yes	
20	MCB		Brand: Insert Country of Origin: Insert, Protected Number of Poles: 2, Current Rating: 15A to 30 A (As Required), Voltage Rating: 230 V AC/400 V AC , Features: Overcurrent & Magnetic	
21	Fuse		Brand: Insert Number of Poles: 2, Current Rating (A): (As Required) Voltage Rating: 230 V AC/400 V AC	
18.Sub Distribution Board (SDB):				
1	Brand Name		Insert	
2	Model No.		Insert	
3	Country of manufacturer		Insert	
4	Casing Sheet (Material)		Weather proof stainless steel / G.I Sheet 16 AWG or Better, Color: Silver/Gray	
5	Environment		Indoor	
6	Mounting On		Wall	
7	No of Busbar Plate		2	
8	Material of Busbar Plate		Copper	
9	Size of Busbar Plate		As required	

Sl. No.	Items	Unit	Data	Guranteed by bidder
10	Grounding Strip/Plate		Yes	
11	Mountain Channel of CB & SPD & Fuse		Yes	
12	Grounding Cable Size (External)		Min. 25 RM	
13	Grounding Cable Size (Internal)		Min. 16 RM	
14	Dimension		16"x14"x7" or Higher	
15	Painting		Power Coating	
16	Cable Grand		Yes	
17	Door Lock		Yes	
18	Including / Fitted Following Accessories as per attached Drawing			
19	SPD (Surge Protection Device) - Type-2		Against: Indirect lightning strikes causing induced or conducted overvoltages on the power distribution network. Protected Number of Poles: 2 Version: Plug-in Nominal AC Voltage of the System (U): 230 / 400 V Arrester Class: II Discharge Current: Nominal (8 / 20 μs) (kA) : Insert I (max, 8 / 20 μs) (kA) : Insert Impulse Current:I (imp, 10 / 350 μs) (kA) : Insert Maximum Continuous Operating Voltage (Uc): (L-PE) V : Insert (L-N) V : Insert (N-L) V : Insert Voltage Protection Level (Up, kV): Insert Short Circuit Withstand Icc (kA): Insert Short-Circuit Protective Devices: Curve B Breakers $\leq$ 125 A or Better Curve C Breakers $\leq$ 125 A or Better gL Type Fuses $\leq$ 125 A or Better gG Type Fuses $\leq$ 125 A or Better Width in Number of Modular Spacings: 2 Indicator: Yes	
20	MCB		Brand: Insert Country of Origin: Insert, Protected Number of Poles: 2, Current Rating: 15A to 30 A (As Required), Voltage Rating: 230 V AC/400 V AC Features: Overcurrent & Magnetic	

Sl. No.	Items	Unit	Data	Guranteed by bidder
21	Fuse		Brand: Insert Number of Poles: 2 Current Rating (A): (As Required) Voltage Rating: 230 V AC/400 V AC	

1.1.1 Control, Protection, Substation Automation & Metering

1.1.1.1 Line Distance Protection

No.	Description	Unit	Minimum Requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL (Switzerland/Sweden/Germany/UK/USA/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Insert (Main-01 & Main-02 shall be from different manufacturer)	
3.2	Relay Software version		Insert	
3.3	Relay Hardware version		Insert	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, $\pm 5\%$	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	6	
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3 *Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos.	6 (For Line VT & Bus VT)	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	150	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable) (Should be increased as per the scheme design)	
10.2	Minimum operating range	V	110V DC ($\pm 20\%$ tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	20 (minimum 8 Nos. high speed trip output and 2 Nos. watchdog outputs) (Should be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	

No.	Description	Unit	Minimum Requirements	Guaranteed
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	5 (2ms for high speed contact)	
12	Number of LEDs	Nos.	15 (programmable) (Should be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	
14	Software requirement		Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license	
14	GPS Time synchronization	Yes/ No	Yes	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 based Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Impedance protection	
17.1	Tripping options		Single and/or three phases	
17.2	Number of parameter setting groups	Nos.	Minimum 4 (Independently settable)	
17.3	Pre-configuration		For all basic functions	
17.4	Number of impedance protection zones	Nos.	5	
17.5	Shape of impedance zone		Mho/Quadrilateral	
17.6	Reverse looking element		Settable in all 5 zones	
17.7	Can resistance and reactance reaches be set independent of each other	Yes/ No	Yes	
17.8	Arc forward and reverse reach setting independent of each other?	Yes/ No	Yes	
17.9	Switch on to fault	Yes/ No	Yes	
17.10	Out of Step	Yes/ No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed
17.11	Stub Protection	Yes/ No	Yes	
17.12	Blind Fault Protection	Yes/ No	Yes	
17.13	Power swing block	Yes/ No	Yes	
17.14	Communication aided impedance protection		PUTT, POTT, CB Echo logic, Weak infeed echo logic, DTT, Zone-1 extension etc.	
17.15	Communication aided Directional Earth Fault	Yes/ No	Yes	
17.16	Impedance zone operating time	Sec	Settable between 0s and 30s (or higher range) with step size of 0.01s	
17.17	Impedance setting range	Ohm	0.1 to 1000 or higher with the step size of 0.001/In	
17.18	Relay Operating Time' i) Output contact making time ii) Relay Time	ms	Insert	
18	Back up protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement)	
20	Monitoring functions			
20.1	Fuse failure supervision, current circuit supervision	Yes/ No	Yes	
20.2	U, I, P, Q, S, f, PF monitoring	Yes/ No	Yes	
20.3	Fault locator	Yes/ No	Yes	
20.4	Event records and oscillographic disturbance records		Event recorder should keep at least 256 Nos previous records and disturbance recorder should handle at least 9 Nos analogue channels and at least 24 Nos binary channels	
21	Tripping and indication logics		Should be programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

1.1.1.2 Line Differential Protection

No.	Description	Unit	Minimum Requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL. (Switzerland/Sweden/Germany/UK/USA/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Insert (Main-01 & Main-02 shall be from different manufacturer)	
3.2	Relay Software version		Insert	
3.3	Relay Hardware version		Insert	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, $\pm 5\%$	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	8 (4 for Double Busbar arrangement)	
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3 *Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos.	6 (For Line VT & Bus VT)	
9.2	Nominal voltage	V AC	110	
9.3	Minimum continuous withstand voltage	V AC	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable) (Should be increased as per the scheme design)	
10.2	Minimum operating range	V	110V DC ($\pm 20\%$ tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	20 (minimum 8 Nos high speed trip output and 2 Nos watchdog outputs) (Should be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	

No.	Description	Unit	Minimum Requirements	Guaranteed
11.5	Maximum operating time	ms	5ms & 2ms for high speed contact	
12	Number of LEDs	Nos.	15 (programmable) (Should be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license	
15	GPS Time synchronization	Yes/No	Yes	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
16.3	Protection communication		Should be suitable for multiplexed, routed switched or dedicated fiber optic communication	
16.4	Binary input transfer		Should be able to transfer at least 8Nos binary signals between the IEDs	
17	Main protection function		Line differential protection	
17.1	Tripping options		Single and/or three phases	
17.2	Number of parameters setting groups	Nos	Minimum 4 (Independently settable)	
17.3	Pre-configuration		For all basic functions	
17.4	Differential characteristics		Restrained biased characteristics with charging current compensations	
17.5	Harmonics blocking		2nd and 5th harmonics	
17.6	CT summation		Internal CT summation facility should be available for 1 and ½ CB arrangement	
17.7	Emergency protection (Should be enabled in case of differential communication failure)		Impedance protection with at least 4 mho/quadrilateral zone setting options, PSB, SOTF, VTFF and all scheme communication features ¹	
17.8	Display options		There must be provision of displaying restraining and differential current on the HMI	

¹PUTT, POTT, CB Echo logic, Weak infeed echo logic, DTT, Zone-1 extension etc.

No.	Description	Unit	Minimum Requirements	Guaranteed
17.9	Tripping time		Instantaneous	
17.10	Protected distance		Should be able to protect at least 150km of line and further facility of extending protected line length in the relay should be provided	
18	Back up protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchrocheck and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement)	
20	Monitoring functions			
20.1	Fuse failure supervision, current circuit supervision	Yes/No	Yes	
20.2	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.3	Event records and oculographic disturbance records		Event recorder should keep at least 256 Nos previous records and disturbance recorder should handle at least 9 Nos analogue channels and at least 24 Nos binary channels	
21	Tripping and indication logics		Programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

1.1.1.3 Transformer Differential Protection (3 Winding):

No.	Description	Unit	Minimum Requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL. (Switzerland/Sweden/Germany/UK/USA/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Insert (Main-01 & Main-02 shall be from different manufacturer)	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	

No.	Description	Unit	Minimum Requirements	Guaranteed
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, $\pm 5\%$	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	12 (8 Nos for 2 winding Transformer)	
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3 *Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs		6 (For Line VT & Bus VT)	
9.2	Nominal voltage	V AC	110	
9.3	Minimum continuous withstand voltage	V AC	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	20 (programmable) (Should be increased as per the scheme design)	
10.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	20 (minimum 8 Nos high speed trip output and 2 Nos watchdog outputs) (Should be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	10	
12	Number of LEDs	Nos.	15 (programmable) (Should be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	

No.	Description	Unit	Minimum Requirements	Guaranteed
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any timebounded license.	
15	GPS Time synchronization	Yes/No	Yes	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Transformer differential protection	
17.1	Application		For 3 winding and Auto-Transformers (For 2 winding transformer as per requirement)	
17.2	Number of parameter setting groups	Nos.	Minimum 4 (Independently settable)	
17.3	Pre-configuration		For all basic functions	
17.4	Differential characteristics		Restrained biased characteristics with stabilization during magnetizing inrush and CT saturation	
17.5	Harmonics blocking		2nd and 5th harmonics	
17.6	CT ratio matching and vector group compensation		Internally done, Software based	
17.7	CT connection		CT connections from each voltage level should be connected individually without external summation	
17.8	Display options		There must be provision of displaying restraining and differential current on the HMI	
17.9	Tripping time		Instantaneous	
17.10	Restricted Earth Fault		High / low impedance type	
18	Back up protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchrocheck and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double Busbar arrangement)	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 256 Nos previous records and disturbance recorder should handle at least 9 Nos analogue channels and at least 24 Nos binary channels	
21	Tripping and indication logics		Should be programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	
21	Tripping and indication logics		Programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

Over current and Earth fault protection:

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL. (Switzerland/Sweden/Germany/UK/US A/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, $\pm 5\%$	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	4	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3*Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos	4	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable) (Should be increased as per the scheme design)	
10.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	10 (minimum 6 Nos high speed trip output and 2 Nos watchdog outputs) (Should be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	10	
12	Number of LEDs	Nos.	8 (programmable) (Should be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
15	GPS Time synchronization		Should be available	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base)	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
			Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault protection with IEC and ANSI/IEEE characteristics curves	
17.1	Number of parameter setting groups	Nos.	Minimum 4 (Independently settable)	
17.2	Minimum stages in each setting groups for Over-current	Nos	3	
17.3	Minimum stages in each setting groups for Earth fault	Nos	3	
17.4	Pre-configuration		For all basic functions	
17.5	Tripping time		Settable between 0s to 150s	
17.6	Pick up setting range for Time delayed Directional/Non-directional OC	A	$0.1 \cdot I_n$ to at least $20 \cdot I_n$ (step size 0.01)	
17.7	Pick up setting range for High set Directional/Non-directional OC	A	$0.5 \cdot I_n$ to at least $35 \cdot I_n$ (step size 0.1)	
17.8	Pick up setting range for Time delayed Directional/Non-directional EF	A	$0.01 \cdot I_n$ to at least $20 \cdot I_n$ (step size 0.01)	
17.9	Pick up setting range for High set Directional/Non-directional EF	A	$0.5 \cdot I_n$ to at least $35 \cdot I_n$ (step size 0.1)	
17.10	TMS setting range for IDMT		0.025 to at least 1.5 (step size 0.025)	
18	Other protection functions		Comprehensive voltage protection functionality including over-voltage, under-voltage, negative sequence overvoltage, residual over-voltage, under-frequency, over-frequency, Rate of Change of Frequency (ROCOF) protection	
19	Control functions		2 Sets of Synchrocheck for single and multi CB arrangements if required by PSLD (1 set for Double Busbar arrangement)	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 20Nos previous records and disturbance recorder should handle at least 8Nos analogue channels and at least 24Nos binary channels	
21	Tripping and indication logics		Should be programmable	
22	Standards		Should conform IEC-60255 in all aspects	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
23	Type test certificate		Should be provided	

1.1.1.4 Bay Control Unit (BCU) & Protection Unit (BCPU):

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL. (Switzerland/Sweden/Germ any/UK/USA/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50/60Hz, $\pm 5\%$	
8	Current transformer requirement			
8.1	No of Inputs	Nos	Min 4	
8.2	Nominal current	A	Operable in 1A and 5A	
8.3	Minimum continuous current capacity	A	3*Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos	Min 5 (For Line voltage and Bus voltages)	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos	Min 60 (programmable) (Can be increased as per the scheme design)	
10.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$	

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
			tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos	Min 20 (minimum 5 Nos fast operating trip output and 1 Nos watchdog outputs) (Can be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	10	
12	Number of LEDs	Nos	08 (programmable) (Can be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to issue close & open commands to switching devices through visual animation, access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
15	GPS Time synchronization		Should be available	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Instantaneous/delayed, directional/non-directional,	

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
			over current and earth fault protection with IEC and ANSI/IEEE characteristics curves	
17.1	Number of parameter setting groups	Nos	Minimum 4 (Independently settable)	
17.2	Minimum stages in each setting groups for Over-current	Nos	3	
17.3	Minimum stages in each setting groups for Earth fault	Nos	3	
17.4	Pre-configuration		For all basic functions	
17.5	Tripping time		Settable between 0s to 150s	
17.6	Pick up setting range for Time delayed Directional/Non-directional OC	A	$0.1 \cdot I_n$ to at least $20 \cdot I_n$ (step size 0.01)	
17.7	Pick up setting range for High set Directional/Non-directional OC	A	$0.5 \cdot I_n$ to at least $35 \cdot I_n$ (step size 0.1)	
17.8	Pick up setting range for Time delayed Directional/Non-directional EF	A	$0.01 \cdot I_n$ to at least $20 \cdot I_n$ (step size 0.01)	
17.9	Pick up setting range for High set Directional/Non-directional EF	A	$0.5 \cdot I_n$ to at least $35 \cdot I_n$ (step size 0.1)	
17.10	TMS setting range for IDMT		0.025 to at least 1.5 (step size 0.025)	
18	Other protection functions		Comprehensive voltage protection functionality including over-voltage, under-voltage, negative sequence overvoltage and residual over-voltage protection	
19	Control functions		Synchrocheck Implementing interlocking logics Execution of close and open command for switching devices coming from SAS and Device HMI	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 256 Nos previous records and disturbance recorder should handle at least 9 Nos analogue channels and at least 24	

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
			Nos binary channels	
21	Tripping and indication logics		Should be programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

1.1.1.5 Frequency Protection

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer			
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50/60Hz, $\pm 5\%$	
8	Voltage transformer requirement			
8.1	No of Inputs		3	
8.2	Nominal voltage	V AC	110	
8.3	Minimum continuous withstand voltage	V AC	220	
9	Language		English	
10	Binary input module			
10.1	Minimum number of inputs	Nos	5 (programmable)	
10.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos	8	
11.2	Minimum operating range	V	110V and 220V DC ($\pm 20\%$ tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
12	Number of LEDs	Nos	8 (programmable)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
14	Software requirement		Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license	
15	GPS Time synchronization		Should be available	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Frequency protection functions		Comprehensive frequency protection functionality including over-frequency, under-frequency, frequency rate of change with rate of change of rise and rate of change of fall freely.	
17.1	Number of parameter setting groups	Nos	Minimum 4 (Independently settable)	
17.2	Pre-configuration		For all basic functions	
17.3	Frequency setting range	Hz	40 to 60 or higher range (in step size of 0.01Hz)	
17.4	Time setting range of U/F and O/F	sec	0 to 100 or higher range (in step size of 0.01s)	
17.5	Setting range of Rate of Change of Frequency (ROCOF))	Hz/sec	0.1 to 10 or higher range (in step size of 0.01Hz/sec)	
17.5	Time setting range of ROCOF	sec	0 to 50 or higher range (in step size of 0.01s)	
18	Event records and oscillographic disturbance records		Event recorder should keep at least 256 Nos previous records and disturbance recorder should handle at least 9 Nos analogue channels and at least 24 Nos binary channels	
19	Tripping and indication logics		Should be programmable	
20	Standards		Should conform IEC-60255 in all aspects	
21	Type test certificate		Should be provided	

1.1.1.6 Busbar and Breaker Failure Protection

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
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SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL. (Switzerland/Sweden/Germany/UK/USA/ France).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Installation			
3.1	Operating architecture		Distributed	
3.2	Number of Central Unit	Nos	1	
3.3	Number of Bay Units	Nos	As mentioned in Substation Single Line Diagram; For Breaker Failure Protection of Tie CB in 1 and Half CB bus arrangement, stand-alone relays will also be accepted.	
3.4	Minimum number of Bay Units supported by single Central Unit	Nos	30	
4	Central Unit Requirements			
4.1	Relay Type & model		Should be filled up by bidder	
4.2	Relay Software version		Should be filled up by bidder	
4.3	Relay Hardware version		Should be filled up by bidder	
4.4	Language		English	
4.5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
4.6	Relay auxiliary voltage	V DC	Minimum range of 48V to 250V; with protective fuse	
4.7	Maximum ripple		≤15%	
4.8	Operating frequency	Hz	50Hz, ±5%	
4.9	Binary Inputs of Central Unit			
	4.8.1	Minimum number of binary inputs	Nos.	12 (programmable)
	4.8.2	Minimum operating range	V DC	Substation nominal DC voltage ±15%
	4.8.3	Operating time	ms	<1
4.10	Binary Outputs of Central Unit			
	4.9.1	Minimum number of outputs	Nos.	9
	4.9.2	Operating time	ms	3
	4.9.3	Operating voltage	V	Upto 250 V AC/DC
	4.9.4	Continuous current capacity	A	8
	4.9.5	Short time current capacity	A	30A for at least 0.5s
	4.9.6	Binary output reset response		Programmable for latched and self reset
4.11	Number of LEDs	Nos.	20 (programmable)	
4.12	HMI		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer	
5	Bay Unit Requirements			

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
5.1	Relay Type & model		Should be filled up by bidder	
5.2	Relay Software version		Should be filled up by bidder	
5.3	Relay Hardware version		Should be filled up by bidder	
5.4	Language		English	
5.5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
5.6	Relay auxiliary voltage	V DC	Minimum range of 48V to 250V	
5.7	Maximum ripple		≤15%	
5.8	Operating frequency	Hz	50Hz, ±5%	
5.9	Binary Inputs of Bay Unit			
	5.8.1	Minimum number of binary inputs	Nos.	12 (programmable)
	5.8.2	Minimum operating range	V DC	Substation nominal DC voltage ±15%
	5.8.3	Operating time	ms	<1
5.10	Binary Outputs of Bay Unit			
	5.9.1	Minimum number of outputs	Nos.	16
	5.9.2	Operating time	ms	3
	5.9.3	Operating voltage	V	Upto 250 V AC/DC
	5.9.4	Continuous current capacity	A	8
	5.9.5	Short time current capacity	A	30A for at least 0.5s
	5.9.6	Binary output reset response		Programmable for latched and self reset
5.11	CT requirements of Bay Unit			
	5.10.1	No of CT Inputs	Nos.	4
	5.10.2	Nominal current	A	Operable in 1A and 5A (User settable)
	5.10.3	Minimum continuous current capacity	A	4*Nominal current
	5.10.4	Thermal withstand capacity	A	100*Nominal current for at least 1s
	5.10.5	Burden per phase	VA	≤0.2
5.12	Number of LEDs	Nos.	8 (programmable)	
5.13	HMI		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer	
5.14	Test socket		Should be installed in the front side of the panel with each Bay Unit	
5.15	Supply of applicable test plug	Nos	2 Nos for each substation	
6	Communication interface & Software			
6.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration,	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
			disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
6.2	GPS Time synchronization		Should be available	
6.3	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
6.4	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
6.5	Protection communication interface			
6.5.1	Type of communication		Optical fibre	
6.5.2	Number of cores per Bay Unit	Nos	2	
6.5.3	Core/sheath diameter		62.5/125µm (multi-mode)	
6.5.4	Maximum permissible attenuation	dB	5	
6.5.5	Minimum supported transmission length	m	1200	
7	Protection Functions			
7.1	Main protection function			
7.1.1	Required function		Highly reliable low-impedance based busbar differential protection	
7.1.2	Evaluation criteria		Differential current with restrain feature Directional current comparison method	
7.1.3	Evaluation method		Phase segregated	
7.1.4	Through-fault stability during CT saturation		Must be complied	
7.1.5	CT switching/Busbar selection		Must be done internally	
7.1.6	Minimum fault current pick-up setting	A	0.2 to 4 x I _N in step size of 0.01	
7.1.7	Differential restraining characteristics slope setting		0.5 to 0.8; in step size of 0.05	
7.1.8	Differential current alarms Current setting Time delay setting		5 to 50% of minimum pick-up in steps of 5% 2 to 10s in steps of 1s	
7.1.9	Isolator alarm time delay		0.5 to 90s	
7.1.10	Typical tripping time		20 to 30ms at I _{Diff} /I _{Rest} ≥ 5	
7.1.11	Settable CT ratio per feeder		50 to 10,000/1A	
7.2	Check zone criterion		Should be available	

SL. No.	Description		Unit	PGCB's requirements	Guaranteed
	7.2.1	Minimum fault current pick-up setting	A	0.2 to 4 x IN in step size of 0.01	
	7.2.2	Differential restraining characteristics slope setting		0 to 0.8; in step size of 0.05	
	7.2.3	Settable CT ratio per feeder		50 to 10,000/1A	
7.3	Additional protection function 1				
	7.3.1	Required function		TEE-point differential protection (for 1 and half CB bus arrangement only)	Not applicable for Double busbar arrangement
	7.3.2	Evaluation criteria		Differential current with restrain feature Directional current comparison method	
	7.3.3	Evaluation method		Phase segregated	
	7.3.4	Through-fault stability during CT saturation		Must be complied	
	7.3.5	CT switching/selection		Must be done internally	
	7.3.6	Minimum fault current pick-up setting	A	0.2 to 4 x IN in step size of 0.01	
	7.3.7	Differential restraining characteristics slope setting		0.5 to 0.8; in step size of 0.05	
	7.3.8	Differential current alarms Current setting Time delay setting		5 to 50% of minimum pick-up in steps of 5% 2 to 10s in steps of 1s	
	7.3.9	Isolator alarm time delay		0.5 to 90s	
	7.3.10	Typical tripping time		20 to 30ms at IDiff/IRest ≥5	
	7.3.11	Settable CT ratio per feeder		50 to 10,000/1A	
7.4	Additional protection function 2				
	7.4.1	Required function		Breaker failure protection	
	7.4.2	Current setting range		0.1 to 2 x IN in step size of 0.1 x IN	
	7.4.3	Measurement accuracy		±5%	
	7.4.4	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip	
	7.4.5	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms	
	7.4.6	Setting range of remote trip timer (t2)	ms	10 to 5,000ms in steps of 10ms	

SL. No.	Description		Unit	PGCB's requirements	Guaranteed
	7.4.7	Remote trip pulse duration	ms	100 to 2,000ms in steps on 10ms	
7.5	Additional protection function 3				
	7.5.1	Required function		End-fault protection	
	7.5.2	Current setting range		0.1 to 2 x IN in step size of 0.1 x IN	
	7.5.3	Timer setting range	ms	100 to 10,000ms in steps of 100ms	
7.6	Selective Tripping & Blocking options				
	7.6.1	Selective tripping		Should be provided based of statuses of switching devices	
	7.6.2	Selective blocking		Should be available for differential current alarm, switching object alarm, measurement abnormality, communication failure between Central Unit and Bay Unit	
	7.6.3	Forced blocking		Should be provided with selector switches installed in the panel for following options: BBP block, BFP block, EFP block, Output contacts block, All functions block	
7.7	Pre-configuration			For all basic functions with respect to the complete Single Line Diagram of the substation	
8	Monitoring & Supervision functions				
8.1	Current measurement			For all feeders and all phases, Differential Current, Restraining current	
8.2	Switching object monitoring			Should be available	
8.3	Self supervision system			Should be available for Central Unit and Bay Units	
8.4	Event records			Event recorder should keep at least 256 events in each bay unit and at least 1000 events in Central Unit	
8.5	Time stamp of event records			Date and time with 1ms accuracy	
8.6	Disturbance records			Should be available with wave shapes of all current measurements and at least 32 binary inputs and outputs for each bay unit.	
8.7	Sampling frequency of disturbance record		Hz	At least 2400	
9	Tripping and indication logics			Should be programmable	
10	Standards			Should conform IEC-60255 in all aspects	
11	Type test certificate			Should be provided	
12	Environmental requirements				
12.1	Temperature				
	12.1.1	Operation	⁰ C	-10 to +55	
	12.1.1	Storage and Transport	⁰ C	-40 to +85	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
	.2			
12.2	Climate tests			
12.2.1	Cold		-25 ⁰ C/16h	
12.2.2	Dry heat		+70 ⁰ C/16h	
12.2.3	Damp heat		-25 ⁰ C to +70 ⁰ C, 1 ⁰ C, 2 cycles	
12.2.4	Damp heat (long time)		+40 ⁰ C, 93% relative humidity/4 days	
12.3	Insulation resistance tests		>100 MOhm @0.5kV	
12.4	Dielectric tests		2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
12.5	Impulse test		1.2/50 μS/0.5 Joule, 5kV AC	

1.1.1.7 Trip circuit supervision relays (4 Nos for 2 feeders):

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer's name		ABB/SIEMENS/GE/SEL (Switzerland/Sweden/Germany/UK/ USA/ France).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Supervision mode		Pre-close and post-close	
5	Maximum operating time	ms	70	
6	Rated voltage	V DC	100-125 or higher range	
7	Minimum threshold voltage	V DC	25% lower than the nominal voltage	
8	Thermal rating of the coil	%	120% of the rated voltage, continuous	
9	Maximum coil burden	W	20W at rated voltage	
10	Number of Normally Open contacts	Nos	As required for standard scheme	
11	Number of Normally Close contacts	Nos	As required for standard scheme	
12	Standards		Should conform IEC-60255 in all aspects	

1.1.1.8 Self Reset trip relays (as required for providing standard number of tripping and annunciation signals):

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer's name		ABB/SIEMENS/GE/SEL (Switzerland/Sweden/Germany/UK/ USA/ France).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Reset mechanism		Self reset	
5	Maximum operating time	ms	10	
6	Maximum reset time	ms	20	
7	Rated voltage	V DC	100-125 or higher range	
8	Minimum threshold voltage	V DC	35% lower than the nominal voltage	
9	Minimum Rated capacity of relay contacts		AC 1250VA with maxima of 5A and 300V DC 1250W with maxima of 5A and 300V	
10	Minimum thermal capacity of relay contacts		AC 7500VA with maxima of 30A and 300V DC 7500W with maxima of 30A and 300V	
11	Number of Normally Open contacts	Nos	As required for standard scheme	
12	Number of Normally Close contacts	Nos	As required for standard scheme	
13	Standards		Should conform IEC-60255 in all aspects	

1.1.1.9 Self Reset trip relays (as required for providing standard number of tripping and annunciation signals):

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer's name		ABB/SIEMENS/GE/SEL (Switzerland/Sweden/Germany/UK/ USA/ France).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Reset mechanism		Hand reset	
5	Maximum operating time	ms	10	
6	Rated voltage	V DC	100-125 or higher range	
7	Minimum threshold voltage	V DC	35% lower than the nominal voltage	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
8	Minimum Rated capacity of relay contacts		AC 1250VA with maxima of 5A and 300V DC 1250W with maxima of 5A and 300V	
9	Minimum thermal capacity of relay contacts		AC 7500VA with maxima of 30A and 300V DC 7500W with maxima of 30A and 300V	
10	Number of Normally Open contacts	Nos	As required for standard scheme	
11	Number of Normally Close contacts	Nos	As required for standard scheme	
12	Standards		Should conform IEC-60255 in all aspects	

1.1.1.10 Test Socket

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1.1	Manufacturer			
1.2	Country of origin			
1.3	Type Line main 1 and 2 Line back-up and bus coupler Transformer main 1 and 2 Bay unit BBF Distance protection		Insert	
1.4	Standards		IEC	
1.5	Each protection device must have its own test socket		Yes	
1.6	Test socket must obtain safe online protection testing and maintaining, and performing whole tripping test with following AR		Yes	
1.7	Test socket should have enough contacts to: Short-circuit current inputs from CT's Isolate voltage inputs from VT's Isolate trip circuit for each phase separately Isolate CB close command Isolate signalling voltage Inhibit breaker failure initialising Inhibit sending of communication signal Allow functional testing of protection		Yes	

1.8	Socket should be designed for 4 mm banana plugs access		Yes	
2.2.1	Number of outputs	NO/NC	Min. 2/2	

1.1.1.11 Energy Meter (3-phase, 4-wire, 3-element, Numerical Indoor Type Multi-function Programmable Tariff Meter with Power Quality Monitoring):

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
1	Manufacturer's name		CEWE/Elster/Landis+Gyr/EDMI/SEL	
2	Country of Manufacturing		France/UK/USA/Switzerland/Sweden/Germany/EU/Canada	
3	Model		Should be filled up by bidder	
4	Meter type		Numerical, programmable, multi-function tariff meter	
5	Housing & mounting		Flush/surface mounting housing and capable of sustaining in harsh environmental condition	
6	Panel mounting kit		Should be supplied	
7	Display language		English	
8	Connection type		CT/VT operated, 3-phase, 4 wires, solidly grounded neutral	
9	Installation		Indoor installation	
10	Type of socket		To be mentioned	
11	Number of element	Nos	3 (three)	
12	Number of terminals	Nos	At least 10 (ten)	
13	Current range	A	1 to 10, user programmable	
14	Starting Current	A	0.1% of nominal	
15	Continuous Thermal current rating	A	1.5*In or higher	
16	Short time thermal rating	A	10*In or higher for 1sec	
17	Voltage range	V AC	50 to 82.5 (P-N) or higher range, Burden-10MΩ	
18	Overload voltage	V AC	1.2*Vn, continuous	
19	Meter constant	Imp/	Shall be mentioned	
20	Multiplication factor		The following shall be inscribed on the meter. Display reading X CT ratio X PT ratio = Actual reading in KWh	
21	Visual indication of operation		Pulse indicator on the front of meter as per meter constant.	
22	Burden			
	22.1 Current Circuit	VA/phase	< 0.1 @ 1A, < 0.5 @ 5A	
	22.2 Voltage Circuit (with auxiliary power)	VA/phase	< 0.1	
	22.3 Voltage Circuit (with self power)	VA/phase	< 6VA	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
23	Auxiliary supply range		Dual Power Supply: i. 80V to 240V AC/DC or higher range ii. Self Power with VT voltage (80V to 130V AC)	
24	Operating frequency		50Hz ($\pm 5\%$)	
25	Measuring mode		True 4 quadrant	
26	Accuracy class		0.2 for kWh, 0.5 for kVARh	
27	Losses at nominal load		To be mentioned	
28	Remote communication		Standard metering protocol, MODBUS; Communication facility to Network Control Center should be available	
29	Communication port		- The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard. - Following communication ports have to be available: - Optical 1107 Port (front mounted): supporting DLMS protocol - RS485: supporting MODBUS protocol - RS232: Optional - Ethernet: Optional	
30	Software requirement		- Should be able to configure and monitor with user-friendly PC-based tool. - Necessary software for configuration and parameterization has to be supplied free of cost and without any time-bound license - The parameterization software must run on Windows operating environment. - The software must be protected by software keys to control duplication and installation. - The software should have a customizable printing feature by task list. - The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angle); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days. - Tamper feature: The meter must have Errors & Warnings codes, History log and Event log(minimum 400events) to record date & time of all power outages, demand resets, time	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
			change. The Meter should be able to display the phasor diagram.	
31	Meter sealing condition		Hermetically or Ultrasonic welded	
32	Display options		Built-in HMI LCD display, configurable display, including meter ID, power quadrant display	
33	Integration period		30 (thirty) minutes	
	Resetting period		1 (one) month	
	Cumulative MD transfer		Built-in	
	Cycle Timing device		Built-in	
34	Normal display list		- Complete LCD test, Present date, Present time - Current billing total kWh-Del, Current billing total kWh-Rec - Current billing total kVARh-(Q1+Q4), Current billing total kVARh-(Q2+Q3) - Current billing maximum kW-Del, Current billing maximum kW- Del Date, Current billing maximum kW-Del Time, Current billing cumulative kW-Del - Current billing maximum kW-Rec, Current billing maximum kW-Rec Date, Current billing maximum kW-Rec Time, Current billing cumulative kW-Rec - Phase A voltage, Phase B voltage, Phase C voltage - Phase A current, Phase B current, Phase C current - Phase A voltage angle, Phase B voltage angle, Phase C voltage angle - Phase A current angle, Phase B current angle, Phase C current angle - System PF-arithmetic, Line frequency	
35	Alternate mode display list		- Complete LCD test, Present date, Present time - Current billing total kWh-Del, Current billing total kWh-Rec - Current billing total kVARh-(Q1+Q4), Current billing total kVARh-(Q2+Q3) - System PF-arithmetic, Line frequency	
36	Data storage		The meter shall have sufficient capacity (minimum 400 KB) to store the following readings and data in non-volatile memory even in case of power failure. - Equipment identification codes, security codes and access codes. - Number of power interruption with date & time (minimum 100 events). - Latest power failure time & date - Date & time of meter tempering. (Voltage &	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
			Current missing, demand reset, time change). • Event logs • Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4) • Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence. The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 90 (ninety) days. • Load Profile data [kWh, KVarh (Q1+Q4) • Phase voltage • Phase amps	
37	Data logging and event recording		Should be available	
38	In built clock		Should be available	
39	Provision of GPS synchronization		Should be available	
40	Additional Features		i. Power Quality Measurement (At least 1 GB of memory, 192 channels of LDP, 24kHz waveform, 600 VSSI summary events, Wave View, Flicker, Power Harmonics and Interharmonics, Total Harmonic Distortion) ii. Necessary software for accessing the mentioned features should be provided without any time-bound license.	
41	Construction		The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal.	
42	Terminal		Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.	
43	Environment requirement			
	43.1 Ingress protection		IP54 or better	
	43.2 Operating temperature		-10 ⁰ C to +60 ⁰ C	

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
	43.3 Storage temperature		-40 ^o C to +80 ^o C	
	43.4 Humidity range		0% to 95%, non-condensing	
44	Weight of the meter		To be mentioned	
45	Dimension of the meter		To be mentioned	
46	Outline, drawing and leaflets		To be provided	
47	Performance curves for balanced and unbalanced load		To be mentioned	
48	Year of manufacture		To be mentioned	
49	Minimum Battery Service life and shelf life	Years	10 (ten) & 15 (fifteen) respectively	
50	Meter service life	Years	15 (fifteen)	
51	Reference standard		Relevant ANSI/IEC standard	
52	Warranty	Days	540	
53	Type test certificate		Should be provided	

1.1.1.12

1.1.2

1.1.2.1 Overall Fault Clearance Times

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	230 kV Busbar Faults:			
	Main protection relay operating time	ms	Insert	
	Auxiliary and tripping relay time (where used)	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	
2	132 kV Busbar Faults:			
	Main protection relay operating time	ms	Insert	
	Auxiliary and tripping relay time (where used)	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	
3	230/135/34.5 kV Transformer Faults:			
	Main protection relay operating time	ms	Insert	
	Auxiliary and tripping relay time	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	
4	132/34.5 kV Transformer Faults:			
	Main protection relay operating time	ms	Insert	
	Auxiliary and tripping relay time	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	
5	230 kV Line Faults:			
	Distance protection maximum	ms	Insert	

	operating time			
	Permissive scheme time delay	ms	Insert	
	Auxiliary relay time (where used)	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	
6	132 kV Line Faults:			
	Distance protection maximum operating time	ms	Insert	
	Permissive scheme time delay	ms	Insert	
	Auxiliary relay time (where used)	ms	Insert	
	Circuit breaker time	ms	Insert	
	Total	ms	Insert	

1.1.2.2 Multi-Phase Auto reclose

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1.	Manufacturer's name and address		Insert	
2.	Country of origin		Insert	
3.	Type		Insert	
4.	Model No.		Insert	
5.	Standard		Insert	
6.	Single phase auto reclose		Insert	
7.	Three phase auto reclose		Insert	
8.	Multi-phase auto reclose		Insert	
9.	Main -1 Protection		Insert	
10.	Main -2 Protection		Insert	

1.1.2.3 Front Panel Annunciation for OHL & Power Transformers (Optional)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Front Panel annunciation for OHL & TR			
1.1	Panel mounting		Yes	
1.2	Number of inputs		Min. 16	
1.3	Contact type		NO/NC	
1.4	Galvanic isolation		Yes	
1.5	Self-monitoring via front indication via relay contact		Yes	
1.6	Response delay time		Adjustable	
1.7	Bright LED technology		Yes	
1.8	Audible device output		Yes	
1.9	Lamp test button		Yes	
1.10	Acknowledgement button		Yes	
1.11	Horn acknowledgement button		Yes	
	Overall compliance with the requirements (yes/no)			

The front panel annunciation must be parameterised, configured and delivered as per Engineer's requirements.

1.1.2.4 Front Panel Annunciation for Control Room (Optional)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Front Panel annunciation for Control Room			
1.1	Panel mounting		Yes	
1.2	Number of inputs		Min. 48	
1.3	Contact type		NO/NC	
1.4	Galvanic isolation		Yes	
1.5	Self-monitoring via front indication via relay contact		Yes	
1.6	Response delay time		Adjustable	
1.7	Bright LED technology		Yes	
1.8	Audible device output		Yes	
1.9	Lamp test button		Yes	
1.10	Acknowledgement button		Yes	
1.11	Horn acknowledgement button		Yes	
	Overall compliance with the requirements (yes/no)			

The front panel annunciation must be parameterised, configured and delivered as per Engineer's requirements.

1.1.2.5 SCADA Server

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14261	SCADA Server			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Industrial 19" rack	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	GB	≥ 16	
2.6	Video display adapter type		Insert	
2.7	Video display adapter memory		Insert	
2.8	Hard disc type		SSD	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	Insert	
2.11	Number of hard discs	pcs.	Insert	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Serial interface RS232		Yes	
2.15	Number of serial interfaces		Min. 2	
2.16	Fast Ethernet network interface card type		Insert	
2.17	Number of fast Ethernet network interface cards	pcs.	4	
2.18	Fans	Yes/No	Insert	
2.19	Monitor (min 24")	pcs.	2	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		LED (IPS)	
2.19.4	Standards		IEC	
2.19.5	Supply voltage			
2.19.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.19.5.2	Power consumption	W	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

1.1.2.6 SCADA servers must be in hot-standby redundant configuration.

Substation Automation System

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	General			
1.1	Standards			
	Test Cab: Damp heat, steady state Test Db: Damp heat, cycle (12h + 12h cycle) Digital I/O, Analogue I/O dielectric Tests Digital I/O, Surge withstand test Radio interference test Transient fast burst test Static Discharge Electromagnetic fields		IEC 60068-2-78 IEC 60068-2-30 IEC 60255-27 IEC 61000-4-5 IEC 60870-3/Class 2 IEC 61000-4-4 IEC 61000-4-2 IEC 61000-4-3	
1.2	Number of years of proven field experience of offered system. (Note: proof of experience should be furnished. The components used in the offered system and those with field experience should be the same)	Year	5	
1.3	Design life of substation Automation System	Year	15	
1.4	Manufacturers quality assurance system		ISO 9001/9002 or equivalent	
1.5	Dimensions of cubicle Width Depth Height Floor load	mm mm mm N/m2	Insert Insert Insert Max 600	
1.6	Temperature range (min/max)	oC	0/50	
1.7	Relative humidity	%	93	
1.8	Intelligent Electronic Devices (IED's)			
	-serial communication interface included?	Yes/No	Yes	
	-Protection & Control IED's connected same bus?	Yes/No	Yes	
	- self monitoring	Yes/No	Yes	
	- display of measured values	Yes/No	Yes	
	-remote parameterization	Yes/No	Yes	
	-disturbance record upload and analysis	Yes/No	Yes	
1.9	Availability Calculation shall be furnished for each equipment as well as for the entire system.	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.10	The main part of the system, HMI, Gateway, IED shall be furnished with dual communication port against any failure.	Yes/No	Yes	
1.11	SNTP server shall provide GPS time-sync information to all communication (HMI, Gateway, IED) and the system shall be synchronized.	Hz	Yes	
1.12	Ethernet switch shall have dual system topology not to lose entire system with single switching system failure.	V	Yes	
2.	Station Level Equipment:			
2.1	Station Controller		Industrial PC	
2.2	MTBF (Mean time between Failures)	Hours	50000	
2.3	Station computer shall have dual connection to Ethernet switch as redundant (hot, standby)	Yes/No	Yes	
2.4	Hot standby take over time	Seconds	Yes	
2.5	Dual Wide Monitor each HMI (over 25")	Yes/No	Yes	
2.6	Single wide screen	Yes/No	Yes	
2.7	Number of years of proven field experience of offered software	years	5	
2.8	Operating System		Windows	
2.9	i) All standard picture as per spec included in HMI ii) Process Status Display & Command Procedures iii) Event processing as per spec iv) Alarm processing as per spec v) Reports as per spec vi) Trend Display as per spec vii) Graphical fault information receiving function viii) Disturbance & Fault recording and analysis with graphical format ix) User Authority levels as per spec x) System supervision & monitoring as per spec xi) Automatic sequence control as per spec	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3	Gateway to National Load dispatch Center			
3.2	Number of years of proven filed experience of offered unit Insulation tests Fast disturbance tests Industrial environment Industrial grade hardware with no moving parts (PC based gateway is not accepted) Design life of offered equipment Redundant communication channel Redundant CPU Redundant DC/DC Supply	%	5Yrs IEC 60255-27 IEC 61000-4-4, Calss 4 EN61000-6-4 Yes 15 Yrs Yes Yes Yes 50000Hrs Yes	
3.	Station Bus:			
3.1	Physical Medium		Glass fibre optic	
3.2	Each communication devices shall have dual connection, hot and standby.	Yes/No	Yes	
4.	Inter-bay Bus: Physical Medium		Glass fibre optic	
5	Printer server: MTBF	Hours	200000	
6	Hard Copy colour Printer: MTBF	Hours	180000	
7	Master Clock – GPS (Global Positioning System) Receiver: MTBF	Hours	150000	
8	Bay control Unit - HV			
8.1	Number of years of proven field experience of offered unit		5	
8.2	Separate Bay controller unit provided for each bay & feeder	Yes/No	Yes	
8.3	Type of bay controller offered HV/MV		HV	
8.4	Select Before Operate with Open Execute & Close	Yes/No	Yes	
8.5	Single bit dependence	Yes/No	Yes	
8.6	Interlocking, bay & Station wide	Yes/No	Yes	
8.7	Synchro check function Maximum Voltage difference Maximum Frequency difference Maximum Phase difference	Specify Range	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.8	Double command blocking	Yes/No	Yes	
8.9	Independent settable parameter groups	No	4	
8.10	Local Display Unit	Yes/No	Yes	
8.11	Sequence of event recorder Events Time resolution	Nos msec	256 1	
8.12	Disturbance recording file transfer function	Yes/No	Yes	
8.13	Comtrade file generation function of Disturbance Recorder	Yes/No	Yes	
8.14	IED shall have dual connection to Ethernet switch (hot & standby)	Yes/No	Yes	
8.15	Comprehensive self-supervision	Yes/No	Yes	
8.16	Battery free backup of events and disturbance records	Yes/No	Yes	
8.17	Insulation tests	Standard	IEC 60255-27	
8.18	Fast disturbance tests	Standard	IEC 61000-4-4, Class 4	
8.19	Temperature range: IED's Operation Transport and storage	oC oC	-10 to +50 -10 to +50	
8.20	Relative humidity: Operating max./min Transport and storage	% %	93 93	
9	Back up control mimic –HV (400kV)			
9.1	Control functionality: Control of breaker as well as all isolators/earthing switch (Control functionality should not be affected if bay controller fails)	Yes/No	Yes	
9.2	Key-Locked	Yes/No	Yes	
9.3	Interlock override function	Yes/No	Yes	
9.4	Separate backup control mimic provided for each bay & feeder	Yes/No	Yes	
10	Bay control Unit - MV			
10.1	Number of years of proven field experience of offered unit		5	
10.2	Separate Bay controller unit provided for each bay & feeder	Yes/No	Yes	
10.3	Type of bay controller offered HV/MV		HV	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.4	Select Before Operate with Open Execute & Close	Yes/No	Yes	
10.5	Single bit dependence	Yes/No	Yes	
10.6	Interlocking, bay & Station wide	Yes/No	Yes	
10.7	Synchro check function Maximum Voltage difference Maximum Frequency difference Maximum Phase difference	Specify Range	Insert	
10.8	Double command blocking	Yes/No	Yes	
10.9	Independent settable parameter groups	No	4	
10.10	Local Display Unit	Yes/No	Yes	
10.11	Sequence of event recorder Events Time resolution	Nos msec	256 1	
10.12	Disturbance recording file transfer function	Yes/No	Yes	
10.13	Comtrade file generation function of Disturbance Recorder	Yes/No	Yes	
10.14	IED shall have dual connection to Ethernet switch (hot & standby)	Yes/No	Yes	
10.15	Comprehensive self-supervision	Yes/No	Yes	
10.16	Battery free backup of events and disturbance records	Yes/No	Yes	
10.17	Insulation tests	Standard	IEC 60255-27	
10.18	Fast disturbance tests	Standard	IEC 61000-4-4, Class 4	
10.19	Temperature range: IED's Operation Transport and storage	oC oC	-10 to +50 -10 to +50	
10.20	Relative humidity: Operating max./min Transport and storage	% %	93 93	
11	Back up control mimic –HV (400kV)			
11.1	Control functionality: Control of breaker as well as all isolators/earthing switch (Control functionality should not be affected if bay controller fails)	Yes/No	Yes	
11.2	Key-Locked	Yes/No	Yes	
11.3	Interlock override function	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
11.4	Separate backup control mimic provided for each bay & feeder	Yes/No	Yes	
12	Bay control Unit - LV			
12.1	Number of years of proven field experience of offered unit		5	
12.2	Separate Bay controller unit provided for each bay & feeder	Yes/No	Yes	
12.3	Type of bay controller offered HV/MV		HV	
12.4	Select Before Operate with Open Execute & Close	Yes/No	Yes	
12.5	Single bit dependence	Yes/No	Yes	
12.6	Interlocking, bay & Station wide	Yes/No	Yes	
12.7	Synchro check function Maximum Voltage difference Maximum Frequency difference Maximum Phase difference	Specify Range	Insert	
12.8	Double command blocking	Yes/No	Yes	
12.9	Independent settable parameter groups	No	4	
12.10	Local Display Unit	Yes/No	Yes	
12.11	Sequence of event recorder Events Time resolution	Nos msec	256 1	
12.12	Disturbance recording file transfer function	Yes/No	Yes	
12.13	Comtrade file generation function of Disturbance Recorder	Yes/No	Yes	
12.14	IED shall have dual connection to Ethernet switch (hot & standby)	Yes/No	Yes	
12.15	Comprehensive self-supervision	Yes/No	Yes	
12.16	Battery free backup of events and disturbance records	Yes/No	Yes	
12.17	Insulation tests	Standard	IEC 60255-27	
12.18	Fast disturbance tests	Standard	IEC 61000-4-4, Class 4	
12.19	Temperature range: IED's Operation Transport and storage	oC oC	-10 to +50 -10 to +50	
12.20	Relative humidity: Operating max./min Transport and storage	% %	93 93	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
13	Back up control mimic –HV (400kV)		DELETED	
14	System Performance:			
14.1	Exchange of display (First reaction)	second	< 1	
14.2	Presentation of a binary change in the process display	second	< 0.5	
14.3	Presentation of an analogue change in the process display	second	< 1	
14.4	From order to process output	second	< 0.5	
14.5	From order to updated of display	second	< 1.5	

1.1.2.7 Operator Workstation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Operator Workstation			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Insert	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	GB	≥ 16	
2.6	Video display adapter type		Dual head capability	
2.7	Video display adapter memory	MB	Insert	
2.8	Hard disc type		SSD	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	Insert	
2.11	Number of hard discs	pcs.	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Sound card type		Insert	
2.15	Fast Ethernet network interface card type		Insert	
2.16	Number of fast Ethernet network interface cards	pcs.	4	
2.17	Fans	Yes/No	Insert	
2.18	Monitor (min 24")	pcs.	2	
2.18.1	Manufacturer		Insert	
2.18.2	Country of origin		Insert	
2.18.3	Type		LED (IPS)	
2.18.4	Standards		IEC	
2.18.5	Supply voltage			
2.18.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.18.5.2	Power consumption	W	Insert	
2.19	Visible diagonal	"	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

1.1.2.8 Printer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14263	Printer			
1.1	Manufacturer		Insert	
1.2	Model		Insert	
1.3	Country of origin		Insert	
1.4	Standards		IEC / ISO	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	

2.2	Type		Colour laser	
2.3	Format		A4	
2.4	Resolution	dpi	Insert	
2.5	Memory	MB	Insert	
2.6	Parallel port	Yes/No	Insert	
2.7	Fast Ethernet port		Yes	
2.8	USB port	Yes/No	Insert	
2.9	Minimum speed	Page/min	Insert	
	Overall compliance with the requirements (yes/no)			

1.1.2.9 Engineering PC

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Monitoring Workstation			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Insert	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Processor type		Latest generation i7	
2.3	Processor clock	GHz	≥ 3.5	
2.4	Memory type		Insert	
2.5	Memory capacity	GB	≥ 16	
2.6	Video display adapter type		Insert	
2.7	Video display adapter memory	MB	Insert	
2.8	Hard disc type		SSD	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	≥ 512	
2.11	Number of hard discs	pcs.	Insert	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Sound card type		Insert	
2.15	Serial interface RS232		Yes	
2.16	Fast Ethernet network interface card type		Insert	
2.17	Number of fast Ethernet network interface cards	pcs.	1	
2.18	Fans	Yes/No	Insert	
2.19	Monitor (min 24")	pcs.	1	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		LED (IPS)	
2.19.4	Standards		IEC	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.19.5	Supply voltage			
2.19.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.19.5.2	Power consumption	W	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

1.1.2.10 Time Synchronization Device

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14271	Time Synchronization Device			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Rack mounting case		Insert	
2.3	Synch. Pulse output, 1 min	Yes/No	Insert	
2.4	Fast Ethernet port / FO		Yes	
2.5	Serial port		Yes	
2.6	Protocol		NTP	
	Overall compliance with the requirements (yes/no)			

1.1.2.11 Weather Station (Optional)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Weather Station			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	Characteristics			
2.1	Hygro-thermo transmitter with weather thermal radiation shield			
2.1.1	Input	°C	–40..+60	
2.1.1.1	Output	mA	4-20	
2.1.1.2	Accuracy		1/3 Class B (±0.3 K)	
2.1.2	Input	% rel. h	0..100	
2.1.2.1	Output	mA	4-20	
2.1.2.2	Accuracy	% rel. h	±3	
2.2	Wind transmitter	Yes/No		
2.2.1	Input	m/s		
2.2.2	Output	mA		
2.2.3	Accuracy	%		
2.3	Wind direction transmitter	Yes/No		
2.3.1	Input	°		
2.3.2	Output	mA		
2.3.3	Accuracy	°		
2.4	Baro transmitter	Yes/No		
2.4.1	Input	mbar		
2.4.2	Output	mA		
2.5	Interface unit		Yes	
2.6	Overvoltage protection		Yes	
2.7	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

1.1.2.12 Ethernet Switch Process LAN

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14273	Ethernet Switch-Process LAN			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Ethernet ports			
2.2.1	Number of ports		Min. 6xRJ45 or Min. 6xFO for IED connections AND 2xFO (1 GB) for process LAN	
2.2.1	Type of ports		RJ45 or FO and Fibre Optical (1 GB)	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..50°C	
2.4.2	Storage		–20..+70°C	
2.5	Switching method an layer		Store & Forward Layer 3 (IEC 61850), RSTP (802.1w); eRSTPTM or RSTP (802.1D-2004) network fault recovery	
2.6	Switching latency		≤ 5µs	
2.7	Switching bandwidth		≤ 1.6 Gbps	
2.8	Failsafe output relay		Potential-free	
2.9	Cyber security features			
2.9.1	Multi-level passwords		Yes	
2.9.2	SSH/SSL encryption		Yes	
2.9.3	Enable/disable ports, MAC based port security		Yes	
2.9.4	Port based network access control		Yes	
2.10	System features			
2.10.1	Automatic learning negotiation and crossover detection			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.10.2	Port configuration, status, statistics, mirroring, security			
2.10.3	Network fault recovery		≤ 5 ms	
2.11	Type Test Reports		To be included with bid	
2.12	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

Technical characteristics of optical ports of process LAN Ethernet switches must comply with appropriate characteristics of fibre optic cables for protection and control (see Code No. 14296).

1.1.2.13 Ethernet Switch Control Room

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14274	Ethernet Switch-Control Room			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Ethernet ports			
2.2.1	Number of ports		Min. 16	
2.2.1	Type of ports		RJ45	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..50°C	
2.4.2	Storage		−20..+70°C	
2.5	Switching method an layer		Store & Forward Layer 3 (IEC 61850), RSTP (802.1w); eRSTPTM or RSTP (802.1D-2004) network fault recovery	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.6	Switching latency		≤ 5μs	
2.7	Switching bandwidth		≤ 1.6 Gbps	
2.8	Failsafe output relay		Potential-free	
2.9	Cyber security features			
2.9.1	Multi-level passwords		Yes	
2.9.2	SSH/SSL encryption		Yes	
2.9.3	Enable/disable ports, MAC based port security		Yes	
2.9.4	Port based network access control		Yes	
2.10	System features			
2.10.1	Automatic learning negotiation and crossover detection			
2.10.2	Port configuration, status, statistics, mirroring, security			
2.10.3	Network fault recovery		≤ 5 ms	
2.11	Type Test Reports		To be included with bid	
2.12	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

1.1.2.14 Protection Monitoring Software

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14281	Protection Monitoring Software			
1.1	Protection Monitoring Software			
1.1.1	Communication with protection terminals		Yes	
1.1.2	Protection terminal configuration		Yes	
1.1.3	Protection terminal parameter setting		Yes	
1.1.4	Disturbance data collecting		Yes	
1.1.5	Disturbance data analysing		Yes	
1.1.6	Other software:		Insert	
	Overall compliance with the requirements (yes/no)			

1.1.2.15 SCADA Software

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14282	SCADA Software			
1.1	Basic SCADA server software			
1.1	Basic SCADA server software	pcs.	2	
1.1.1	Communication with 2 higher level control centres		Yes	
1.1.2	Real-time database management		Yes	
1.1.3	Data processing		Yes	
1.1.4	Data acquisition		Yes	
1.1.5	Alarm and event processing		Yes	
1.1.6	Data archiving		Yes	
1.1.7	Report generation and printing		Yes	
1.1.8	Redundancy management		Yes	
1.2	Operator workstation software	pcs.	2	
1.3	Communication software	pcs.	2	
1.3.1	Communication with 2 higher level control centres		Yes	
1.4	Application libraries	pcs.	1, optional	
1.5	Software tools	pcs.	1	
1.5.1	Database creating, maintaining and viewing		Yes	
1.5.2	User interface definition		Yes	
1.5.3	Report definition		Yes	
1.5.4	System configuration		Yes	
1.5.5	Historical data maintaining		Yes	
1.5.6	Database and historical data export/import		Yes	
1.5.7	Analysis and diagnostic tools		Yes	
1.5.8	Training simulator		Yes	
1.5.9	Other software tools according to Contractor's concept:		Insert	
	Overall compliance with the requirements (yes/no)			

Fibre Optic Cables & Terminal Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Fibre Optic Cables & Terminal Equipment			
1.1	Sufficient quantity of adequate glass fibre optic cables for overall Protection & Control & Monitoring & Metering system should be foreseen and included in the bid.		Yes	
1.2	Below proposed quantities shall be verified according to specific Bidder's design.		Yes	
1.3	Final quantities must be estimated and delivered as per Single Line Diagram and Substation layouts.		Yes	
1.4	At least 20% spare in cable length, as well as in number of fibres in cable, should be foreseen.		Yes	
1.5	Fibre optic ducted cables shall be foreseen.		Yes	
1.6	Type of fibre optic		Multimode	
1.7	Number of fibres in cable		Min. 4	
1.8	Operational Wave length		Insert	
1.9	Attenuation factor maximum		Insert	
1.10	Band-width minimum		Insert	
1.11	Manufacturer		Insert	
2	Characteristics			
2.1	Fibre optic terminations. Overall quantities of specific fibre optic terminations should be closely related to number of fibres in each cable (each fibre, used or spare, should be properly terminated). At least 20% spare terminations for each proposed type should be foreseen.		Yes	
2.1.1	Plug connectors type		Insert	
2.1.2	Connection technology		Insert	
2.1.3	Plug pin type		Insert	
2.1.4	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	Optical distributor with connectors Overall quantity of Optical Distributor with Connectors should be closely related to number of relay houses. Optical Distributor with Connectors should be foreseen for both cable ends. At least 10% spare Optical Distributors with Connectors should be foreseen.		Yes	
2.2.1	Fibre optic cable gland		To accept metal-free optical cable	
2.2.3	Patch-cord connection		Yes	
2.2.4	Type of optical connectors		Insert	
2.2.5	Manufacturer		Insert	
2.3	Patch-cord with optical connectors Overall quantity of fibre optic patch-cord cables should be closely related to number of protection and control devices (terminals) in each particular relay house. At least 20% spare patch-cord cables should be foreseen.		Yes	
	Overall compliance with the requirements (yes/no)			

The quantities and specifications of the optical distributor with connectors and patch-cord with optical connectors predicted according to the optical ring configuration for control and according to the configuration of busbar protection.

The technical characteristics of fibre optic cables for protection and control have influence on optical ports characteristics of process LAN Ethernet switches.

1.1.2.16 Special Control Equipment and Tools

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Special Control Equipment and Tools			
1.1	Special Control Equipment and Tools			
1.1.1	Special equipment and tools for setting, repairing, handling and maintaining of control system	set	1	
1.1.2	Software needed for configuration, setting, commissioning, testing, communication, interfacing with substation system	set	1	
1.1.3	Laptop brand-name computer	pcs.	2	
1.1.4	Test plugs, including all necessary accessories (transport case, cables, plugs, etc.)	set	2	
	Overall compliance with the requirements (yes/no)			

1.1.2.17 Automatic Voltage Regulation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14008	Automatic Voltage Regulation			
1.1	Manufacturer		MR Germany or ABB Sweden make.	
1.2	Country of origi		Germany / Sweden.	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: Without resetting Restart time	ms s	> 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		1	
2.2.2	Rated current for 110 kV	A	1	
2.2.3	Permissive overload, continuous		3xI _r	
2.2.4	Permissive overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissive overload, continuous	% U _r	150	
2.3.4	Permissive overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	VA	< 0.3	
2.4	Voltage control function			
2.4.1	Set voltage range	% U _{r2}	Insert	
2.4.2	Set voltage dead-band range	% U _{r2}	Insert	
2.4.3	Upper limit busbar voltage range	% U _{r2}	Insert	
2.4.4	Lower limit busbar voltage range	% U _{r2}	Insert	
2.4.5	Line voltage drop compensation	Yes/No	Insert	
2.4.6	Regulation for capacitive load	Yes/No	Insert	
2.4.7	Undervoltage blocking range	% U _{r2}	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4.8	Overcurrent blocking range	% Ir	Insert	
2.4.9	Parallel operation		Yes	
2.4.10	Parallel operation principal		Insert	
2.5	Communication ports		Yes	
2.5.1	Port for front-connected PC			
2.5.1.1	Protocols supported		Insert	
2.5.1.2	Communication speed	Kbit/s	Insert	
2.5.1.3	PC side connector type		Insert	
2.5.2	System interface			
2.5.2.1	Number of rear ports		Min. 1	
2.5.2.2	Protocols supported		IEC 61850	
2.5.2.3	Communication speed	Mbit/s	Min. 100	
2.5.2.4	Connector type		RJ45 or FO	
2.5.3	External time synchronisation		Insert	
2.6	Tap changer, tap position		BCD code	
2.7	Self-supervision		Yes	
3	Additional requirements			
3.1	Test socket		Yes	
3.2	Setting and configuration of Automatic Voltage Regulator approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

1.1.2.18 Test Socket

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Test socket			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type Line main 1 and 2 Line back-up and bus coupler Transformer main 1 and 2 Bay unit BBF Distance protection		Insert	
1.4	Standards		IEC	
1.5	Each protection device must have its own test socket		Yes	
1.6	Test socket must obtain safe online protection testing and maintaining, and performing whole tripping test with following AR		Yes	
1.7	Test socket should have enough contacts to: Short-circuit current inputs from CT's Isolate voltage inputs from VT's Isolate trip circuit for each phase separately Isolate CB close command Isolate signalling voltage Inhibit breaker failure initialising Inhibit sending of communication signal Allow functional testing of protection		Yes	
1.8	Socket should be designed for 4 mm banana plugs access		Yes	
	Overall compliance with the requirements (yes/no)			

1.1.3 Digital Fault and Disturbance Recorder (DFDR)

SL	ITEM	UNITS	PGCB'S REQUIREMENT	Guaranteed
(A)	GENERAL			
1.	Manufacture's name and address		To be mentioned	
2.	Type		To be mentioned	
3.	Power supply	VDC	110	
4.	-Power supply for printer	VAC	240	
(B)	ANALOGUE INPUTS			
1.	Number of channel Expandability		As per required number of signals for particular feeders As required for future feeders	
2.	Nominal current	Amp	1A/5A	
3.	Nominal voltage	Vac/Vdc		
	-Current	mA/Amp		
4.	Frequency response			
5.	Cut –off frequency			
	Bandwidth	dB	Insert	
	Attenuation at	dB	Insert	
	(C) Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	Yes	
	(d) Simultaneously programmable sampling rate for all feeders/inputs -Locally Changeable - Remotely Changeable	Yes/No Yes/No	3 distinct programmable Sampling rates and generate 3 simultaneously distinct records Yes Yes	
	(e) Possible sampling rates	Samples/sec Samples/sec Samples/sec	3 different sampling rates: Slow. 1Hz-500Hz Fast: 0.5kHz-6kHz Continuous (variable rate)	
6.	DC coupled inputs	Yes/No	Yes, all Analog inputs should be capable of connecting AC or DC inputs as per site requirement without changing any hardware .	

SL	ITEM	UNITS	PGCB'S REQUIREMENT	Guaranteed
7.	Resolution	bits	16 bits	
8.	Accuracy	%	Min 0.5	
9.	Burden			
	1.Current Circuit at IN	VA	Insert	
	2.Voltage Circuit	VA	Insert	
10.	Over load			
	1.Current	% In	100% In continuously, Min 600% in for 1sec	
	2.Voltage Circuit	% Vn	2Vn and max. 350Vn	
(C)	DIGITAL INPUTS			
1.	Number of channel -Expandability(without and time skew)		As per required number of signals for particular feeders As required for future feeders	
2.	Selectable input level	Vdc	N/O or N/C. 24,48,110 and 220 VDC	
3.	Type		Potential or potential free contract	
4.	Resolution	ms		
(D)	MEMORY			
1.	Size	MB	64 MB or Higher	
2.	Type		SolidState	
3.	Pre-fault time (fast scanning rate)	sec	0.1-2 user	
4.	Post-fault (fast scanning rate)	sec	programmable 0.1-2 user	
5.	Pre and Post fault time (slow scanning rate)	sec	min. 180 user	
6.	In-Build Flash disk (auto-maintained)	GB	min. 4 GB	
(E)	SENSORS/ TRIGGERING CRITERIA			
	All sensors/triggers are preferable Programmable and Virtually recordable	Yes/No	Yes	
1.	Logical combination sensor	Yes/No	Yes	
2.	Three phase over or under Voltage/ Current	Yes/No	Yes	
3.	Mono phase over or under Voltage/ Current	Yes/No	Yes	
4.	*du/dt,dp/dt,dq/dt, [Single/3 Phases], df/dt, etc.	Yes/No	Yes	
5.	RMS [Voltage/Current]	Yes/No	Yes	

SL	ITEM	UNITS	PGCB'S REQUIREMENT	Guaranteed
6.	Zero Sequence	Yes/No	Yes	
7.	Negative, Positive Sequence	Yes/No	Yes	
8.	Frequency	Yes/No	Yes	
9.	DC Step	Yes/No	Yes	
10.	Pending/Swing	Yes/No	Yes	
11.	Digital level and edge	Yes/No	Yes	
12.	Sensor Trigger	Yes/No	Yes	
13.	Event Trigger	Yes/No	Yes	
14.	Manual Trigger	Yes/No	Yes	
15.	Remote Trigger	Yes/No	Yes	
(F)	CLOCK SYSTEM			
1.	Internal Clock	Yes/No	Yes	
2.	Accuracy			
3.	External Synchronization	Yes/No	Yes	
4.	Time resolution between 2 synchronized pulse			
(G)	OUTPUT ALARM RELAY CONTACT			
1.	Max. operation Voltage DC/AC	Vac/Vdc	250 Vac or above, 60 Vdc or above	
2.	Make and carry for 0.5 sec	A	Min. 8A	
3.	Carry continuously	A	Min. 5A	
4.	Break (DC)-resistive	W		
(H)	INTERFACE FOR DATA COMMUNICATION			
1.	Full definition compression	Yes/No	Yes	
2.	Maximum transmission rat	Bits/Sec		
3.	Standard serial port (EIA-232-D)	Yes/No	Yes	
4.	Printer Port	Yes/No	Yes	
5.	Dedicated serial port for modem	Yes/No	Yes	
(I)	PRINTER DATA			
1.	Printer amplitude (scaling peak to peak)			
2.	Time Scale (mm/s)			
3.	Printer resolution	mm		
4.	Auto printing	Yes/No	Yes	
(J)	Fault Priority transmission	Yes/No	Yes	
(K)	Fault location (distance calculation)	Yes/No	Yes	
(L)	Test certificate from internationally recognized Laboratories	Yes/No	Yes	

SL	ITEM	UNITS	PGCB'S REQUIREMENT	Guaranteed
(M)	COMMUNICATION AND REMOTE ANALYZING UNIT			
1.	Processor Pentium	(MHz), Yes/No	Yes, at least 450MHz Pentium	
2.	Co-Processor Pentium	Yes/No	Yes	
3.	Main memory capacity	(Mb), Yes/No	Yes, at least 64Mb	
4.	Color graphics board S-VGA	Yes/No	Yes	
5.	Screen S-VGA	Yes/No	Yes	
6.	Hard disk unit	Yes/No	Yes, at least 40GB	
7.	Printer	Yes/No	Yes	
8.	Modem	Yes/No	Yes	

1.1.4 Telecommunication Equipment

Fibre Optic Multiplexer Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.0	GENERAL:			
1.1	Type of multiplexer		SDH: ADM & PDH	
1.2	Complying to ITU-T rec.		Yes	
1.3	Transmission Capacity	Mbit/s	STM-4 & STM-16	
1.4	Access capacity on 64 kbit/s	channels	Minimum 200	
1.5	Access capacity on 2 Mbit/s	channels	Minimum 40	
1.6	Redundant central processor		Shall be available	
1.7	Digital cross connect function		Fully non-blocking	
2.0	Available AGGREGATES:			
2.1	Optical aggregates (ITU-T G.957)		As per field requirement	
3.0	Available TRUNK INTERFACES:			
3.1	HDB3, 2 Mbit/s interfaces per module	Nos.	Minimum 8	
3.2	Complying to ITU-T rec.		G.703, transparent G.704, selectable	
3.3	HDLSL, 2Mbit/s interface: no of copper wires Capacity on 2Mbit/s or on 1Mbit/s Capacity selectable	Nos. ch ch / pair of wire	4 or 2 30 or 15 30 / 2 pairs 30 / 1 pair 15 / 1 pair	
4.0	Available USER INTERFACES			
4.1	Voice interfaces for trunk lines:			
4.1.1	1 + 1 com path protection, available for all		yes	
4.1.2	Analogue, 4wire with E&M: Input level level Output	dBr	+7.5 .. -16 +7.0 .. -16.5	
4.1.3	Analogue, 2wire with E&M: Input level level Output	dBr	+6.5 .. -12.5 -1.0 .. -20	
4.1.4	Digital, 2Mbit/s CAS or PRI		Yes	
4.2	Voice interfaces for remote subscriber:			
4.2.1	2wire, subscriber side	dBr	-5 .. +4 / -7.5 .. -1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.2.2	2wire, PABX side	dBr	-5 .. +4 / -7.5 .. -3	
4.3	Integrated teleprotection			
4.3.1	Interface for Commands:			
4.3.1.1	Number of independent commands	Nos.	4	
4.3.1.2	Transmission time max.	ms	6	
4.3.1.3	Signal voltage	Vpeak	250	
4.3.1.4	1 + 1 com path protection		yes	
4.3.2	Interface(s) for Differential Protection:			
4.3.2.1	Electrical interface: G.703	kbit/s	64	
4.3.2.2	Optical Interface	kbit/s	Minimum 64	
4.4	Data: channels per module			
4.4.1	1 + 1 com path protection, available for all		yes	
4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	Nos.	4	
4.4.3	V.11/X.24 (RS-422): 64kbit/s	Nos.	4	
4.4.4	V.35: 64kbit/s	Nos.	4	
4.4.5	V.36 (RS-449): 64kbit/s	Nos.	2	
4.4.6	G.703: 64kbit/s	Nos.	8	
4.4.7	Ethernet: 10/100 BaseT WAN capacity Protocols	Nos. Mbit/s	1 Min: 2x 2Mbit/s Min.: IP	
4.5	Integrated alarm gathering module:			
4.5.1	Number of external alarms per module	Nos.	Min. 20	
4.5.2	Auxiliary power supply for ext. contacts		Yes	
4.6	Network Management System			
4.6.1	Type/Name of configuration tool			
4.6.2	For fault / configuration management		Yes / yes	
4.6.3	For local / remote operation		Yes / yes	
4.6.4	Data communication network (DCN)		Ethernet / IP or Ethernet / OSI	
4.7	Ambient Conditions:			
4.7.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-25 .. + 55 / class 1.2	
4.7.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-25 .. + 70 / class 2.2	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.7.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 .. +45 / class 3.1E	
4.8	Power Supply			
4.8.1	Operation	VDC	48 / 60 (-15/+20%)	
4.8.2	Fully redundant power supply		yes	

Power Line Carrier Equipment (Not Applicable)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1	Wave Trap		Not Applicable	
1.2	HF Coupling Unit			
1.	Manufacturer/model		Insert	
2.	Type		Insert	
3.	Working temperature range	°C	Insert	
4.	Available bandwidth		Insert	
5.	Tuning range		Insert	
6.	Composite loss over tuning range		Insert	
7.	Line side impedance range for phase/phase coupling		Insert	
8.	Equipment side impedance		Insert	
9.	Drain coil current carrying continuous for 1 second for 3 seconds	A	Insert	
10.	Isolation transformer voltage withstand for 1 minute	V	Insert	
11.	Main arrester voltage	V	Insert	
12.	Earth switch interlock with door		Insert	
13.	Compatibility with IEC Recommendation 481		Insert	
1.3	High Frequency Cable			
1.	Manufacturer		Insert	
2.	Type		Insert	
3.	Coaxial or quad		Insert	
4.	Surge impedance		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.	Voltage withstand: between conductors between cores and armouring	V	Insert Insert	
	Attenuation per km: at 50 kHz at 400 kHz		Insert	
1.4	Digital PLC Terminal			
1.	Manufacturer/model		Insert	
2.	Type		Insert	
3.	Compliance with relevant parts of IEC62488-1		Insert	
4.	DC voltage working range		Insert	
5.	Service conditions (temperature and RH)		Insert	
6.	Power consumption		Insert	
7.	Design life		Insert	
8.	Carrier frequency range		Insert	
9.	Gross bandwidth		Insert	
10.	Teleprotection equipment mounted within the PLC units		Insert	
11.	Technical description of the equipment		Insert	
12.	Type of coupling (phase/phase or inter circuit)		Insert	
13.	Return loss within the carrier frequency band		Insert	
14.	Transmission rate of the digital signal		Insert	
15.	Output impedance		Insert	
16.	Dynamic range of receiver for digital signal		Insert	
17.	Means of RF frequency selection		Insert	
18.	Frequency spacing for parallel connections between two digital PLCs between a digital and an analogue PLC		Insert	
19.	Output power (before hybrid at coaxial cable)		Insert	
20.	Channel terminal power at output to coupling equipment		Insert	
21.	Type of digital modulation available/proposed		Insert	
22.	Calculations to justify operation of the PLC over the transmission lines		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
23.	Any limitations in paralleling of terminals (to digital or analogue PLCs)		Insert	
24.	Required minimum SNR for minimum BER		Insert	
25.	Switching off of parallel PLCs, not to cause interference with working PLCs		Insert	
26.	Spurious emissions		Insert	
1.5	Digital PLC Terminal (Terminal)			
27.	Maximum transmitting level for parasitic signals: 0-4 kHz from the band limits 4-8 kHz from the band limits >8 kHz from the band limits		Insert	
28.	Voltage withstand		Insert	
29.	Capacity options available for various services equipped within the digital bit stream		Insert	
30.	Capacity allocation proposed for this project		Insert	
31.	Speech channel 2W/4W interface		Insert	
32.	Speech channel impedance/levels		Insert	
33.	"Long line" telephone facility		Insert	
34.	Speech channel interfaces available (E&M etc.)		Insert	
35.	Service telephone		Insert	
36.	Type of speech codec		Insert	
37.	Compatibility with analogue speech bands		Insert	
38.	Method of telephone signalling		Insert	
39.	Frequency response of speech channel (Ref 800 Hz)		Insert	
40.	Data channel interface		Insert	
41.	Synchronous/asynchronous data channel availability		Insert	
42.	Data signalling transmission rates which can be accommodated		Insert	
43.	FSK Interface		Insert	
44.	VFT signal levels (2W and 4W)		Insert	
45.	Frequency response of VFT channel (Ref 3 kHz)		Insert	
46.	Test facilities		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
47.	Alarm facilities		Insert	
48.	Equipment technical description		Insert	
49.	Terminal MTBF	Hours	Insert	
50.	Single or duplicated PSU		Insert	
1.6	Teleprotection Equipment			
1.	Manufacturer/model		Insert	
2.	Type		Insert	
3.	DC voltage working range		Insert	
4.	Service conditions (temperature and RH)		Insert	
5.	Power consumption		Insert	
6.	Configured for analogue or digital communications media		Insert	
7.	Design life		Insert	
8.	Suitable for direct, permissive, blocking signalling		Insert	
9.	Single/duplication of teleprotection signals		Insert	
10.	VFT channel allocation and bandwidth		Insert	
11.	Frequency or coded signalling		Insert	
12.	Use of guard channel		Insert	
13.	Signal transmission time		Insert	
14.	Modem programmability		Insert	
15.	Means of monitoring communications channel		Insert	
16.	Transmission of "trip/send" signal at increased level		Insert	
17.	No. of signals per terminal		Insert	
18.	Facility to hold on output signal		Insert	
19.	Trip extension facility/time		Insert	
20.	Minimum/maximum input pulse and corresponding output		Insert	
21.	No. of receive output contracts		Insert	
22.	Provision of counters		Insert	
23.	Voltage withstand		Insert	
24.	Transmitter level output range		Insert	
25.	Receiver sensitivity range		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
26.	Receiver alarm level or BER referred to nominal		Insert	
27.	Minimum alarm contact closure time		Insert	
28.	No. of alarm contacts		Insert	
29.	19"/ETSI rack mounting practice		Insert	
30.	Information to be submitted with the Tender (a) Technical description (b) MTBF calculations (c) Performance graphs/details		Insert	
1.7	PAX Telephone Equipment and Subscriber Equipment			
(a)	Exchange equipment			
1.	Type reference		Insert	
2.	Manufacturer		Insert	
3.	Dimensions of cubicle		Insert	
4.	Rack width		Insert	
5.	Literature reference for typical layout of cubicle		Insert	
6.	Operating temperature range		Insert	
7.	Operating relative humidity		Insert	
8.	Power requirements		Insert	
9.	Mean time between failures		Insert	
10.	Maximum number of local extensions		Insert	
11.	Maximum number of remote extensions		Insert	
12.	Maximum number of trunk lines		Insert	
13.	Maximum number of connecting circuits		Insert	
14.	Method of signalling Local extensions 2W Remote extensions 4W Trunk lines 4W		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.	Frequency of audible tones Dial tone Hz Busy tone Hz Ringing tone Hz Ringing current Hz		Insert	
16.	Ring voltage		Insert	
17.	Type of processor		Insert	
18.	Type of memory		Insert	
(b)	Subscriber telephone			
1.	Type reference		Insert	
2.	Manufacturer		Insert	
3.	Type of dial (rotary/pushbutton)		Insert	
4.	Operating voltage		Insert	
5.	Outdoor bell		Insert	
6.	Type reference		Insert	
7.	Manufacturer		Insert	
8.	Operating voltage		Insert	

GTP 33kV XLPE Power Cable

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
2	Manufacturer		Insert	
3	Origin		Insert	
4	Type		Insert	
5	Rated system voltage	kV	33	
5.1	phase	kV	Insert	
5.2	line to line	kV	Insert	
6	Max. permissible system voltage	kV	36	
7	Rated frequency	Hz	50	
8	Max. operating current	A	Insert (Calculation is required)	
9	Nominal cross-sectional area	mm ²	800 mm2 Cu 95 mm2 Cu (Calculation is required)	
10	Impulse withstand voltage	kV	170	
11	Power frequency withstand voltage	kV	70	
12	Shape of conductor		Insert	
13	Nominal cross section of Cu-screen	mm ²	Insert	
14	Thickness of outer sheath	mm	Insert	
15	Insulation thickness	mm	8-9	
16	Material of conductor screen		Insert	
17	Material of insulation screen		Insert	
18	Material of metallic screen		Insert	
19	Material of Outer sheath		Insert	
20	Min. bending radius	D	Insert	
21	Max. pulling force		Insert	
22	Max. DC resistance at 20°C	ohm/km	0.0366	
23	Max. AC resistance at 20°C	ohm/km	Insert	
24	Max. inductance in single configure	mH/km	Insert	
25	Operating capacitance	μF/km	Insert	
26	Charging current (phase)		Insert	
27	Charging load (phase)		Insert	
28	Earth fault current	kA	Insert	
29	Short circuit rating for 3 sec	kA	40 (Calculation is required)	
30	Current rating			
30.1	in soil	A	Insert	
30.2	in air	A	Insert	
31	standard		Insert	

Transmission Line

Schedule E: Technical Particulars and Guarantees

General

The technical data schedules hereafter provide more details on the specific technical criteria and complement the Information given in the bidding document.

They form an essential part of bid submission and will be used in bid evaluation.

They should be fully completed and submitted with the bid.

Technical Data Schedules

The technical data schedules hereafter provide more details on the specific technical criteria and complement the Information given in the bidding documents.

They form an essential part of bid submission and will be used in bid evaluation.

They should be fully completed and submitted with the bid.

Towers

1.1.1 Towers (No need to fill if tower design is provided by the Employer)

Fill out 1 form for each manufacturer

Parameters	Unit	Tower Type										
		2DL	2D1	2D25	2DT6	2D9	2QL	2Q1	2Q30	2QT6	2DR	2DAX
Total height of tower (standard)	(mm)											
Vertical spacing between conductor- earthwire	(mm)											
Horizontal phase separation	(mm)											
Vertical phase separation	(mm)											
Total approx. mass of standard height tower without stub & cleat*	(kg)											
Total approx. mass of E1.5 tower*	(kg)											
Total approx. mass of E3.0 tower**	(kg)											
Total approx. mass of E4.5 tower**	(kg)											
Total approx. mass of E6.0 tower**	(kg)											
Total approx. mass of E9.0 tower**	(kg)											
Total approx. mass of E12.0 tower**	(kg)											
Total approx. mass of E15.0 Tower**	(kg)											
Total approx. mass of stub & cleat*	(kg)											
Approximate ultimate compression load/leg (E9.0 & E15)*	(kN)											
Approximate ultimate uplift load/leg (E9.0 & E15)*	(kN)											

*The final figures will be obtained during detailed design of towers and the approval thereof after award of contract, and the towers shall be supplied accordingly within the contract price.

1.2 Piled Foundation Details

1.2.1 230kV Towers

Tower Type Particulars	2DL (Highest extension)	2D1 (Highest extension)	2D25 (Highest extension)	2DT6 (Highest extension)	2D9 (Highest extension)	2QL (Highest Extension)	2Q1 (Highest Extension)	2Q30 (Highest Extension)	2QT6 (Highest Extension)	2DR (Highest Extension)	2DAX (Highest Extension)
Type of piled foundation											
Number of piles per leg*											
Length of pile* (mm)											
Diameter of pile* (mm)											

* The final figures will be obtained during detailed design of tower foundations and the approval thereof after award of contract, and the foundations shall be supplied accordingly within the contract price.

2.3 Conductor, Earthwire & OPGW

2.3.1 230 kV Line –(ACSR Mallard)

Fill out 1 form for each manufacturer

Conductor	Phase		Earthwire	
	As per Bid requirement	As per Bid Proposal	As per Bid requirement	As per Bid Proposal
Designation (Code Name)				
Type				
Reference standards				
Aluminium/ Aluminium alloy grade				
Steel grade				
Galvanising Thickness				
Aluminium class (AS wire)				
Aluminium type (AS wire)				
Conductor max. continuous operating temperature (°C)				
Minimum mass of grease (kg/km)				
Creep period of conductor to be considered (years)				
No. and diameter of aluminium wire (No./mm)				
No. and diameter of steel wire (No./mm)				
Overall diameter of conductor (mm)				
Overall sectional area of conductor (mm ²)				
Rated tensile strength of conductor (kN)				
Weight (kg/km)				
Direction of external lay				
Cross Sectional Area of Al (mm ²)				
Cross Sectional Area of Composite Core (mm ²)				
No. of Composite Core (mm)				
Shape of wires				
Diameter of Composite Core (mm)				
Rated tensile strength of core (kN)				
Current carrying capacity at 180 Deg C (amp)				
Max. allowable emergency operating temp. (Deg C)				
Maximum DC Resistance at 20 Deg C (ohm/km)				

Name & Signature of
Manufacturer's Representative:

Stamp of Manufacturer

2.4 OPGW & Fittings

2.4.1 230kV Line

Fill out 1 form for each manufacturer

Parameter	Unit	Overland Portion		River Crossing Portion	
		As per Bid requirement	As per Bid Proposal	As per Bid requirement	As per Bid Proposal
OPGW designation & type					
Number of fibres					
Reference standard					
Number and diameter of aluminium strands	mm				
Number and diameter of steel strands	mm				
Corrosion protection of steel strands					
Internal fibre tube diameter	mm				
Overall diameter	mm				
Guaranteed ultimate tensile strength	kN				
Final modulus of elasticity	N/mm ²				
Coefficient of linear expansion	1/degree				
DC resistance at 20°C	ohms/m				
Maximum short circuit current capacity	kA ² sec				
Assumed temperature rise	°C				
Standard weight	kg/m				
Weight of grease	kg/m				
Standard length on drum*	m				
Weight of complete drum	kg				
Maximum drum length	m				
Installation minimum bending radius	m				
Optical Characteristics:					
Cut-off wave length	nm				
Attenuation at Nm	dB/km				
Zero dispersion wave length	nm				
Chromatic dispersion at nm	ps/km				
Individual splice loss	dB				
Bit error rate					
OPGW Fittings:					
Guaranteed ultimate tensile strength	kN				
• Suspension set	kN				

Parameter	Unit	Overland Portion		River Crossing Portion	
		As per Bid requirement	As per Bid Proposal	As per Bid requirement	As per Bid Proposal
• Tension set					
Overall length of set					
• Suspension set	mm				
• Tension set	mm				
Mass of set					
• Suspension set	kg				
• Tension set	kg				
Drawing numbers					
Cross section of OPGW					
Cross section of non-metallic cable					
Joint box					
Fixing clamps					
OPGW suspension set					
OPGW tension set					
OPGW vibration damper					

* Drum length to be finalized after finalization of tower locations as per check survey.

Name & Signature of
Manufacturer's Representative:

Stamp of Manufacturer

2.5 Insulator Sets & Fittings

2.5.1 230kV Line

Fill out 1 form for each manufacturer

Parameter	Unit	As per Bid requirement				As per Bid Proposal			
		Insulator Set Type							
		Suspension/ Heavy Suspension	Tension	Low Duty Tension	Jumper Suspension	Suspension/ Heavy Suspension	Tension	Low Duty Tension	Jumper Suspension
Insulator unit type no.									
Dielectric material									
Total creepage per unit	mm								
Spacing	mm								
Overall shed diameter	mm								
Puncture voltage	kV								
Electro-mechanical failing load of unit	kN								
Drawing no. of unit									
Type test certificate no.									
Number of units per string	pcs.								
Total creepage of string	mm								
Overall length of set	mm								
Sag adjuster type and step	mm								
Ultimate strength of set	kN								
Mass of set	kg								
Anticipated									
• lightning impulse withstand voltage	kV								
• Power frequency withstand voltage	kV								
• Corona extinction level	kV								

Name & Signature of
Manufacturer's
Representative:

Stamp of
Manufacturer

2.6 Spacers and Spacer Dampers

Fill out 1 form for each manufacturer

230kV Line:

Parameter	Unit	As per Bid requirement	As per Bid Proposal	As per Bid requirement	As per Bid Proposal
		Overland		River Crossing	
Unit weight	kg				
Material	-				
Number of spacer dampers to be used for each phase per span*	pcs.				
Total quantity of spacer dampers for one basic span*	pcs.				

- * These quantities shall be based on the design of the proposed spacer dampers. The quantities mentioned above may increase at the contractor's cost, if during design approval such increase is necessary.

Name & Signature of
Manufacturer`s Representative:

Stamp of Manufacturer

2.7 Vibration Dampers

Fill out 1 form for each manufacturer

230kV Line:

Parameter	Unit	As per Bid requirement	As per Bid Proposal	As per Bid requirement	As per Bid Proposal
		Overland		River Crossing	
Unit weight of vibration dampers • for phase conductor • for earthwire • for OPGW	kg kg kg				
Number of vibration dampers to be used for phase conductor per standard span	pcs.				
Number of vibration dampers to be used for earthwire per standard span	pcs.				
Number of vibration dampers to be used for OPGW per standard span	pcs.				

These quantities shall be based on the design of the proposed vibration dampers. Actual number of vibration damper will be decided according to the Manufacturer's recommendation for each span.

Name & Signature of
Manufacturer's
Representative:

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area
(Package-2)**

SCHEDULE F

PROPOSED SUBCONTRACTORS

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area (Package-2)

SCHEDULE F

PROPOSED SUBCONTRACTORS

The bidder shall propose a list of the Sub-contractors in the following table as per Section-3, Evaluation and Qualification Criteria, Volume 1 of 3 of the Bidding Document.

Sl. No.	Name and Address of the Subcontractor

Signature -----
Date -----

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Construction of 230kV Transmission Line and Substation at Araihasar JEZ area
(Package-2)**

SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

**Construction of 230kV Transmission Line and Substation at Araihaazar JEZ area
(Package-2)**

SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

Coefficient Scope of Index	Country of Origin; Currency of Index	Source of Index; Title/Definition	Value on Stated Dates	
			Value	Date
For Transformer: a=0.15 b=0.22 c=0.25 d=0.15 e=0.03 f=0.2				