Procurement of Plant

Design, Supply, and Installation

Single-Stage: Two-Envelope Tender Procedure

TENDER DOCUMENT
for
Procurement
of

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

Issued on: July 25, 2022

Invitation for Tenders No.:27.21.0000.101.07.416.22.4342,

Contract Ref. No.:PGCB/AIIB/000308-BGD/SS/Package-1
Employer:Power Grid Company of Bangladesh Limited (PGCB)

Country:Bangladesh

Volume 3 of 3

N.B. The term **Tender/Tenderer** and **Bid/Bidder**shall have same meaning.

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT
FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

(PGCB/AIIB/000308-BGD/SS/Package-1)

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POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

(PGCB/AIIB/000308-BGD/SS/Package-1)

Overall & brief description of Scope of Work

OVERALL DESCRIPTION OF THE WORKS

1.1 Description of Overall Project

The Government of Peoples Republic of Bangladesh has prioritized the power sector development and has taken massive initiatives to build a country wide power network (transmission & distribution). As per our Power System Master Plan (PSMP, 2016), a transmission system capable of supplying 40000 MW electricity throughout the country is necessary by 2030. With the aim of realizing Government's vision, Power Grid Company of Bangladesh Ltd. (PGCB) has undertaken numerous projects to strengthen the National Grid in order to meet the proliferating demand of electricity of the country.

At present, Government of Bangladesh have been constructing many EPZ & Hi-Tech parks all around the country, where reliable electricity transmission is extremely required. Moreover, in order for effective evacuation of power from Power Plants & transmission of that power throughout the country with appropriate quality; PGCB is strengthening the National Transmission Grid by constructing substations & transmission lines.

This project about the power evacuation & transmission infrastructure development consisting of 01 no. of 230/132/33kV Indoor GIS substation at Anwara to evacuate power from 300MW United Power Plant and connecting to Grid through Sikalbaha, New Mooring substations. Here power shall be stepped-down to 132kV & 33kV voltage level by step-down transformers to serve the 132kV grid & utility respectively.

Two nos. of 132kV circuits shall be connected from Anwara 230/132/33kV to Cox'sbazar (N) 132/33kV Indoor GIS substation. Moreover, Dohazari-Cox'sbazar 132kV double circuit line shall be Line-In-Line-Out (LILO) connected here.

Teknaf 132/33kV Indoor GIS substation shall be built and fed from Cox'sbazar (N) 132/33kV substation by 132kV double circuit line.

For providing reliable power to Bangbandhu Hi-Tech city at Kaliakoir, 230/33kV Indoor GIS substation shall be constructed here and fed from Kaliakoir 400/230/132kV AIS substation by 230kV double circuit line. 230kVbay extension at Kaliakoir 400/230/132kV substation is also within scope of this project.

For reliable transmission system, PGCB makes implementation of Frequency Control and Frequency drop protection, power system protection, emergency control system and other associated task for qualitative upgradation of Bangladesh power system.

1.2 Description of this Package

The scope of works under this turnkey contract is: design, supply, manufacture, quality assurance, inspection and testing, delivery, new packing for export, insurance, shipment & transport to the site, complete construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning, defect liability for all equipment, including all civil works for constructing of new 230kV, 132kV Indoor GIS substation and extension of existing 230kV bays.

All necessary works have to including in the contract price, including all kinds of dismantling works, if any.

The civil design has to incorporate countermeasures against flooding so as not to affect any substation equipment during the wet season. Given the recorded past maximum flood water level in the project area, sufficient ground level height for land formation is required at the Contractor's responsibility.

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

The geotechnical studies and soil investigations are in the Contractor's scope of work.

The Civil Design and backfilling have to consider and incorporate protection measures against flooding. The sufficient ground level height for land formation is required at the Contractor's responsibility and will be subject of the Employer's approval. Finishing Ground Level (FGL) shall be at least 500 mm above the Highest Flooding Level (HFL). The Bidders has to inform themselves about the HFL.

Generally, **land development** of **new substation** shall be made for the **total substation area** and **boundary wall** shall be made for the **total substation area.**
Generally, **land development** of the **substation** which has to be **extended/renovated** shall be made only for the **required substation area** and **extension** of the **boundary wall** shall be made only if it is required.

The Contractor's responsibility is to provide that all parts of the works be completed in every respect for commercial operation, to the requirements of the Engineer.

The drawings provided in the bidding documents are indicative only and hence do not reflect the entire scope of works. The Bidder has to consider all Tender drawings as preliminary and for Tender purpose only. The drawings may be changed at the time of execution. All dimensions are preliminary and general. Not all equipment is shown on the drawings. Details are not shown at all. The Contractor has to make Engineering and to provide detail calculation, detail design and detail drawings of the complete facilities, which will be subject of the Employer's approval.

The Bidder is be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment. All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price

The other ends of Transmission Lines have to be covered from the tele-communication point of view under the scope of this contract. All equipment and services have to be provided
All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price.
The bid price shall include supply and delivery of mandatory spare parts, maintenance tools and test equipment.

The works under this turnkey contract include the following:

- Construction of 230/33kV Indoor GIS (with future provision of 132kV) at Bangabandhu Hi-Tech city at Kaliakoir and Extension of 02 (two) nos. 230kV Bays at existing 400/230/132kV Kaliakoir Substation
- Construction of 230/132/33kV Indoor GIS (with future provision of 400kV) at Anwara
- Construction of 132/33kV Indoor GIS (with future provision of 230kV) at Cox'xbazar (N)
- Construction of 132/33kV Indoor GIS at Teknaf

Detail scope of work is described in schedule-A.

1.3 Detailed Description of the Scope of Supply for Tele-communication System

The communication part of the project shall provide the interconnection between all substations involved in the Project:

The purpose of the telecommunication system is to provide all the necessary telecommunication channels for the following sub-systems:

- SCADA for data exchange between the substations and the National Load Despatch Centre (NLDC) by two communication technologies i.e. LAN & WAN
- Tele-protection to enable the communication between line differential protection relays and between distance protection relays,
- Telephone to enable telephone communication between the substations and NLDC,
- Metering: Data transfer between meters and the entity in charge of collecting and processing metering data,
- Any other telecommunication channels.

Digital PLC System shall be provided for each 420 kV Transmission Line. The characteristics shall be defined during the Design stage and there will be subject of the Employer's approval.

1.3.1 Recommendation of Communication system

Telecom equipment (Optical Transmission and ADD/DROP MUX)
- STM-16/64 / 10G or 100G / DWDM
  - MPLS (Layer-3)
- ADD/DROP Multiplexer (PDH)

Services:
- LAN Service (IP Phone, RTU/SAS, Office LAN etc)
- WAN Services (RTU, CC camera, DFDR, etc)
- E1/TDM/TributaryServices (PABX, etc)

NMS:
- End-to-End Trail management
- Protection management (I+I MPS, MSSP RING, SNCP, SNCPM)
- Clock management
- DCN Channel management

Existing equipment and facilities in PGCB Telecommunication Network
- STM-1/4
  - FOX-515/615
  - MSE-5010 (OSN-1500B)
  - MSE-5001 (Metro)
- ADD/DROP Multiplexer (PDH)
  - DXC-5000
  - FOX-515/615

Services:
- LAN Service (IP Phone, RTU/SAS etc)
- WAN Services (RTU, CC camera, DFDR, etc)
- TDM/Tributary Services (PABX, etc)

NMS :
- FOXMAN-UN/U-2000
  - End-to-End Trail management
  - Protection management (I+I MPS, MSSP RING, SNCP, SNCPM)
  - Clock management
  - DCN Channel management
  - License of all communication equipment for NMS Integration

1.3.2 Architecture of the Overall Telecommunication System

- Two (2) new SDH & PDH multiplexers (and with two (2) optical boosters only if it is required) and one (1) 48 cores Optical Distribution Frames (ODF).
- Two (2) digital PLC and two (2) Line Matching Units (LMU).

The length of the communication links is indicated in the provided drawing:

- **Map of Bangladesh Tele-communication system:**

A scheme of the overall telecommunication system is attached at following drawings:

- **SDH Telecommunication System and**
- **Digital PLC System**

1.3.3 Scope of Work and Supply

The scope of work and supply of the telecommunication system:

- One (1) optical fibre cable from the gantry for each of 400kV, 230 kV and/or 132 kV OHL to the substation communication room, including 48 cores and non-metallic (underground) but with the same optical characteristics with the OPGW (compliant to ITU-T-G 655 recommendation), shall be provided, for each of 400kV, 230 kV and/or 132 kV OHL at every involved Substation

- One (1) Optical Distribution Frames (ODF), of 48 cores capacity each, shall be provided, for each of 400kV, 230 kV and/or 132 kV OHL at every involved Substation. ODF shall be installed in the telecommunication / control room to facilitate the termination of fibres, testing and isolating of both the optical fibre cable and fibre optic terminal equipment.

- Two (2) Optical SDH / PDH multiplexers, shall be provided, for each involved Substation, including:
  - Duplicate CPU
  - Duplicate power supply
  - One optical STM-16 ports for each 400 kV transmission line
  - One optical STM-4/16 ports for each 230 kV transmission line
  - One optical STM-4/16 ports for each 132 kV transmission line
  - Two MPLS (at least 10 G) ports for each transmission line
  - One 16x2 Mbps (E1) drop card
  - One 8x2 Mbps (E1) elect. Card
  - One card with four ports 10/100 Base T LAN
  - One card with four ports 10/100 Base T Router
  - One card with 10x2-w voice for FXS
  - Required no. of cards with 4x4 commands for distance protection after detail design

- The optical SDH / PDH multiplexer shall be preferably of ABB FOX 515/FOX 615 type and GE(make: France& India) to ensure fully integration with existing FOX 515/FOX 615.

- Depending of the length of each 400 kV, 230 kV and/or 132 kV one or two optical boosters may be required.

- One (01) digital PLC with Ethernet facilities and two LMU (phase-to-earth coupling) shall be provided, for each of 400kV at every involved Substation, together with the coaxial cable for connecting PLCs to LMUs.

1.3.4 Engineering Services

General

The engineering services shall be provided by the Contractor to the necessary extent and detail of a turnkey project. They shall include drawings, instructions and all other technical documents required to allow the Contractor to build, erect, commission, operate and maintain the telecommunication system, even if these are not specifically mentioned in these Technical Requirements.

Design Services
The Contractor shall design in detail the general layout of the telecommunication system, based on the preliminary design and modifications agreed. This general layout shall be submitted to the Employer / Employer's Representative for approval and comments. It shall also include all detailed structural drawings, detailed descriptions and reports required to permit an exact understanding of the solution adopted.
Once the general layout is approved, the Contractor shall include following as a minimum requirement:

- design of all works required for the implementation and extension of the telecommunication system, general layouts of the telecommunication system, engineering of telecommunication system, all necessary calculations.

These engineering services shall also include:

- design reports,
- complete drawings of all system,
- integration in the existing telecommunication system.

1.4 Detailed Description of the Scope of Supply for SCADA, Control & Monitoring System

1.4.1 Overall Scope of Work and Supply

The SCADA facility shall be based on:

- The communication with the NLDC Master and Backup Station shall be via the supplied Gateway for remote monitoring and control of the substation.
- Industrial Gateway shall be implemented at each involved substation for remote monitoring & control from the NLDC. It shall provide all the necessary control and monitoring facilities for 400kV level, 230kV level, 132kV level, 33kV level and auxiliaries.
- At existing substation with RTU, monitoring and control shall be provided through existing RTU. Contractor shall supply & install of necessary equipment such as sub-rack, IED/relay, transducers, DI, DO card etc. for integrating new bays through existing RTU.
- At existing substation with SAS facility, Contractor shall supply & install required no's of BCU for Bay Extension with BCU panel. All required configuration of BCU, SAS servers and Gateway is the under the scope of the contractor.
- For new substation, contractor shall supply, install and configure 02 (two) numbers of Industrial Gateway independent of SAS servers and will be configured as hot-standby mode. The hot gateway shall report to both Master station at Aftabnagar, Rampura (through VLAN network) & Backup station at Siddhirganj (through routed network) simultaneously. It shall be configured according to the signal list, station address, IP address, communication parameter etc. provided by PGCB. The Gateway shall have adequate capacity (minimum 25% additional spare point with license) to meet to the future extensions of substation.
- To ensure cyber security, contractor shall supply, install and configure hardware firewall.
- In case of windows operating system based gateway there should be USB port, VGA port, LAN ports, RAM, HDD/SSD with one spare parts, TFT monitor with mouse and key board etc. Hard disk should be 50% free and CPU loading maximum of 30% at normal condition. If gateway is firmware based then 02(two) nos. of control card is required. Gateways also have minimum 06 (six) nos LAN port & redundant power supply. There should be GPS facilities for time synchronization. In addition, cyber security has to be ensured at field level with firewall. Supported Protocol shall be IEC 60870-5-104, 61850 & Modbus etc.

- All necessary configuration, modification and adaptation work of the existing SCADA platform at both stations of NLDC to integrate the new substations and the new bays at far-end substation(s) shall be under the scope of the contractor.

- For 132kV, 230kV& 400kV Level, all feeders and for 33kV level, all incomer feeder and minimum 05 (five) number of outgoing feeders shall be remotely controlled via SCADA from NLDC at each substation. All necessary equipment, including required numbers of BCU and panels shall be provided under the scope of the project.

  A scheme/*Architecture* of the substation automation system is attached.

1.4.2 Adaptation and Configuration of the NLDC

Integrating Gateway with NLDC, the following work shall be done at Master Station and Standby Master Station.
Scope of work includes following:
Pre Database Work
a) Collection of network data for EMS application
b) Modelling, database creation, verification and update should be done at both NLDC
c) Modification and update of database for far end substation related to the Sub Station
d) The following work should be done at Master station and Backup station:

1. SCADA Database Modelling
2. Substation Display
3. Network database Modelling
4. DTS Database Modelling
5. Alarm database Modelling
6. Validation
   - Cross validation of all databases and create update copy of those databases.
   - On-lining of databases in DTS (Simulator) server
   - Checking and modifying (if require) topology of Substations, Devices, Network etc.
7. Gateway configuration
   Configuring the Gateway according to requirements/ signals, mapping address, data communication Parameters, Source IP, Destination IP etc.
8. Local Test
   The following test will be carried out at site using e-terracontrol software
   • Verification of all Analog Measurement and checking of Limit, Deadband, Polling Time
   • Verification of Digital signals status (OPEN, CLOSE, BETWEEN, INVALID)
   • Verification of ALARMS, EVENTS etc.
   • Verification of Control and Interlock
9. Database Update

The following activities will be carried out in Master NLDC and Backup NLDC after successful site test.
• On-lining of all databases in Running Servers
• IP/VLAN Configuration on Polling servers and switch
• Compilation & On-lining of all the displays on WEB servers

10. Tuning of Power System Application

• Tuning will be done for all available Network applications in SCADA/EMS server DTS (Dispatcher Training Simulator).

11. End to End Test

The following activities will be carried out in NLDC Master Station and Standby Master Station
• Verification of all Analog Measurement,

• Verification of Digital signals and Controls
• Verification of displays including Single line, Pop up, alarms etc.
• Verification of communication line for Redundancy
• Verification of continuous and complete reporting of the Gateway to NLDC.

Notes:
• Data communication path creation for both NLDC Master Station and Standby master Station is scope of Integration
• Collection of Network parameter value required for modelling network database is in Contractor's
scope of work
• Contractor will conduct necessary work for both at NLDC & Substation (if required)

Requirements / Signals

• Indications: Digital Input (Double Point)
The following indications shall be provided
– Circuit Breaker, Isolator & Earth Switch Open/ Close for line, transformer, bus coupler
– Circuit Breaker for Reactor/Capacitor bank & 33kv Loadshed feeder
• Load Flows, System Voltage and frequency
Electrical quantities shall be provided to enable the following measurements
– Voltage (kV), Frequency (Hz) for Busbar
– Megawatt (MW), MegaVar (MVAR), Amperes (AMP), Voltage (kV) for Line
– MW, MVAR, Amperes, kV at both sides, Tap Position Indication (TPI) for Transformer
– Megara for Reactor/Capacitor bank
• Alarms: Digital Input (Single Point):
– Remote/ Local Switch for all Circuit Breakers.
– Bay Fault (DC Fail for Transformer Panel).
– Breaker Fault (OR gate Spring Charge, SF6 Low).
– Protection Class-1 (Distance, Differential).
– Protection Class-2 (Over current, Earth fault).
– Protection Class-3 (bus bar).
– Transformer Alarm (Buchholz Alarm, Oil Level Low).
– Transformer Trip (Buchholz Trip, PRD Trip)
– Transformer Temperature Alarm (Oil Temp Alarm, Winding Temperature).
– Transformer Temperature Trip (Oil Temp trip, Winding Temperature trip).
– Tap Changer Alarm.
– Tap changer trip.
– Tap changer high limit.
– Tap changer low limit.
– Auto recloses operated
– DC fail
– AC fail
• Controls-Digital Output (Double point)
The following facilities shall be controlled from the NLDC
– Circuit Breaker and Motorized Isolator Open/ Close for Line, Transformer bay & bus coupler,
– Circuit Breaker Open/ Close for 33kV load shed feeder
– Tap Changer Raise/ Lower for Transformer
• Network modelling parameters
Line length, line conductor type, short circuit data for zero sequence (%R, %X, % of full charging susceptance) etc.

The SCADA system of the National Load Despatch Centre is based on ALSTOM platform. The communication protocol to be used for data exchange between the NLDC and the substations shall be IEC 60870-5-104 for the data transmission from substation.

Adaptation work and configuration of the NLDC will mainly consist of:
• Modelling the new substations and new bays.

• Database update of NLDC (ABB Network Manager Platform).
• Configuration of ABB Network Manager Platform to display the single line diagrams, statuses,
alarms, measurements of the new substations and new bays.
• Database creation / modification & update at respective SCADA/EMS servers at all master station.
• Creation of associate display and modification of existing displays wherever required.
• Point to point test.

1.4.3 General Principle and Description of SCMS

The substation control and monitoring system shall have distributed client/server architecture. It shall consist of:
• The BCU equipment, which will be installed at the bay level,
• The substation level equipment, to be installed in the control room,
• A redundant communication network between station level and bay level for data exchange to limit the number of cables and ensure extension of the system. The exchange of information between distributed single bay unit and central substation control level shall be performed through redundant fibre optic wires. The communication network shall be based on the following architecture:
– One optical double-ring LAN with protection and BCU,
– One UPT CAT 5 redundant LAN at substation level.

The station level equipment will be power supplied from the two independent AC sources:
• One from the AC station auxiliaries 230 V AC 50 Hz,
• The second one from a UPS,
• An automatic change over shall prevent supply interruption.

In the event of loss of supply or disconnection for any reason, the system shall reboot automatically (without loss of stored information) and will update statuses of all devices when the power supply recovers. The updating process shall not inhibit control functions.

The substation control level must support future expansion of substation control system, having a 25% of resources as minimum.

At bay level, all control functions, data acquisition interlocking functions shall be done in the bay control devices within the bay level equipment. Each feeder shall be equipped with an individual bay control device.

For the data acquisition of substation auxiliaries, information (LV/MV switchgear, station battery, charger, UPS etc.,) a local RTU (or BCPU) shall be provided and installed in the control building. The bay control devices shall be connected to the station level via a redundant optical fibre communication link.

The bay level equipment shall comprise at least the following elements:
• Bay control unit (BCU). Bay computer shall be separate unit (not incorporated in the protection
unit).
• Input / output modules for digital and analogue signals,
• Communication with protection equipment and analogue signals,
• Redundant optical fibre communication with substation level or ring bus communication,
• Backup mimic panel for maintenance control and measurements. One two position switch shall be
provided on control panel:
– Local: Only local control is enabled, the interlocking function is on bay level only, no synchronization,
– Remote: Only remote control is enabled.
– In both cases, all the data must be transmitted to the higher level (NLDC),

• Communication port for operation / maintenance from a laptop computer.

Bay control units shall be supplied from 110 V DC.
In the event of loss of supply or disconnection for any reason, the system shall reboot automatically (without loss of stored information) and will update statuses of all devices when the power supply recovers. The updating process shall not inhibit control functions. There should not be any loss of data due to the loss of auxiliary supply.
It shall be taken into consideration that additional bay control units can be added to the system, without disturbance of the system, for future expansion. A provision of 20% in bay units' expansion is required, as well as a provision of 10% in I/O signals, within each bay.
Control and supervision of the system will be possible from different levels:
• NLDC,
• Substation control level from the operator workstation,
• Bay control level.

On all levels, a correct interlocking will be ensured which provides the highest safety for staff and equipment. On the substation control level, the interlocking is managed by the microprocessor-based system, on the bay level it is performed by hard wiring.
The substation control system shall follow the specifications of IEC family 61850, 60870-5-101/104, 60870-5-102 and 60870-5-103. It is an obligatory requirement that the same Manufacturer supplies equipment and software for both the substation control and supervision system and the protection system.

List of Signals
The list below states the types of signals for the different configurations of bay types to assist in the determination of needs and possibilities for each of analysed systems of the future substation. The estimated signals are shown in the tables and include but not limited to:
Signalling:
• Protection (start, tripping, zones/phases, AR, communication send/receive),
• Automatic systems (start, tripping, operation, working mode)
• Central systems (backup trips, trip during long power swing, busbar protection and breaker failure,
protection off, remote control off, feeder maintenance off),
• Switching equipment (manual control, emergency trip),
• Mode of operation: Local / Remote.

Warning:
• Protection (faults),
• Automatic systems (faults),
• Fault locator (faults),
• Event recorder (faults),
• Control systems (voltage control),
• Breaker (control blocking from a gas pressure low, a gas pressure low, AR inhibit from driver fault, driver supply voltage loss, driver fault, pole discordance).
• High voltage switch position:
• Breaker (separate pole - each 2 bits),
• Disconnectors (separate pole - each 2 bits),
• Earth switches (separate pole - each 2 bits).

Control:
• Breaker (close, open),
• Disconnectors (close, open),
• Line earth switch (close, open),
• Automatic systems (off, on,)
• Voltage regulation systems (choice of voltage level, regulation mode, tap changer control).
Series interfaces:
• From digital protections and disturbance recorder,
• From diagnostic system of primary equipment,

• From monitoring system (transformer, etc.).
Measurements:
• Phase currents,
• Phase voltages
• Real power and energy for both directions,
• Reactive power and energy for both directions,
• Frequency, power factor,
• Device switching statistics.

Metering (for planning / operation not for commercial purpose):
• Real energy for both directions,
• Reactive energy for both directions.

Auxiliary systems:
• Aux 33 kV AC,
• Aux.400/230 V AC,
• Aux.110V DC,
• Aux.220V AC UPS,
• Aux.48 V DC,
• Fire protection,
• Security light,
• Alarm system,
• HVAC,
• Telecommunication alarms,
• GPS time synchronizing input (NTP Protocol)

1.4.4 Scope of Work and Supply at New Substations

The substation control system refers to the station level and bay level controls. The station level control equipment shall include the following:

Station Level

- Arrangement of the all bays
- 2 (two) independent station computers operating on a main and hot standby basis,
- 2 (two) operator workstations including 2 x 21" color monitors (complete with appropriate desk and chair).
- The second operator workstation shall have the capability to be used as Employer's Representative workstation,
- 2 (two) numbers of independent SCADA Gateways
- Hardware Firewall
- Black & White A4 laser printer,
- Color A3 laser printer,
- Common bay control unit for monitoring auxiliary power supply and all other equipment on a substation level (telemetry, telecommunication, HVAC, fire protection, etc.),
- Satellite clock, which should run on SNTP protocols. The satellite clock will provide the reference time to the comprehensive Substation Control and Monitoring System and protection relays through IEC61850 substation LAN., The satellite clock system will be complete with GPS receiver, antenna and time synchronization ports.

- Interface for laptop computer for maintenance, information transfer and emergency HMI,
- Non-fail power supply system,
- Communication network equipment (substation local area network, field communication network, optical couplers, etc.),
- Optical connection for data exchange with the NLDC.
- Configuration of the new/existing Gateway.

The station computers and gateway in the substation must be separate machines from the station HMI (operator workstation) and should be located in the control panels, and not on the control desk with the HMI.

Bay Level

The control system of the bay level at substation shall be carried out with microprocessor based Bay Control Unit (BCU) control system. All BCUs shall be provided with IEC 61850 Edition 2 communication ports.

- The connections between BCUs and the station level shall be based on redundant fibre optic links.
  These communication ports will be used for control, indication and alarm systems to the substation automation system and SCADA. The BCU shall be provided for all:
  • 400kV, 230kV and 132kV transmission line bays,
- 400/230kV, 400/132kV, 230/132kV, 230/33kV and 132/33 kV power transformers,
- 400kV, 230kV and 132kV bus-bars
- 05 (Five) nos. of 33kV outgoing feeders (BCU and panels) and
- Auxiliaries.

A bay control unit (BCU) shall provide the following:
• Control for each individual circuit / bay with a LCD mimic and user interface for control and monitoring of the circuit / bay,
• Interface for protection devices that cannot directly interface with the substation control system local area network,
• Interface for laptop computer for maintenance, information transfer and emergency HMI,
• Interlocking functions (soft and hard wired).

Station level control functions shall include the following:
• Control of all switching devices,
• Real-time indication of events and alarms,
• Display of analogue values and high / low limit checking,
• Display of historical values,
• Data archiving,
• Disturbance monitoring and analysis,
• Trend display,
• Protection and control relay setting information,
• Protection relay fault and disturbance records,
• Time synchronization,
• Interlocking function to prevent unsafe operator action (display message if operator attempts an inappropriate action),
• Self-check and diagnostic,

• Manual data setting by the operator, including:
• Hand dressed data entry,
• Control inhibit setting,
• Alarm inhibit setting,
• Maintenance tag setting,
• High / low limit setting.
• Remote access to substation control system from SCADA system using a TCP / IP link.

All peripheral devices that constitute the substation automation system should be supervised and monitored by Control through IEC 61850 or any other compatible protocol.

1.4.5 Scope of Work and Supply at Existing Substations

The existing SCMS shall be extended to integrate the new feeders.
The BCU shall be provided, with IEC 61850 Edition 2 communication ports, for each feeder. The connections between BCUs and the station level shall be based on redundant fibre optic links. These communication ports will be used for control, indication and alarm systems to the substation automation system and SCADA facility of NLDC.

A bay control unit (BCU) shall provide the following:
• Control for each individual circuit / bay with a LCD mimic and user interface for control and monitoring of the circuit / bay,
• Interface for protection devices that cannot directly interface with the substation control system local area network,
• Interface for laptop computer for maintenance, information transfer and emergency HMI, Interlocking functions (soft and hard-wired).

All necessary optical/Ethernet switches shall be provided to connect the new BCUs to the station level of SMS.All necessary configurations, modification and adaptation work shall be provided.The signal list will follow the same rules as for new substations.

1.4.6 Engineering Services

General:
The Engineering services shall be provided by the Contractor to the extent and detail necessary for a turnkey project. They shall include drawings, instructions and all other technical documents required allow the Contractor to build, erect, commission, operate and maintain the substation systems, even if these are not specifically mentioned in these Technical Requirements.

Design Services:
The Contractor shall design in detail the general layout of the SCADA and substation control system, based on the preliminary design and modifications agreed. This general layout shall be submitted to the Employer / Employer's Representative for approval and comments. It shall also include all detailed structural drawings, detailed descriptions and reports required to permit an exact understanding of the solution adopted.

Once the general layout is approved, the Contractor shall include the following as a minimum requirement:
• Design of all works required for the implementation and extension of the SCADA and substation control system,
• General layouts for the SCADA and substation control system,
• Engineering of SCADA and substation control system,
• All necessary calculations.
• These Engineering services shall also include:
• Design reports,
• Complete drawings of all systems,
• Integration in existing SCADA system.

1.5 Terminal Points

1.5.1 Transmission Line Circuit Connections

The slack spans including overhead earth wires between the 400kV, 230kV and 132kV overhead line terminal towers and the substation gantry structures shall be supplied and terminated by the overhead line Contractors. All required insulators and hardwires shall also be supplied by the overhead line Contractors.
Eyebolts/U-bolts or other suitable fixtures for terminating the slack spans on the switchyard gantry shall be provided under this substation contract.

The overhead line Contractor shall provide a jumper from the slack span of sufficient length to terminate on the substation entry equipment. The supply of appropriate clamps and the actual termination of the jumper to the substation equipment shall be carried out under this contract.

PLC facilities such as line trap and coupling capacitor, new or currently used in existing substations shall be carried out under this contract.

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

The overhead line Contractor shall terminate the OPGW at the substation gantry in the terminal joint boxes provided by the overhead line Contractors. The connection between OPGW joint boxes at the substation gantry and control room building via underground optical fibre cables shall be carried out under this contract; it includes supply & installation of fibre optic cable of a size similar to the OPGW.

1.5.2 Communication and SCADA Equipment

The voice communication, tele-protection signaling and main distribution frame (MDF) for optical fibre cable will be supplied and installed under this contract.

Necessary equipment for incorporating new & existing equipment system into the existing SCADA system shall also be supplied and installed under this contract:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software shall be provided for the tele-control & tele-metering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura for integration of the scope of the work.

In order to provide the tele-control & tele-metering facilities required at the existing NLDC, all plant supplied under this contract shall be equipped with potential free auxiliary contacts for indications and alarms. CT and VT circuits shall be fitted, where required, with the appropriate shorting and fused terminals.

All required electrical signals for signalization and control shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system or RTU. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway or RTU of the substation automation system using IEC 60870-5-104 protocol. Necessary transducer, control & interposing relays, RTUs, etc. shall be used. Necessary interfacing between the Substation Automation gateway and the communication equipment is to be carried out.

Sufficient investigations shall be made on the existing telecommunication and SCADA system for new and existing transmission lines and associated new and existing substations so that the necessary equipment shall be provided for complete telecommunication system after the new and existing transmission lines and substations are connected/reconnected.

All and complete connection between the new equipment and the existing equipment for control & protection system, SCADA, communication system, and low voltage supply system shall be provided.

The other ends of Transmission Lines have to be covered from the telecommunication point of view under the scope of this contract. All equipment and services have to be provided.

In addition, to implement the complete SCADA system after completion of the project, modification of the existing software in the master and back-up computer of the national control centre, and modification /extension /renovation of hardware (installing additional printed circuit cards or other equipment, etc. if required) shall be made under this contract.

1.6 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:

(a) **International Training:** The following engineers nominated by the Employer shall be provided with training at specialist manufacturer's works/Training facility as follows:

SL	Description	No. of Engineer	Duration (Days) excluding travelling time
1.	HV GIS Substation & Equipment Design, MRE & Testing as per latest IEC standards	04	14
2.	Computer Aided Design Software: PSCAD – Primary & Advance level	04	14

(b) **International Witnessing:** The following engineers nominated by the Employer shall participate in the inspection and witnessing of factory acceptance tests at manufacturers' works as follows:

SL	Description	No. of Engineers	Duration (Days) excluding travelling time	No. of Trip/ Visit
		Each Visit		
1.	Transformers 230/132/33kV, 250/350MVA	02	10	1 (or, as required)
2.	Transformers 230/33kV, 120/140MVA	02	10	1 (or, as required)
3.	Transformers 132/33kV, 80/120MVA	02	10	3 (or, as required)
4.	230kV GIS	02	10	2 (or, as required)
5.	132kV GIS	02	10	3 (or, as required)
6.	Circuit Breaker (400 & 230kV)		0	0
7.	Bus Reactor & Shunt Reactor		0	0
8.	Disconnector (400 & 230kV)		0	0
9.	Instrument Transformer (400 & 230kV)		0	0
10.	Lightning Arrester (400 & 230 kV)		0	0
11.	Control, protection &	02	7	1

	SAS			
12.	Communication Equipment and SCADA gateway	02	7	1
13.	DC system (Battery & Charger system	02	7	1

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

All power transformer (if any) & shunt reactor (if any) shall be factory tested in front of Employers Engineers.
For GIS, at-least one from Each type of bay, such as Bus Coupler bay, transformer bay, line bay, cable bay, Bus PT bay shall be tested.

For CB 25% of the Supplied quantity shall face witness of Employers Engineers.

For CRP, at-least one from Each type of relay& Control System, such as Busbar protection relay&Control System, transformer protection relay& Control System, line protection relay& Control System, cable protection relay & Control System (if any) etc. shall be tested.

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

For other Equipment (DS, IT set, LA set, battery & charger) 10% the Supplied quantity shall face witness of Employers Engineers. For Instrument Transformer, each type (associated with voltage level and model) shall be tested.

Without duly signed by at least two nos. of witnesses of Engineers from Employer, any FAT (Factory Acceptance Test) report shall not be accepted by the employer.

Factory Acceptance Tests shall be carried out according to the approved list. Copies of the relevant test report shall be submitted. Equipment that has failed to meet Acceptance Tests shall be rejected. The shipment shall be carried out after the approval of the FAT report by PGCB.

(c) **Local Training:** On-site instruction & demonstration by the manufacturer's engineer on operations and maintenance of the followings:

SL	Description	No. of Engineer	Duration (days)
1.	HV AIS/GIS switchgears	10	06
2.	Transformers	10	06
3.	Protection & Substation automation system	10	06
4.	Telecommunication and SCADA	10	06

The Contractor shall be responsible for bearing all costs for the trainees (for item (a)+(b)), including air fares, accommodation, meal, healthcare, transportation, visa fees etc. together with payment of a daily allowance of **US$ 80** for each of the Employer's trainee. The Employer's engineer attending the Pre-shipment inspection (as mentioned in item no.-b) shall be provided with the same facilities except the payment of daily allowance which is to be **US$ 100.** For local/on-site trainings, (item no. c),contractor shall providedaily allowance of **BDT 1000.00 for each of the trainee**. For local/on-site instruction training, trainings shall have to be arranged at any Substation of respective local Grid Circle or GMD area with the consultation of Superintending Engineer, Grid Circle.

The contractor shall consider the cost for international witnessing (Item: b), and the cost shall be included in the price of the respective equipment for which the pre-shipment inspection shall be done.

Due to any unavoidable circumstances, if any pre-shipment inspection can't be done by the engineers

nominated by the Employer, the total amount of expenses (**US$)** for that purpose shall be deducted from the contract price submitted by the contractor. The amount shall be finalized by a committee of PGCB.

Between Employer's Factory Acceptance Tests Witness & Third Party Inspection, the employer shall have the right to choose how the inspection will be performed.

Note: The Contractor shall have to submit the Schedule of each Training & FAT and taken 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.

1.6.1 Training Contents:

For each Training, Trainers shall have minimum 10 years' experience in the related fields. For Transformer & HV substation training, the trainer shall have experience of at least 400kV Class, 520MVA 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. Also, prior to training, the contractor shall have to submit detail contents of training with day by day scheduling, to the employer for approval.

Contents of HV GIS Substation & Equipment Design, MRE & Testing as per latest IEC standards:

SL	Topics	Contents	Duration
1.	GIS Substation Design	1. Layout design of GIS Substation upto 800kV 2. Insulation coordination including PSCAD for EMTP 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	14 days
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	

Contents of Computer Aided Design Software: PSCAD – Primary & Advance level:

SL	Topics	Contents	Duration
1.	PSCAD	Transformer Energization (In-rush energizing & Representing different core types, Network resonance, Unbalanced loading, Ferroresonance)	14 days
		Transient Overvoltage (TOV) studies: (Line energizing , Capacitor bank back-to-back switching, selection of in-rush and out-rush reactors, Breaker re-strike, Energy dissipation of surge arrestors, arrestor rating, and the selection of arrestors ,Transient recovery voltage (TRV) across breakers)	
		Lightning Impulse Co-ordination study, Switching Impulse Analysis , Selection of BIL accordingly	
		Analysis of HVDC system transients	
		PSCAD Fundamentals, PSCAD Environment and Overview of Some Useful Features, Creating a Simple Case in PSCAD, Transformer Model and Inrush current Analysis, Induction Motor and Startup Transients, Transmission line and Cable Modelling in PSCAD, Ferranti Effect and Mitigation using Shunt Reactors, PSCAD Model development for Transient Studies, PSCAD Features to Efficiently Performs Simulations (Multiple Run, Snapshot, Python Automation), Synchronous machine model and its controls, Insulation Coordination Studies, Switching Studies, Lightning Studies (Network Resonances, Temporary Overvoltage),Transient Recovery Voltage analysis, Introduction to Power Electronics	

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

(PGCB/AIIB/000308-BGD/SS/Package-1)

SCHEDULE A

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

BRIEF DESCRIPTION OF THE WORKS

The bidder shall be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment. All necessary materials, adjustments, dismantling, re-routing, temporary, remedial and tiding-up work in order to complete the work specified shall be included in the contract price. **The contractor is responsible for ensuring that all and/or and any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid Price whether they be described in the specification, schedule or not.**

The equipment/plant to be designed, supplied, installed, tested & commissioned as stipulated in bid specification &shown in bid drawings (Volume 2 of 3) and technical requirements (particulars) as described in schedule-E (GTP, volume-3 of 3) .

Section-I: Bangabandhu Hi-Tech city 230/33kV (Future-132kV) Indoor GIS

New 230/33kV (with future provision for 132kV) indoor GIS shall be constructed at Bangabandhu Hi-Tech city of kaliakoir to facilitate reliable power to that industrial zone & other 33kV utilities. Two nos. of 230kV circuits shall be fed from Kaliakoir 400/230kV AIS substation nearby. Presently it shall be 230/33kV indoor GIS substation, but space provision shall be kept for future 132kV GIS extension with 230/132kV transformers.

230kV GIS switchyard:

230kV indoor GIS busbar scheme shall be double busbar scheme with rating of 230kV, 4000A, 50kA/3s. Other present scope of facility shall be as below in brief (details are referred in schedule-A &SLD):

- 230kV double busbar scheme, 4000A, 50kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GISof different makes.
- One (01) set of 230kV, 4000A, 50kA/3s Bus Coupler Bay (BCB)
- Two (02) sets of 230kV, 3150A, 50kA/3s Line Circuit Bayswith GIL termination& SF6 to Air Bushings for Kaliakoir-1 & -2, with future space provision for two (02) sets of same rated line bays
- Two (02) sets of 230kV, 3150A, 50kA/3s Transformer Bays with GIL termination & SF6 to Air Bushings for 230/33kV Transformer-1 & -2, with future space provision for three (03) sets of same rated Transformer bay
- Two (02) sets of 230/33kV, 120/140MVA Power Transformers with 33kV incomer AIS switchgear, future space provision for one (01) set of 230/33kV, 120/140MVA & two (02) sets of 230/132kV, 350/450MVA Power Transformer
- Future space provision of 132kV GIS switchyard with GIS building including six (06) sets of line circuit bays, two (02) sets of transformer bays, BCB, etc.
- Two (2) sets of station auxiliary transformers with the capacity of 3-phase, 33/0.415kV, 350kVA with necessary 33kV AIS switchgear
- Necessary LV power & control cables, steel structures, insulators, fittings, terminations, conductors, jumpers, etc.
- 230kV GIS building with minimum capacity of present scope & future extensions as

mentioned above. Detail design of GIS building shall be finalized during execution stage.

33kV AIS switchyard:

In case of 33kV, PGCB scope shall include 33kV incomer portion which shall be AIS as mentioned above. 33kV indoor GIS shall be made by other utility.

Section-II: Kaliakoir 230kV AIS Bay extension:

The Kaliakoir Substation is an existing 400/230/132kV AIS substation of PGCB. Under this project, scope of work include extension of two (02) 230kV AIS bays at Kaliakoir Substation for Kaliakoir- Bangabandhu Hi-Tech city 230kV overhead double-circuit transmission line. The busbar scheme for existing 230kV system is one & half breaker busbar scheme. Land is development will be done by other contractor. Developed & empty land shall be handed over for bus extension & constructing two (02) nos. of new bays. Details are referred in schedule-A & SLD.

Section-III: Anwara 230/132/33kV (Future-400kV) Indoor GIS

New 230/132/33kV (with future provision for 400kV) indoor GIS shall be constructed at Anwara in Chattogram, to facilitate reliable power to that Chattogram area & evacuate power from United 300MW Power Plant. Two nos. of 230kV circuits shall be connected from Shikalbaha, two nos. of 230kV circuits shall be connected from New Mooring, two nos. of 230kV circuits shall be fed from 300MW United Power & two nos. of 230kV furnished bays shall be kept as spare. Presently it shall be 230/132/33kV indoor GIS substation, but space provision shall be kept for future 400kV GIS extension with 400/230kV transformers.

230kV GIS switchyard:

230kV indoor GIS busbar scheme shall be double busbar scheme with rating of 230kV, 4000A, 50kA/3s. Other present scope of facility shall be as below in brief (details are referred in schedule-A & SLD):

- 230kV double busbar scheme, 4000A, 50kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- Two (02) sets of 230kV, 4000A, 50kA/3s Bus Coupler Bay (BCB)& two (02) sets of same rated Bus Section Bay
- Eight (08) sets of 230kV, 3150A, 50kA/3s Line Circuit Bays with GIL termination & SF6 to Air Bushings for Shikalbaha-1 & -2, New Mooring (Anandabazar)-1 & -2, United Power -1 & -2, spare-1 & -2, with future space provision for four (04) sets of same rated line bays
- Two (02) sets of 230kV, 3150A, 50kA/3s Transformer Bays with GIL termination & SF6 to Air Bushings for 230/132kV Transformer-1 & -2, with future space provision for one (01) set of same rated Transformer bay
- Two (02) sets of 230/132/33kV, 250/350MVA Power Transformers with future space provision for one (01) set of same rated Power Transformer

- Two (2) sets of station auxiliary/earthing transformers with the capacity of 3-phase, 33/0.415kV, 400kVA with necessary 33kV AIS switchgear
- Necessary LV power & control cables, steel structures, insulators, fittings, terminations, conductors, jumpers, etc.
- 230kV GIS building with minimum capacity of present scope & future extensions as mentioned above. Detail design of GIS building shall be finalized during execution stage.

132kV GIS switchyard:

132kV indoor GIS busbar scheme shall be double busbar scheme with rating of 132kV, 3150A, 40kA/3s. Other present scope of facility shall be as below in brief (details are referred in schedule-A & SLD):

- 132kV double busbar scheme, 3150A, 40kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- One (01) set of 132kV, 3150A, 40kA/3s Bus Coupler Bay (BCB)
- Two (02) sets of 132kV, 3150A, 40kA/3s Line Circuit Bays for Cox (N)-1 & -2, with future space provision for six (06) sets of same rated line bays
- Two (02) sets of 132kV, 3150A, 40kA/3s Transformer Bays for 132kV side of 230/132kV Transformer-1 & -2, with future space provision for one (01) set of same rated Transformer bay
- Two (02) sets of 132kV, 3150A, 40kA/3s Transformer Bays for 132kV side of 132/33kV Transformer-1 & -2, with future space provision for one (01) set of same rated Transformer bay
- Two (02) sets of 132/33kV, 80/120MVA Power Transformers with 33kV incomer AIS switchgear, with future space provision for one (01) set of same rated Power Transformer
- Necessary LV power & control cables, steel structures, insulators, fittings, terminations, conductors, jumpers, etc.
- 132kV GIS building with minimum capacity of present scope & future extensions as mentioned above. Detail design of GIS building shall be finalized during execution stage.

33kV AIS switchyard:

In case of 33kV, PGCB scope shall include 33kV incomer portion which shall be AIS as mentioned above. 33kV indoor GIS shall be made by other utility.

Section-IV: Cox'sbazar(N) 132/33kV (Future-230kV) Indoor GIS

New 132/33kV (with future provision for 230kV) indoor GIS shall be constructed at Cox'sbazar north to facilitate reliable power at vicinity area and Teknaf. Presently Anwara-Cox'sbazar 230kV double circuits (charged at 132kV) shall terminate here, two nos. of 132kV circuits shall be connected to Teknaf 132kV substation, LILO of Dohazari-Cox'sbazar 132kV double circuit lines & one no. of 132kV furnished bays shall be kept as spare. Moreover, two nos. of 50MVAR Capacitor bank shall be connected at 132kV level. Presently it shall be 132/33kV indoor GIS substation, but space provision shall be kept for future 230kV GIS extension with 230/132kV

transformers.

132kV GIS switchyard:

132kV indoor GIS busbar scheme shall be double busbar scheme with rating of 132kV, 3150A, 40kA/3s. Other present scope of facility shall be as below in brief (details are referred in schedule-A & SLD):

- 132kV double busbar scheme, 3150A, 40kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- Two (02) sets of 132kV, 3150A, 40kA/3s Bus Coupler Bay (BCB) and one (01) set of same rated Bus Section bay
- Nine (09) sets of 132kV, 3150A, 40kA/3s Line Circuit Bays for Anwara-1 & -2, Dohazari-1 & -2, Cox'sbazar old-1 & -2, Teknaf-1 & -2, one (01) set of furnished spare bay, with future space provision for four (04) sets of same rated line bays
- Two (02) sets of 132kV, 3150A, 40kA/3s bays sufficient for switching 50MVAR capacitor bank
- Three (03) sets of 132kV, 3150A, 40kA/3s Transformer Bays for 132kV side of 132/33kV Transformer-1 & -2, with future space provision for three (03) sets of future 132kV Transformer bay of 230/132kV transformer
- Two (02) sets of 132/33kV, 80/120MVA Power Transformers with 33kV incomer AIS switchgear
- Two (2) sets of station auxiliary transformers with the capacity of 3-phase, 33/0.415kV, 400kVA with necessary 33kV AIS switchgear
- Necessary LV power & control cables, steel structures, insulators, fittings, terminations, conductors, jumpers, etc.
- 132kV GIS building with minimum capacity of present scope & future extensions as mentioned above. Detail design of GIS building shall be finalized during execution stage.

33kV AIS switchyard:

In case of 33kV, PGCB scope shall include 33kV incomer portion which shall be AIS as mentioned above. 33kV indoor GIS shall be made by other utility.

Section-IV: Teknaf 132/33kV Indoor GIS

New 132/33kV indoor GIS shall be constructed at Teknaf to facilitate reliable power at vicinity area. Presently two nos. of 132kV circuits shall be connected to from Cox'sbazar (N) substation.

132kV GIS switchyard:

132kV indoor GIS busbar scheme shall be double busbar scheme with rating of 132kV, 3150A, 40kA/3s. Other present scope of facility shall be as below in brief (details are referred in schedule-A & SLD):

- 132kV double busbar scheme, 3150A, 40kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of

different makes.

- One (01) sets of 132kV, 3150A, 40kA/3s Bus Coupler Bay (BCB)
- Two (02) sets of 132kV, 3150A, 40kA/3s Line Circuit Bays for Cox'sbazar (N)-1 & -2, with future space provision for four (04) sets of same rated line bays
- Two (02) sets of 132kV, 3150A, 40kA/3s Transformer Bays for 132kV side of 132/33kV Transformer-1 & -2, with future space provision for one (01) set of same rated transformer bay
- Two (02) sets of 132/33kV, 80/120MVA Power Transformers with 33kV incomer AIS switchgear
- Two (2) sets of station auxiliary transformers with the capacity of 3-phase, 33/0.415kV, 350kVA with necessary 33kV AIS switchgear
- Necessary LV power & control cables, steel structures, insulators, fittings, terminations, conductors, jumpers, etc.
- 132kV GIS building with minimum capacity of present scope & future extensions as mentioned above. Detail design of GIS building shall be finalized during execution stage.

33kV AIS switchyard:

In case of 33kV, PGCB scope shall include 33kV incomer portion which shall be AIS as mentioned above. 33kV indoor GIS shall be made by other utility.

The position of Bus PT with High Speed ES shall be kept such that, it shall decrease the interruption hours when extension.GIS Design shall consider appropriate buffer zone and section in busbar & GIS compartment suitable for best MRE practice so as to minimize interruption time & maintenance complexity. GIS MRE procedure shall be approved by the employer prior to execution at site.

The scope of work also includes associated control, protection, metering, fiber optic multiplexer equipment for communication & protection, extension of existing substation automation, digital fault & disturbance recorder (DFDR), station power facilities (33kV Auxiliary, LVAC & LVDC system), including towers and gantry structures and relevant accessories, other ancillary system and associated civil works for switchyards, one (1) GIS Control Building to accommodate 33kV GIS, protection and control IED and associated equipment, local control kiosks, outdoor switchyards, cable tunnels and trenches, complete water supply & sewerage system including pump, pump house, water reservoir, etc., security wall, fences, entrance and internal access roads, security guard station, car parking lot and all other necessary substation facilities and supply of mandatory spare parts and maintenance tools.

Scope includesall other ancillary system, necessary substation facilities and supply of mandatory spare parts and maintenance tools.

The extent of supply and service is described in the following clauses and in the respective sections of the specification. All work not expressly called for in the Specification, but necessary for the completion of the work shall be performed and furnished by the Contractor at no additional cost to the Employer.

The scope of works under this turnkey contract is: design, supply, manufacture, quality assurance, inspection and testing, delivery, new packing for export, insurance, shipment & transport to the site, complete construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning, defect liability for all equipment, including all civil works.

Especially the civil design has to incorporate countermeasures against flooding so as not to affect any substation equipment during the wet season.

The Contractor's responsibility is to provide that all parts of the works be completed in every respect for commercial operation, to the requirements of the Engineer. All details, accessories etc. required for the complete installation and satisfactory operation of the works not specifically mentioned in this specification are deemed included in the contract price.

The Contractor is responsible for ensuring that all and/or any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid Price whether they be described in the specification, schedule or not. All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price. The Bid Price shall include all other miscellaneous works required.

In case of extension & renovation works, all required as-built drawings may not be available for the existing plants & equipment which are required to be modified/renovated; the contractor is also responsible to make drawings as required to complete the works.

The “Schedule of Requirements” (the scope of work described herein, stated detail in schedule-A) for equipment, materials and services and the detailed technical specifications of equipment and materials of the Bidding Documents shall be read in conjunction with the detailed technical specifications of equipment and materials described in Volume 2 of the bidding documents & technical particulars (GTP in schedule-E) of volume-3. The drawings provided in the Bidding Documents are indicative only and hence the entire scope of work is not fully reflected in those drawings.

The programme of works shall be as shown in schedule C of Times for Delivery and Completion. Within one month of acceptance of the Bid, the contractor shall submit a programme chart detailing times required for the design, manufacture, testing, delivery and erection for the complete work.

The bar chart shall indicate the various phases of work for all appropriate items of the Contract, from commencement of the Contract to its final completion e.g. design, survey, approval of drawings, ordering of materials, manufacture, testing, delivery, erection and commissioning. The bar chart shall, when appropriate, allow the requisite periods of approval by the Employer, and/or any other regulatory body.

If at any time during the execution of the contract it is found necessary to modify the approved bar chart, the Contractor shall inform the Employer and submit a modified bar chart for approval. Such approval is not deemed to be consent to any amendments to the contractual completion date(s).

Modifications that may affect site work and associated local arrangements must provide asufficient notice period to allow for any necessary re-arrangements.

The Employer intends that access will be given to a reasonable number of sites to providecontinuity of work. However, the Contractor shall accommodate reasonable delays in access to some individual area of the sites that may prevent sequential foundation installation and support erection work being carried out. Provided he has overall continuity of work, this shall not affect the Contractor's programme.

The detailed requirements are listed in Schedule-A (Schedule of Requirements) and Schedule-B

(Schedule of Rates & Prices) of volume 3 of 3 in the Bidding Documents.

The various items of work are described very briefly in the relevant Price Schedules. The various items of the Schedule of Prices (schedule-B) shall be read in conjunction with the schedule of requirements (schedule-A), corresponding sections in the Technical Specifications & bid requirements including amendments and, additions, if any. The Bidder's quoted rates shall be based on the description of activities in the Schedule of Prices as well as other necessary operations required to complete the works detailed in these Technical Specifications.

The unit rates quoted shall include minor details which are obviously and fairly intended, and which may not have been included in these documents but are essential for the satisfactory completion of the various works. The unit rate quoted shall be inclusive of all plant equipment, men, material skilled andunskilled labour etc. essential for satisfactory completion of various works.

All measurements for payment shall be in S.I. units, lengths shall be measured in meterscorrected to two decimal places. Areas shall be computed in square meters & volume in cubic meters rounded off to two decimals.

METHODE OF REFERENCE

The following method of reference shall be used to identify the various required items:

Denomination	Description
A	420 kV switchgear, structures & connections
B	245 kV switchgear, structures & connections
C	145kV switchgear, structures & connections
D	36 kV switchgear, structures & connections
E	Power Transformers& Auxiliary Transformers
F	Control, protection, substation automation and metering
G	DFDR system
H	HV Power cable and associated terminations
I	Earthing and lightning protection
J	Multicore low voltage power and control cables
K	Batteries, chargers and DC distribution
L	LVAC distribution
M	Civil works, building and foundations
N	Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system
O	Fibre optic multiplexer equipment for communication and protection
P	SCADA system for Tele-control and Telemetering
Q	Generator for Emergency Aux. Power
R	Other equipment
S	Witnessing FAT, Training & Social program

SCHEDULE A

(SCHEDULES OF REQUIREMENTS)

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

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: Bangabandhu Hi-Tech city 230/33kV Indoor GIS

1A **400kV GIS Switchyard, structures & connections (Not scope of work)**
(Deleted)

1B **245kV GIS Switchyard, structures & connections**

245kV indoor Type Gas Insulated Switchgear (GIS)

The 245kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

Item No.		Description of Equipment Requirement	Unit	Quantity
1B		**245 kV switchgear, equipment connection and steel structures (Technical data of CT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
1B1		**245kV GIS Line Feeder Bays, each comprises with:**	**Set**	**02**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	245kV, 3150A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	245kV, 3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	245kV, 50kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	245kV, 50kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	viii.	245kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	3
	x.	Local Control Cubicle	Set	1
	xi.	Complete set of miscellaneous items required for safe and efficient	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
		operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate		
	xii.	Partial Discharge monitoring internal sensor	Lot	1
1B2	**245kV GIS Transformer Feeder Bays, each comprises with:**		**Set**	**02**
	i	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	245kV, 3150A, 50kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	245kV,3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	245kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	vii.	245kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3
	viii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	3
	ix.	Local Control Cubicle	Set	1
	x.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xi.	Partial Discharge monitoring internal sensor	Lot	1
1B3	**245kV Bus Coupler Bays, 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 / hydraulic / spring&hydraulic operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phasebusbarDisconnectorwith Earth Switchcomplete with motor operating mechanism	Set	02
	iv.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	v.	Local Control Cubicle	Set	01
	vi.	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, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
1B4	**245kV Bus Section Bays, comprises with: (NA)**		**Set**	**00**
	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 / hydraulic / spring&hydraulic operating mechanism	Set	01

Item No.	Description of Equipment Requirement		Unit	Quantity
	iii.	245kV, 4000A, 50kA/3s, three phasebusbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	245kV, 50kA/3s single phaseCurrent Transformer	No.	06
	v.	Local Control Cubicle	Set	1
	vi.	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,cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
1B5	**245kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**02**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	245kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iii.	245kV, 50kA/3s, three phase, make proof (high speed) typeEarth 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,cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
1B6	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
	AIS Switchgear, Equipment & Structure			
1B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	12
1B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
1B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector *1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare	Lot	1
	iii.	Nut-bolt	Lot	1
1B10	**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 with single beam	No.	9

Item No.	Description of Equipment Requirement		Unit	Quantity
	b)	Beam	No.	6
	c)	Gantry Column with double beam	No.	0
	ii.	Equipment Structure with Nut & Bolts		
	a)	LA	No.	12
	b)	Outdoor CSE	No.	0
	iii.	Nut & Bolts	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1

1C **145kV GIS Switchyard, structures & connections**

(Deleted)

1D **36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers**

36kV Indoor Type Gas Insulated Switchgear (GIS)

(Deleted)

36kV Air Insulated Switchgear (AIS)

The 36kV outdoor AIS switchgears shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

1D1 Two (2) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism

1D2 Four (4) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch

1D3 Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch

1D4 Six (6) nos. of single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers

1D5 Twelve (12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer& Auxiliary connection

1D6 Six (6) nos. of Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.

1D7 Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer

1D8 One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard

1D9 One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)

1D10 One (1) lot of cables & terminations including other accessories for auxiliary transformer connection

1E Power Transformers & Auxiliary transformers

Item No.	Description of Equipment Requirement	Unit	Quantity
1E	**Power Transformers & Auxiliary transformers (Technical data of CT/BCT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
1E1	230/33 kV, 120/140 MVA (ONAN/ONAF), three phase outdoor type power transformer and Remote Tap Changer Control (RTCC) Panel.Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2
1E2	Auxiliary power transformer 33/0.415 kV, 350 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase 2-core current transformers in all bushings, associated outdoor neutral CTs, including all necessary connections & support structures. The auxiliary transformer capacity shall be validated by calculation during execution stage; and if required, higher capacity transformer shall have to be provided within same price.	Set	2
1E3	Design, supply and construction of Water Spray fire fighting system for 230kV transformers including water pipe network and reservoir at normal pressure for:		
	i. 230/33 kV Power Transformer	Set	2

1F Control, Protection, Substation Automation & Metering

Item No.	Description of Equipment Requirement	Unit	Quantity
1F	**Control, Protection, Substation Automation & Metering**		
400kV Circuit (Deleted)			
230kV Circuits			

Item No.		Description of Equipment Requirement	Unit	Quantity
1F1		**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F2		**Control, Protection, Monitoring including SAS Function for Power transformer (140MVA) circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Automatic Voltage Regulator (AVR) with provision of auto/manual and independent/parallel operation of Tap Changer		
	iv.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	v.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F3		**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**	Set	1
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F4		**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**	Set	0
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		

Item No.		Description of Equipment Requirement	Unit	Quantity
	ii.	Protection main relay, (67, 67N, 50, 50N, 51, 51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F5	**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 HMI		
	ii.	Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iii.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F6	**Tariff metering comprises with:**			
	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
36kV Circuit				
1F7	**Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles**		Set	2
	Each comprising			
	i.	BCU, Multi-function meter and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (as backup: 87T,67,67N,50,50N,51,51N,49, 81O, 81U, 81R)		
	iii.	Auxiliary relays (TCS, Lockout, etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F8	**Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)**		Set	0

Item No.		Description of Equipment Requirement	Unit	Quantity
		Each comprising		
	i.	Voltage monitoring & overvoltage protection(59)		
	ii.	Auxiliary relays and accessories		
1F9	**Tariff metering comprises with:**		Lot	1
	i.	Meters (Main & Check)	set	2
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
Substation Automation system comprises with			Lot	1
1F10	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	Lot	1
	iii.	GPS system (including lightning protection)	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
	v.	LCD Monitor, 75" 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	Engineering Software Tool	Set	1
	xi	Troubleshooting software tool	Set	1
	xii	Other Accessories (if any)	Lot	1

Note: Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVArhmeters for each 230kV line and transformer feeders. For each feeder minimum two meters (main & check with different manufacturer) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

Note: Only on/off monitoring of ES and measuring of bus PT shall be integrated with SAS within the contract price.

1G Digital Fault & Disturbance Recorder System

Item No.	Description of Equipment Requirement	Unit	Quantity
1G1	**Digital Fault & Disturbance Recorder, each comprising**	**Lot**	**01**

Item No.		Description of Equipment Requirement	Unit	Quantity
	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(including lightning protection)	set	01
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	set	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables &Other Accessories	Lot	01

1H 230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL

1H1 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2500 mm^2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

1H2 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2500 mm^2 (least), 145 kV, 2,500A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

1H3 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

1H4 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 145 kV, 2,500A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

1H5 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm^2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable.

(Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution. For 33kV transformer incomer feeders, three (03) runs of cable per phase shall have to be considered. For 33kV transformer outgoing feeders, two (02) runs of cable per phase shall have to be considered.
(Deleted)

1H6 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable. The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

1H7 The lot of Gas Insulated Line (GIL), three phase or single phase enclosure, for 230kV GIS connection circuits with necessary connecting terminal chambers including support structures, etc. for 3150A circuits of 4 nos. of feeders (02 nos. T/L & 02 nos. T/R). The Length of GIL shall be quoted in 'meter' and shall be different for each bay as per actual design. Actual payment shall be as per final design. GIL length shall be calculated considering the physical distance of connection for each bay/feeder/circuit, irrespective of single/three phase enclosure.

1I Earthing and Lightning Protection

Item No.	Description of Equipment Requirement	Unit	Quantity
1I	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.		
1I1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1
1I2	Lightning Protection System for complete substation (overhead earthwire or mast type)	Lot	1
1I3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2

1J Multicore Low Voltage Power & Control Cables

1J1 One (1) lot complete set of multicore low voltage auxiliary XLPE insulated power and control cables (IEC 60502) between all items of equipment supplied under the contract and for connection and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours& tags. The overall substation cable routing and core schedules shall also be provided.

Item No.	Description of Equipment Requirement	Unit	Quantity

1J1	**Multicore Cables for control, protection, metering & power circuits**			
	i.	LV Control Cable	Lot	1
	ii.	LV Power Cable	Lot	1

1K Batteries, Chargers and DC Distribution

1K1 One (1) lot of two (2) sets of 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed, tested and commissioned to provide all DC supplies to equipment including powering two (2) sets of 240V, 50Hz, 3kVA UPS (Inverter) for 60 minutes being supplied. One set shall be used as standby supply.
Necessary DC distribution switchboards shall be provided at the various place of the substation, according to the detail design.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium110V batteries complete, each capacity shall not be less than 350Ah at the 5-hour rate of discharge.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of battery chargers (IGBT type) complete, each float charge shall not be less than 120A rating and input voltage shall be three phase, 50Hz, 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller.
The DC distribution board shall be with 25% overall spare switches for future use.

iv. Two (2) sets of Online UPS (Inverter) 240V, 50Hz, 3kVA powered from 110V DC distribution board as bypass circuit for substation automation system.

Two (2) sets of batteries and battery chargers shall be located in the main control building and shall be used for the first main and second main DC supplies for 230kV switchyards.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) shall be incorporated in substation automation system.

1K2 One (1) lot of two (2) sets of 48V DC system and distribution equipment to be supplied

installed and commissioned in the main control building for the new fiber optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

   During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of 48V battery charger, 90A and input 415V AC.

   During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 48V DC Distribution panel, with Digital Display & Controller.

   The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 25% overall spare switches for future use.

48V DC system and distribution equipment shall be located in the Main Control Building.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

1L LVAC Distribution

1L1 One (1) lot of LVAC panels & switchboards (MCC type, LV S.W room, each panel & control room, generator room, etc.) with Digital Display & Controller, for 230/33kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this project. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.

Station auxiliary power (415V) shall be comprised: Aux. TR-1, Aux. TR-2 sides & Generator

All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC

60309; to be installed, cabled and connected adjacent to the auto transformers (including one set of UPS/inverter backup powered from 110V DC system).

1L2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV earthing/auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check). Substation Automation System shall include the metering for all incoming LVAC source feeder (230kV part).

1M Civil Works, Building and Foundation

1M1 Complete Land Development with carried/dredged earth filling & necessary slope protection (Deleted)

1M2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 33kV GIS switchyards, Transformer yard.

1M3 One (1) lot of complete design, supply and construction of all civil works, including 230kV & 33kV gantry foundations, pole & tower foundations, 230kV and 33kV equipment foundations, power transformers & auxiliary transformer foundations, oil pit, blast walls, substation main gate, security boundary walls and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing, property line demarcation and gravel surfacing, etc.

All necessary outdoor civil works for re- and de-installation and removal of the existing equipment/material/foundations/roads/fence/cables/cable routes, existing 230kV & 33kV (indoor & outdoor) switchyard, existing transformers, transformer foundations (if required), etc. from the site. Cables, transformers & other equipment shall have to be returned to respective GMD. Necessary interim arrangement for dismantling & installation works for any lines'/feeders' by-pass arrangement (if required) are deemed included in contract scope.

1M4 One (1) lot of complete design, supply and construction of all civil items and facilities required for the 230kV GIS buildings cum main control building to install all control and protection panels including batteries & chargers, one manager's rooms, one in-charge's room, tea-room, store room, meeting room and etc., including foundation works, super structure works, EOT crane, lift, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

All necessary indoor civil works for re- and de-installation and removal of the existing equipment from the site.

230kV GIS & control building shall be multi-storied building, with future space provision as stated in the scope above (refer to building drawings for tender purpose, detail design of GIS building shall be finalized during execution stage).

The clearance between GIS and side walls (left, right) shall be minimum 4000mm, the clearance between GIS and periphery walls (top & bottom) shall be minimum 2700mm. GIS building size is defined based on each GIS bay width of 2.0m. In case of increase in building size due to increase of GIS bay width more than 2.0m, price variation in GIS building size shall not be allowed.

This item also includes a single-storied Ansar Barak including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, kitchen, floor finishing, rain water drainage system, lightning protection, etc. (building size of minimum 5.1mX20m, detail design shall be finalized during execution stage)

1M5 Compression test & uplift test of pile

1N Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTVsystem

Item No.	Description of Equipment Requirement	Unit	Quantity
1N	One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings including lighting (flood light; sodium/mercury) for security, roadway, switchyard auxiliary & other houses, Fire Fighting System & CCTV.Necessary Sizing calculation shall have to be submitted for approval during execution stage.		
1N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Battery Rooms, other rooms, etc.) and emergency DC lighting for Indoor (GIS & control room, generator room, auxiliary & other houses)	Lot	1
1N2	Lighting (Flood light LED type) for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor (at strategic locations for equipment operation and inspection)	Lot	1
1N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room		
	i) Fire Fighting system For 230kV GIS Hall & Panel Room	Lot	1
	ii) Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	0
	iii) Fire Fighting system For Control Room	Lot	1
1N4	Complete CCTV with motion sensor (each room and S/Y)	Lot	1

1OTelecommunication System Fibre optic multiplexer equipment for communication and protection

Item No.	Description of Equipment Requirement	Unit	Quantity
1O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations** - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system		

Item No.		Description of Equipment Requirement	Unit	Quantity
		Remote end Substations have following make multiplexer equipment **SS name** / **Telecom Equipment** Existing Kaliakoir 400kV / ABB **All PLC terminal equipment at remote end substations are ABB make**		
1O1		Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising		
	i.	ADM with TP unit with Panels (Front opening, Swing Frame type) & accessories	Set	04
	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	08
	vi.	All other Accessories not included above	Lot	1
1O2		Other Indoor equipment, at Local end SS		
	i.	Primary phone (IP phone)	No.	06
	ii.	Secondary phone (2W phone with caller ID)	No.	10
	iii.	Indoor MDF	Set	1
1O3		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	10
1O4		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	Lot	1
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v.	Optical Booster, if required	Lot	1
	vi.	Outdoor termination box	Set	1
	vii.	Cables, ODF, MDF, panels as required	Lot	1
1O5		PLC equipment at Local end SS		
	i.	Indoor PLC Equipment with all accessories & Panels (Front opening, Swing Frame type)	Set	0
	ii.	Line matching unit	No.	0

Item No.	Description of Equipment Requirement		Unit	Quantity
	iii.	Cables & other accessories for complete PLCC system	Lot	0
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	0

1P SCADA system for Telecontrol and Telemetering

01 (One) lot of ~~extension/modification of~~ complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to provide the tele-control & tele-metering facilities required at the existing National Load Despatch Center (NLDC) Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration of Bangabandhu Hi-Tech City 230/33kV Indoor GIS 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 NLDC SCADA/EMS system both in Master station at Aftabnagar, Rampuraand Backup station at Siddhirganj are under the scope of the contractor.

Scope of supply work in Bangabandhu Hi-Tech City 230/33kV Indoor GIS Substation shall include of 02 (two) no of industrial gateways with redundant Ethernet switches, 01 (one) hardware firewall, cables, separate panel with wiring & all other accessories with proper configuration as needed for the integration work. Therefore, necessary hardware & software shall be installed here (if required)

Item No.	Description of Equipment Requirement		Unit	Quantity
1P	**SCADA system for Telecontrol and Telemetering**			
1P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	2
	b)	Ethernet Switch	Set	2
	c)	Hardware Firewall	Lot	1
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1
	e)	Cables	Lot	1
	f)	All Other Accessories	Lot	1
	ii.	Integration work with Master & Backup NLDC including Engineering, Testing &Commissioning	Lot	1

1Q Generator for Emergency Aux. Power

Item No.	Description of Equipment Requirement	Unit	Quantity
1Q	**Generator for Emergency Aux. Power (with smoke reduction device)**		
1Q1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h	Set	1

Item No.	Description of Equipment Requirement	Unit	Quantity
	• Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device		

1R Other Equipment

Item No.	Description of Equipment Requirement	Unit	Quantity
1R	**Other equipment**		
1R1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	1
1R2	Emergency Interphone (each room)	Lot	1

Section-II: Kaliakoir 230kV AIS Bay extension

Item Description

2A 400kV Switchyard, structures & connections (Deleted)

2B 230kV Switchyard, structures & connections

Busbar configuration is one and half scheme.

Item No.	Descriptions & Requirements
2B	**230kV Air Insulated Switchgear, Equipment Connection and Steel Structure**
2B1	Three (03) sets of 230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, live tank type, **single-pole operation,** SF6 gas circuit breakers with spring-stored energy operating mechanism with support structure.
2B2	Two (02) sets of 230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL,horizontal double break, post type, motor operated disconnectors **with** motor-operated **earthing switch**.
2B3	Six (06) sets of 230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL,horizontal double break, post type, motor operated disconnectors **without earthing switch**
2B4	Twelve (12) nos. of single-phase, 5-core, 230kV, 50kA/1sec, 3000-1500/-1-1-1-1-1A, 50Hz,

	1425kVp BIL post type current transformer
2B5	Six (06) nos. of single-phase, 3-core, 400kV, 50Hz, 1425kVp BIL, capacitor type voltage transformers.
2B6	Six (06) nos. of 198kV rated voltage, 158kV(rms) continuous operating voltage at 50˚c 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters. Rated voltage &MCOV value shall have to be justified by calculation.
2B7	Deleted
2B8	One (1) lot of 400kV post type support insulators required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.
2B9	One (01) lot of rigid tubular bus [Aluminium of grade 63401 WP], flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 230kV busbar and switchgear connection as specified in the technical specifications and bid drawings. Bus capacity shall be minimum 4000A/50kA/1s. Existing Bus is Aluminium Tube with outer dia. 160mm. (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)
2B10	One (1) lot of steel structures for gantry and equipment supports required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.

2C 145kV GIS Switchyard, structures & connections

Deleted

2D 36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers

Deleted

2E Power Transformers& Auxiliary Transformer

Deleted

2F Control, Protection, Substation Automation & Metering

2F	**Control, Protection, Substation Automation System & Metering**
	230 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
2F1	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two (02) sets of 230KV overhead line circuits bays. Main-1 & Main-2 relay shall from different manufacturer. Line Differential Relay model shall have to be matched with other end Substation's Relay.
2F2	One (1)lot of Renovation/Extension of existing Busbar protection for 230kV system. Existing busbar protection model is: ABB::Reb500
2F3	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4wire import and export MWh and MVArh meters (accuracy class 0.2S) for each 230-kV line and transformer feeders. For each feeder minimum two meters (main & check) shall be supplied. Substation Automation System shall include the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.
	Substation Automation System

2F4	Extension of SAS including all required equipment & accessories excluding protection panel & relay for the whole Substation. SAS system shall include BCUs, Ethernet Switches, extension of alarm unit & software, panels, Cables etc. The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status The existing SAS's manufacturer at Kaliakoir 230kV Substation is ABB, Switzerland.
2G	**DFDR**
2G1	One (01) lot of modification / extension of Digital Fault and Disturbance recorder (DFDR) to monitor complete substation including newly added two (02) bays for 230kV AIS. Existing DFDR model is BEN 6000 (Qualitrol).

2H 230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL

2H1 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.

2H2 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

2H3 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)

2H4 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

2H5 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm^2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution. For 33kV transformer incomer feeders, three (03) runs of cable per phase shall have to be considered. For 33kV transformer outgoing feeders, two (02) runs of cable per phase shall have to be considered.

(Deleted)

2H6 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable. The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

2H7 The lot of Gas Insulated Line (GIL), three phase or single phase enclosure, for 230kV GIS connection circuits with necessary connecting terminal chambers including support structures, etc. for 3150A circuits of 8 nos. of feeders (06 nos. T/L & 02 nos. T/R). The Length of GIL shall be quoted in 'meter' and shall be different for each bay as per actual design. Actual payment shall be as per final design. GIL length shall be calculated considering the physical distance of connection for each bay/feeder/circuit, irrespective of single/three phase enclosure.
(Deleted)

2I	**Earthing and Lightning Protection**
2I1	One (1) lot extension of supply and installation of earthing system for outdoor switchyard equipment with necessary connectors and clamps, with design to suit the work under this contract arrangement. If soil resistivity is different for different layer, calculation and GPR shall have to be shown using software like CYMGRD, if existing earthing design is available.
2I2	One (1) lot of supply and installation of lightning protection screen for outdoor switchyard equipment with necessary connectors and clamps, with design to suit the work under this project. Supporting calculation shall have to be shown in Rolling Sphere/ Rez-vig method. Required number of Lightning Mast or gantry with peak (for switchyard) shall be provided as per DSLP calculation during detail design stage.
2J	**Multicore Cables**
2J1	One (1) lot complete set of multicore low voltage 06/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours & tags.. The overall substation cable routing and core schedules shall also be provided.

2K	**Batteries, Chargers and DC Distribution**
2K1	One (01) lot of Extension of existing 110V DC distribution board/ new DCDB panel (if required) to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. 110V DC system and distribution equipment is located in the Main Control Building. All 110V DC status (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) excluding control & protection Panel shall be incorporated in substation automation system. The DC status of control & protection Panel shall be incorporated to SAS by individual IED.
2K2	One (01) lot of Extension of existing 48V DC distribution board/ new DCDB panel (if required) to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this

	contract. 48V DC system and distribution equipment is located in the Main Control Building. All 48V DC status (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) excluding control & protection Panel shall be incorporated in substation automation system. The DC status of control & protection Panel shall be incorporated to SAS by individual IED.

2L	**LVAC Distribution**
2L1	One (1) lot extension of LVAC switchboard for two (02) new 230kV bays at 400kV Kaliakoir substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project. All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm, status of AC MCB/MCCB at SPR with fail alarm etc.) shall be incorporated in substation automation system. MCB must have in built NO/NC contacts. All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

2M	**Civil Works, Building and Foundation**
2M1	Complete Land Development with carried/dredged earth filling & necessary Slope (1V:2H) protection with CC block
2M2	One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV AIS switchyards
2M3	One (1) lot of complete design, supply and construction of all civil works, including 230kVgantry foundations, pole & tower foundations, 230kV equipment foundations, power transformers & auxiliary transformer foundations, oil pit, blast walls, substation main gate, security boundary walls, Boundary wall with RCC retaining wall, Boundary wall without retaining wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak well, PVC pipes etc., switchyard surface finishing, property line demarcation and gravel surfacing, etc. All necessary outdoor civil works for re- and de-installation and removal of the existing equipment/material/foundations/roads/fence/cables/cable routes, existing 230kV (indoor & outdoor) switchyard, existing transformers, transformer foundations (if required), etc. from the site. Cables, transformers & other equipment shall have to be returned to respective GMD. Necessary interim arrangement for dismantling & installation works for any lines'/feeders' by-pass arrangement (if required) are deemed included in contract scope.
2M4	Deleted
2M5	One (01) Testing of pile Foundation, Compression & uplift on random basis

2N	**Lighting, Small Power, , Fire fighting, Air Conditioning and Ventilation**
2N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, and emergency DC lighting for extension work.
2N2	Deleted
2N3	One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection for extension work.
2N4	Deleted

2OTelecommunication System, Fibre optic multiplexer equipment for communication and protection

<table>
<tr><td>2O1</td><td>One (01) complete lot of equipment for extension of existing fibre optic multiplexer equipment at local and remote end Substation for protection & communication, for required part of substation, shall be designed, supplied, delivered, installed, tested and commissioned and integrated into the existing system, under this contract. Fibre optic multiplexer equipment is to be provided for -
<table><tr><td>21 (or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC)</td></tr><tr><td>Distance relay carrier signal (main and back-up)</td></tr><tr><td>SCADA data from switchgear and control system through SAS</td></tr><tr><td>Hot-line telephone system</td></tr><tr><td>Substation LAN system</td></tr></table>
The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. Supply/Extension/Modification of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising:</td></tr>
<tr><td></td><td>1) Substation end equipment-
a) Modification of ADM with TP unit without booster each comprising
i. One (01) set Duplicate CPU (if required)
ii. One (01) set Duplicate PSU (if required)
iii. One (01) lot of Optical STM-16 ports for each direction of 400 kV line-N/A
iv. Optical STM-16 ports for each direcion of 230 kV line
v. Optical STM-4 ports for each direction of 132 kV line – N/A
vi. One (01) set of 16x2 Mbps (E1) card (if required)
vii. One (01) set of card with minimum Eight ports 10/100 Base T LAN (if required)
viii. One (01) set of card with minimum Eight ports 10/100 Base T Router (if required)
ix. One (01) set of card with 20x2-w voice for FXS (if required)
x. One lot of Required no of cards with 4 commands for distance protection after detail design
b) One (01) lot of Optical Booster (if required)
c) One (01) set of IDF/SDF
d) One (01) lot of Cables
e) One (01) lot of EOW telephone with board (if required)
f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories (if required)
g) Other accessories (if any)

2) Other Indoor equipment comprising of
i. One (01) set of PABX Card (FXO)
ii. Two (02) sets of Primary phone (IP phone) (if required)
iii. Ten (10) sets of Secondary phone (2W phone) (required)
iv. One (01) lot of Extension of MDF
v. One (01) lot of Pigtail cables
vi. One (01) lot of ODF

3) Other miscellaneous items

*Existing Telecom panels are from GE and ABB. BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.</td></tr>
<tr><td>2O2</td><td>A lot of Armoured Underground Optical Fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame) shall be designed, supplied, delivered, installed, tested and commissioned, including supply and installation of MDF and digital cables, for required part of substation each comprising of –

i. One (01) lot of Underground optical fiber cable, armoured, 48 core</td></tr>
</table>

	ii. One (01) lot of Outdoor termination box iii. Other miscellaneous items
2O3	PLCC System: (Deleted)
	One (01) lot of the equipment to be supplied, installed and commissioned shall be as per the approved SLD. **400kV** Two (02) sets: - Indoor PLC equipment including teleprotection, cables, etc. at Kaliakoir Substation for (direction Kaliakoir-Bogura) 400 kV line Two (02) sets.: - Line matching units for phase to earth circuit coupling for 400kV lines at Kaliakoir Substation. Additionally, if any Interfaces are required for system configuration at each remote end substation, then interface devices shall be installed in each existing system as a lot.

2P SCADA system for Tele-control and Tele-metering

01 (One) lot extension/modification of complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to provide the tele-control & tele-metering facilities required at the existing National Load Despatch Center (NLDC) Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration of bay extensions at Kaliakoir
400/230/132kVsubstation. 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 NLDC SCADA/EMS system both in Master station at Aftabnagar, Rampura and Backup station at Siddhirganj are under the scope of the contractor.

Scope of supply work in Kaliakoir 400/230/132kVsubstation shall include of 01 (one) no of industrial gateways with redundant Ethernet switches, 01 (one) lot of hardware firewall, cables, separate panel with wiring & all other accessories (if required) with proper configuration as needed for the extension of existing industrial gateway. Both the existing and new gateway shall be configured as hot-standby mode to accommodate all the bays of Kaliakoir 400/230/132kV substation including new bays. Therefore, necessary hardware & software shall be installed here (if required)

Item No.		Description of Equipment Requirement	Unit	Quantity
2P		**SCADA system for Tele-control and Tele-metering**		
2P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	1
	b)	Ethernet Switch	Set	If required
	c)	Hardware Firewall	Lot	If required
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	If required
	e)	Cables	Lot	As required
	f)	All Other Accessories	Lot	As required
	ii.	Integration work with Master & Backup NLDC including Engineering, Testing & Commissioning	Lot	1

2Q Generator for Emergency Aux. Power

Item No.	Description of Equipment Requirement	Unit	Quantity
2Q	**Generator for Emergency Aux. Power (with smoke reduction device)**		
2Q1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device	Set	0

2R Other Equipment

Item No.	Description of Equipment Requirement	Unit	Quantity
1R	**Other equipment**		
2R1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	0
2R2	Emergency Interphone (each room)	Lot	0

Section-III: Anwara 230/132/33kV Indoor GIS

3A 400kV GIS Switchyard, structures & connections (Not scope of work)

(Deleted)

3B 245kV GIS Switchyard, structures & connections

245kV indoor Type Gas Insulated Switchgear (GIS)

The 245kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

Item No.		Description of Equipment Requirement	Unit	Quantity
3B		**245 kV switchgear, equipment connection and steel structures (Technical data of CT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
3B1		**245kV GIS Line Feeder Bays, each comprises with:**	**Set**	**08**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	245kV, 3150A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	245kV, 3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	v.	245kV, 50kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	245kV, 50kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	viii.	245kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	3
	x.	Local Control Cubicle	Set	1
	xi.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xii.	Partial Discharge monitoring internal sensor	Lot	1
3B2	**245kV GIS Transformer Feeder Bays, each comprises with:**		**Set**	**02**
	i	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	245kV, 3150A, 50kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	245kV,3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	245kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	vii.	245kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3
	viii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	3
	ix.	Local Control Cubicle	Set	1
	x.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xi.	Partial Discharge monitoring internal sensor	Lot	1
3B3	**245kV Bus Coupler Bays, 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 / hydraulic / spring&hydraulic operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phasebusbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	245kV, 50kA/3s single phase, Current Transformer	No.	06

Item No.	Description of Equipment Requirement		Unit	Quantity
	v.	Local Control Cubicle	Set	01
	vi.	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, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
3B4	**245kV Bus Section Bays, 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 / hydraulic / spring&hydraulic operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phasebusbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	245kV, 50kA/3s single phaseCurrent Transformer	No.	06
	v.	Local Control Cubicle	Set	1
	vi.	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,cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
3B5	**245kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**04**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	245kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iii.	245kV, 50kA/3s, three phase, make proof (high speed) 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,cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
3B6	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
	AIS Switchgear, Equipment & Structure			
3B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	24
3B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
3B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**			

Item No.	Description of Equipment Requirement		Unit	Quantity
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)	Lot	1
	iii.	Nut-bolt	Lot	1
3B10	**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 with single beam	No.	13
	b)	Beam	No.	10
	c)	Gantry Column with double beam	No.	0
	ii.	Equipment Structure with Nut & Bolts		
	a)	LA	No.	24
	b)	Outdoor CSE	No.	0
	iii.	Nut & Bolts	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1

3C 145kV GIS Switchyard, structures & connections

145kV indoor Type Gas Insulated Switchgear (GIS)

The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

Item No.	Description of Equipment Requirement		Unit	Quantity
3C	**145 kV switchgear, equipment connection and steel structures (Technical data of CT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**			
3C1	**145kV GIS Line Feeder Bays, each comprises with:**		**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s three phase earthing switch complete with motor operating mechanism	Set	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	vi.	145kV, 40kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	viii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	0
	x.	Local Control Cubicle	Set	1
	xi.	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
	xii.	Partial Discharge monitoring internal sensor	Lot	1
3C2	**145kV GIS Transformer Feeder Bays, each comprises with:**		**Set**	**04**
	i	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	vii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3
	viii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	0
	ix.	Local Control Cubicle	Set	1
	x.	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
	xi.	Partial Discharge monitoring internal sensor	Lot	1
3C3	**145kV Bus Coupler Bays, comprises with:**		**Set**	**01**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	145kV, 40kA/3s single phase, Current Transformer	No.	06
	v.	Local Control Cubicle	Set	01
	vi.	Complete Set of miscellaneous items required for safe and efficient	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
		operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate		
	vii.	Partial Discharge monitoring internal sensor	Lot	1
3C4	**145kV Bus Section Bays, comprises with:**		**Set**	**00**
	i	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	145kV, 40kA/3s single phase Current Transformer	No.	06
	v.	Local Control Cubicle	Set	1
	vi.	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, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
3C5	**145kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	145kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iii.	145kV, 40kA/3s, three phase, make proof (high speed) 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,metal support structure, grounding, etc. as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
3C6	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
	AIS Switchgear, Equipment & Structure			
3C7	120kV rated voltage, 96kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	18
3C8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
3C9	**Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard**			
	i.	Insulator	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	ii.	Fittings & Clamps, Connector (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)	Lot	1
	iii.	Nut-bolt	Lot	1
3C10	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**			
	i.	Steel Structure for T/L with Nut & Bolts		
	a)	Gantry Column with single beam	No.	8
	b)	Beam	No.	6
	c)	Gantry Column with double beam	No.	0
	ii.	Equipment Structure with Nut & Bolts		
	a)	LA	No.	18
	b)	Outdoor CSE	No.	18
	iii.	Nut & Bolts	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1

3D **36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers**

36kV Indoor Type Gas Insulated Switchgear (GIS)
(Deleted)

36kV Air Insulated Switchgear (AIS)

The 36kV outdoor AIS switchgears shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

3D1 Two (2) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism

3D2 Four (4) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch

3D3 Four (4) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for auxiliary transformer feeder

3D4 Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism for auxiliary transformer feeder

3D5 Twelve (12) nos. of single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers for 33kV incomer & Auxiliary connection

3D6 Twelve (12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection

3D7 Six (6) nos. of Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer

3D8 Six (6) nos. of Current transformer 36 kV, single-phase, 3-core, multi ratio, 10/1A, 800-1250/1-1A, 31.5kA/1sec, 50 Hz, 170/70 kV BIL, post type current transformer for auxiliary transformer feeder

3D9 Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Earthing/Auxiliary transformer

3D10 One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard

3D11 One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry column & beam,cable trays, nuts & bolts, etc. including other accessories for each connection as requiredfor completing 36kV Switchyard and auxiliary transformer connection (*1 lot= actualrequirement + additional 20% of each type of clamp, connectors and fittings as spare)

3D12 One (1) lot of cables & terminations including other accessories for auxiliary transformer connection

3E Power Transformers & Auxiliary transformers

Item No.	Description of Equipment Requirement	Unit	Quantity
3E	**Power Transformers & Auxiliary transformers (Technical data of CT/BCT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
3E1	230/132/33 kV, 250/350 MVA (ONAN/ONAF), three phase outdoor type power (auto) transformer and Remote Tap Changer Control (RTCC) Panel.Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2
3E2	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer and Remote Tap Changer Control (RTCC) Panel.Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2
3E2	Auxiliary power transformer 33/0.415 kV, 400 kVA, ZNyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase 2-core current transformers in all bushings, associated outdoor neutral CTs, including all necessary connections & support structures. The auxiliary transformer capacity shall be validated by calculation during execution stage; and if required, higher capacity transformer shall have to be	Set	2

Item No.	Description of Equipment Requirement		Unit	Quantity
	provided within same price.			
3E4	Design, supply and construction of Water Spray fire fighting system for 230kV auto transformers including water pipe network and reservoir at normal pressure for:			
	i.	230/132/33 kV Power Transformer	Set	2

3F Control, Protection, Substation Automation & Metering

Item No.	Description of Equipment Requirement		Unit	Quantity
3F	**Control, Protection, Substation Automation & Metering**			
400kV Circuit (Deleted)				
230kV Circuits				
3F1	**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**		Set	6
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F2	**Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Automatic Voltage Regulator (AVR) with provision of auto/manual and independent/parallel operation of Tap Changer		
	iv.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	v.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F3	**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		

Item No.	Description of Equipment Requirement		Unit	Quantity
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F4	**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F5	**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 HMI		
	ii.	Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iii.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F6	**Tariff metering comprises with:**			
	i.	Meters (Main & Check)	set	8
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
132kV Circuits				
3F7	**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		

Item No.		Description of Equipment Requirement	Unit	Quantity
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay & Protection back up relay		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F8	**Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F9	**Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Automatic Voltage Regulator (AVR) with provision of auto/manual and independent/parallel operation of Tap Changer		
	v.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F10	**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**		Set	1
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as		

Item No.		Description of Equipment Requirement	Unit	Quantity
		spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F11		**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**	Set	0
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F12		**Busbar Protection including SAS Function (132kV Circuit)**	Set	1
		Each comprising		
	i.	Protection Relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit HMI		
	ii.	Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iii.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F13		**Tariff metering comprises with:**		
	i.	Meters (Main & Check)	set	6
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
36kV Circuit				
3F14		**Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles**	Set	4
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (as backup: 87T,67,67N,50,50N,51,51N,49, 81O, 81U, 81R)		
	iii.	Auxiliary relays (TCS, Lockout, etc.) *** TTBs have to be placed at the front side of the respective panel. 2		

Item No.		Description of Equipment Requirement	Unit	Quantity
		nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
3F15		**Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)**	Set	0
		Each comprising		
	i.	Voltage monitoring & overvoltage protection(59)		
	ii.	Auxiliary relays and accessories		
3F16		**Tariff metering comprises with:**		
	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
Substation Automation system comprises with			Lot	1
3F17	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	Lot	1
	iii.	GPS system (including lightning protection)	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
	v.	LCD Monitor, 75" 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	Engineering Software Tool	Set	1
	xi	Troubleshooting software tool	Set	1
	xii.	Other Accessories (if any)	Lot	1

Note: Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVArhmeters for each 230kV line and transformer feeders. For each feeder minimum two meters (main & check & different manufacturer) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

Note: Only on/off monitoring of ES and measuring of bus PT shall be integrated with SAS within the contract price.

3G Digital Fault & Disturbance Recorder System

Item No.		Description of Equipment Requirement	Unit	Quantity
3G1		**Digital Fault & Disturbance Recorder, each comprising**	**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	set	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables &Other Accessories	Lot	01

3H 230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL

3H1 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

3H2 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.

3H3 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

3H4 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)

3H5 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm^2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase

XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution. For 33kV transformer incomer feeders, three (03) runs of cable per phase shall have to be considered. For 33kV transformer outgoing feeders, two (02) runs of cable per phase shall have to be considered.
(Deleted)

3H6 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable. The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

3H7 The lot of Gas Insulated Line (GIL), three phase or single phase enclosure, for 230kV GIS connection circuits with necessary connecting terminal chambers including support structures, etc. for 3150A circuits of 8 nos. of feeders (06 nos. T/L & 02 nos. T/R). The Length of GIL shall be quoted in 'meter' and shall be different for each bay as per actual design. Actual payment shall be as per final design. GIL length shall be calculated considering the physical distance of connection for each bay/feeder/circuit, irrespective of single/three phase enclosure.

3I Earthing and Lightning Protection

Item No.	Description of Equipment Requirement	Unit	Quantity
3I	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.		
3I1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1
3I2	Lightning Protection System for complete substation (overheadearthwire or mast type)	Lot	1
3I3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2

3J Multicore Low Voltage Power & Control Cables

3J1 One (1) lot complete set of multicore low voltage auxiliary XLPE insulated power and control cables (IEC 60502) between all items of equipment supplied under the contract and for connection and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours& tags. The overall substation cable routing and core schedules shall also be provided.

Item No.	Description of Equipment Requirement	Unit	Quantity
3J1	**Multicore Cables for control, protection, metering & power circuits**		
	i. LV Control Cable	Lot	1
	ii. LV Power Cable	Lot	1

3K Batteries, Chargers and DC Distribution

3K1 One (1) lot of two (2) sets of 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed, tested and commissioned to provide all DC supplies to equipment including powering two (2) sets of 240V, 50Hz, 3kVA UPS (Inverter) for 60 minutes being supplied. One set shall be used as standby supply.
Necessary DC distribution switchboards shall be provided at the various place of the substation, according to the detail design.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium110V batteries complete, each capacity shall not be less than 400Ah at the 5-hour rate of discharge.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of battery chargers (IGBT type) complete, each float charge shall not be less than 150A rating and input voltage shall be three phase, 50Hz, 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller.
The DC distribution board shall be with 25% overall spare switches for future use.

iv. Two (2) sets of Online UPS (Inverter) 240V, 50Hz, 3kVA powered from 110V DC distribution board as bypass circuit for substation automation system.

Two (2) sets of batteries and battery chargers shall be located in the main control building and shall be used for the first main and second main DC supplies for 230kV switchyards.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) shall be incorporated in substation automation system.

3K2 One (1) lot of two (2) sets of 48V DC system and distribution equipment to be supplied installed and commissioned in the main control building for the new fiber optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of 48V battery charger, 90A and input 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 48V DC Distribution panel, with Digital Display & Controller.

The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 25% overall spare switches for future use.

48V DC system and distribution equipment shall be located in the Main Control Building.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

3L LVAC Distribution

3L1 One (1) lot of LVAC panels & switchboards (MCC type, LV S.W room, each panel & control room, generator room, etc.) with Digital Display & Controller, for 230/33kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this project. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.

Station auxiliary power (415V) shall be comprised: Aux. TR-1, Aux. TR-2 sides & Generator

All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the auto transformers (including one set of UPS/inverter backup powered from 110V DC system).

3L2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV earthing/auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check). Substation Automation System shall include the metering for all incoming LVAC source feeder (230kV part).

3M Civil Works, Building and Foundation

3M1 Complete Land Development with carried/dredged earth filling & necessary slope protection

3M2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 33kV GIS switchyards, Transformer yard.

3M3 One (1) lot of complete design, supply and construction of all civil works, including 230kV, 132kV& 33kV gantry foundations, pole & tower foundations, 230kV, 132kV and 33kV equipment foundations, power transformers & auxiliary transformer foundations, oil pit, blast walls, substation main gate, security boundary walls and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing, property line demarcation and gravel surfacing, etc.

All necessary outdoor civil works for re- and de-installation and removal of the existing equipment/material/foundations/roads/fence/cables/cable routes, existing 230kV, 132kV& 33kV (indoor & outdoor) switchyard, existing transformers, transformer foundations (if required), etc. from the site. Cables, transformers & other equipment shall have to be returned to respective GMD. Necessary interim arrangement for dismantling & installation works for any lines'/feeders' by-pass arrangement (if required) are deemed included in contract scope.

3M4 One (1) lot of complete design, supply and construction of all civil items and facilities required for the 230kV GIS buildings cum main control building & 132kV GIS buildings cum control building to install all control and protection panels including batteries & chargers, one manager's rooms, one in-charge's room, tea-room, store room, meeting room and etc., including foundation works, super structure works, EOT crane, lift, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

All necessary indoor civil works for re- and de-installation and removal of the existing equipment from the site.

230kV & 132kV GIS & control building shall be separate, multi-storied building, with future space provision as stated in the scope above (refer to building drawings for tender purpose, detail design of GIS building shall be finalized during execution stage).

The clearance between GIS and side walls (left, right) shall be minimum 4000mm, the clearance between GIS and periphery walls (top & bottom) shall be minimum 2700mm. GIS building size is defined based on each GIS bay width of 2.0m. In case of increase in building size due to increase of GIS bay width more than 2.0m, price variation in GIS building size shall not be allowed.

This item also includes a single-storied Ansar Barak including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, kitchen, floor finishing, rain water drainage system, lightning protection, etc. (building size of minimum 5.1mX20m, detail design shall be finalized during execution stage)

3M5 Compression test & uplift test of pile

3N Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system

Item No.	Description of Equipment Requirement		Unit	Quantity
3N	One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings including lighting (flood light; sodium/mercury) for security, roadway, switchyard auxiliary & other houses, Fire Fighting System & CCTV.Necessary Sizing calculation shall have to be submitted for approval during execution stage.			
3N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Battery Rooms, other rooms, etc.) and emergency DC lighting for Indoor (GIS & control room, generator room, auxiliary & other houses)		Lot	1
3N2	Lighting (Flood light LED type) for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor (at strategic locations for equipment operation and inspection)		Lot	1
3N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room			
	i)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	0
	ii)	Fire Fighting system For 230kV GIS Hall & Panel Room	Lot	1
	iii)	Fire Fighting system For 132kV GIS Hall & Panel Room	Lot	1
	iv)	Fire Fighting system For Control Room	Lot	1
3N4	Complete CCTV with motion sensor (each room and S/Y)		Lot	1

3O Telecommunication System Fibre optic multiplexer equipment for communication and protection

Item No.	Description of Equipment Requirement	Unit	Quantity
3O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations**		

Item No.	Description of Equipment Requirement	Unit	Quantity
	- 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system **Remote end Substations have following make multiplexer equipment** **SS name** / **Telecom Equipment** Existing Kaliakoir 400kV / ABB **All PLC terminal equipment at remote end substations are ABB make**		
3O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising		
	i. ADM with TP unit with Panels (Front opening, Swing Frame type) & accessories	Set	04
	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	08
	vi. All other Accessories not included above	Lot	1
3O2	Other Indoor equipment, at Local end SS		
	i. Primary phone (IP phone)	No.	06
	ii. Secondary phone (2W phone with caller ID)	No.	10
	iii. Indoor MDF	Set	1
3O3	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	10
3O4	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	Lot	1
	ii. Optical STM-4 Card for each 230 kV line at remote end	Lot	1
	iv. Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v. Optical Booster, if required	Lot	1
	vi. Outdoor termination box	Set	1
	vii. Cables, ODF, MDF, panels as required	Lot	1

Item No.		Description of Equipment Requirement	Unit	Quantity
3O5	PLC equipment at Local end SS			
	i.	Indoor PLC Equipment with all accessories & Panels (Front opening, Swing Frame type)	Set	0
	ii.	Line matching unit	No.	0
	iii.	Cables & other accessories for complete PLCC system	Lot	0
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	0

3P SCADA system for Telecontrol and Telemetering

01 (One) lot of ~~extension/modification of~~ complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to provide the tele-control & tele-metering facilities required at the existing National Load Despatch Center (NLDC) Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration of Anwara 230/132/33kV Indoor GIS 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 NLDC SCADA/EMS system both in Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration work of Anwara 230/132/33kV Indoor GIS substation along with its far-end substations are under the scope of the contractor.

Scope of supply work in Anwara 230/33kV Indoor GIS Substation shall include of 02 (two) no of industrial gateways with redundant Ethernet switches, 01 (one) hardware firewall, cables, separate panel with wiring & all other accessories with proper configuration as needed for the integration work. Therefore, necessary hardware & software shall be installed here (if required)

Item No.		Description of Equipment Requirement	Unit	Quantity
3P	**SCADA system for Telecontrol and Telemetering**			
3P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	2
	b)	Ethernet Switch	Set	2
	c)	Hardware Firewall	Lot	1
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1
	e)	Cables	Lot	1
	f)	All Other Accessories	Lot	1
	ii.	Integration work with Master & Backup NLDC including Engineering, Testing& Commissioning	Lot	1

3Q Generator for Emergency Aux. Power

Item No.	Description of Equipment Requirement	Unit	Quantity
1Q	**Generator for Emergency Aux. Power (with smoke reduction device)**		
3Q1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device	Set	1

3R Other Equipment

Item No.	Description of Equipment Requirement	Unit	Quantity
1R	**Other equipment**		
3R1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	1
3R2	Emergency Interphone (each room)	Lot	1

Section-IV: Cox's Bazar (N) 132/33kV Indoor GIS

4A 400kV GIS Switchyard, structures & connections (Not scope of work)
(Deleted)

4B 245kV GIS Switchyard, structures & connections (Not scope of work)
(Deleted)

4C 145kV GIS Switchyard, structures & connections

145kV indoor Type Gas Insulated Switchgear (GIS)

The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

Item No.		Description of Equipment Requirement	Unit	Quantity
4C		**145 kV switchgear, equipment connection and steel structures (Technical data of CT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
4C1		**145kV GIS Line Feeder Bays, each comprises with:**	**Set**	**09**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	v.	145kV, 40kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	145kV, 40kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	viii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	0
	x.	Local Control Cubicle	Set	1
	xi.	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
	xii.	Partial Discharge monitoring internal sensor	Lot	1
4C2	**145kV GIS Power Transformer Feeder Bays, each comprises with:**		**Set**	**03**
	i	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	vii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3
	viii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	0
	ix.	Local Control Cubicle	Set	1
	x.	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
	xi.	Partial Discharge monitoring internal sensor	Lot	1
4C3	**145kV GIS Capacitor Bank Bays, each comprises with:**		**Set**	**2**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, single pole operation Circuit Breaker with CSD complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	v.	145kV, 40kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	145kV, 40kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	viii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories	No.	0
	x.	Local Control Cubicle	Set	1
	xi.	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
	xii.	Partial Discharge monitoring internal sensor	Lot	1
4C4	**145kV Bus Coupler Bays, comprises with:**		**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	145kV, 40kA/3s single phase, Current Transformer	No.	06
	v.	Local Control Cubicle	Set	01
	vi.	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, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
4C5	**145kV Bus Section Bays, comprises with:**		**Set**	**02**
	i	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	145kV, 40kA/3s single phase Current Transformer	No.	06
	v.	Local Control Cubicle	Set	1
	vi.	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, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
4C6	**145kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**04**

Item No.	Description of Equipment Requirement		Unit	Quantity
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	145kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iii.	145kV, 40kA/3s, three phase, make proof (high speed) 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, metal support structure, grounding, etc. as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
4C7	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
	AIS Switchgear, Equipment & Structure			
4C8	120kV rated voltage, 96kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	39
4C9	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
4C10	**Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard**			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)	Lot	1
	iii.	Nut-bolt	Lot	1
4C11	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**			
	i.	Steel Structure for T/L with Nut & Bolts		
	a)	Gantry Column for single beam	No.	13
	b)	Beam	No.	11
	c)	Gantry Column with double beam	No.	0
	ii.	Equipment Structure with Nut & Bolts		
	a)	LA	No.	39
	b)	Outdoor CSE	No.	33
	iii.	Nut & Bolts	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1

4D **36kV Switchgears and Connections with Power Transformer & Earthing/ Auxiliary Transformers**

36kV Indoor Type Gas Insulated Switchgear (GIS)
(Deleted)

36kV Air Insulated Switchgear (AIS)

The 36kV outdoor AIS switchgears shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

4D1 Three (3) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism

4D2 Six (6) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch

4D3 Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for auxiliary transformer feeder

4D4 Nine (9) nos. of single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers for 33kV incomer & Auxiliary connection

4D5 Fifteen (15) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection

4D6 Nine (9) nos. of Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer

4D7 Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer

4D8 One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard

4D9 One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry column & beam,cable trays, nuts & bolts, etc. including other accessories for each connection as requiredfor completing 36kV Switchyard and auxiliary transformer connection (*1 lot= actualrequirement + additional 20% of each type of clamp, connectors and fittings as spare)

4D10 One (1) lot of cables & terminations including other accessories for auxiliary transformer connection

4E **Power Transformers & Auxiliary transformers**

Item No.	Description of Equipment Requirement	Unit	Quantity
4E	**Power Transformers & Auxiliary transformers (Technical data of CT/BCT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
4E1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer and Remote Tap Changer Control (RTCC) Panel.Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	3
4E2	Auxiliary power transformer 33/0.415 kV, 400 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase 2-core current transformers in all bushings, associated outdoor neutral CTs, including all necessary connections & support structures. The auxiliary transformer capacity shall be validated by calculation during execution stage; and if required, higher capacity transformer shall have to be provided within same price.	Set	2
4E3	Design, supply and construction of Water Spray fire fighting system for 132kV Power transformers including water pipe network and reservoir at normal pressure for:		
	i. 132/33 kV Power Transformer	Set	0
4E4	132kV 50MVAR Capacitor Bank with associated equipment	Set	2

4F Control, Protection, Substation Automation & Metering

Item No.	Description of Equipment Requirement	Unit	Quantity
4F	**Control, Protection, Substation Automation & Metering**		
400kV Circuit (Deleted)			
230kV Circuits(Deleted)			
132kV Circuits			
4F1	**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**	Set	8
	Each comprising		
	i. BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii. Protection main relay & Protection back up relay		
	iii. Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv. Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F2	**Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles**	Set	3
	Each comprising		

Item No.		Description of Equipment Requirement	Unit	Quantity
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Automatic Voltage Regulator (AVR) with provision of auto/manual and independent/parallel operation of Tap Changer		
	v.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F3		**Control, Protection, Monitoring including CSD &SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay & Protection back up relay		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F4		**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F5		**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as		

Item No.		Description of Equipment Requirement	Unit	Quantity
		spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F6	**Busbar Protection including SAS Function (132kV Circuit)**		Set	1
		Each comprising		
	i.	Protection Relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit HMI		
	ii.	Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iii.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F7	**Tariff metering comprises with:**			
	i.	Meters (Main & Check)	set	11
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
36kV Circuit				
4F8	**Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles**		Set	3
	Each comprising			
	i.	BCU, Multi-function meter and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (as backup: 87T,67,67N,50,50N,51,51N,49, 81O, 81U, 81R)		
	iii.	Auxiliary relays (TCS, Lockout, etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
4F9	**Tariff metering comprises with:**			
	i.	Meters (Main & Check)	set	3
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
Substation Automation system comprises with			Lot	1
4F10	i.	Industrial Server PC cum Operator workstation (or separate PCs) with SAS & Engineering Software and including monitors& accessories	Set	2

Item No.	Description of Equipment Requirement		Unit	Quantity
	ii.	Ethernet Switch for SAS	Lot	1
	iii.	GPS system (including lightning protection)	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
	v.	LCD Monitor, 75" 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	Engineering Software Tool	Set	1
	xi	Troubleshooting software tool	Set	1
	xii	Other Accessories (if any)	Lot	1

Note: Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVArhmeters for each 230kV line and transformer feeders. For each feeder minimum two meters (main & check & different manufacturer) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

Note: Only on/off monitoring of ES and measuring of bus PT shall be integrated with SAS within the contract price.

4G Digital Fault & Disturbance Recorder System

Item No.	Description of Equipment Requirement		Unit	Quantity
4G1	**Digital Fault & Disturbance Recorder, each comprising**		**Lot**	**00**
	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	set	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables &Other Accessories	Lot	01

4H 230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL

4H1 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested

and commissioned of 2000 mm^2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

4H2 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.

4H3 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

4H4 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)

4H5 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm^2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution. For 33kV transformer incomer feeders, three (03) runs of cable per phase shall have to be considered. For 33kV transformer outgoing feeders, two (02) runs of cable per phase shall have to be considered.
(Deleted)

4H6 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

4H7 The lot of Gas Insulated Line (GIL), three phase or single phase enclosure, for 230kV GIS connection circuits with necessary connecting terminal chambers including support structures, etc. for 3150A circuits of 8 nos. of feeders (06 nos. T/L & 02 nos. T/R). The Length of GIL shall be quoted in 'meter' and shall be different for each bay as per actual design. Actual payment shall be as per final design. GIL length shall be calculated

considering the physical distance of connection for each bay/feeder/circuit, irrespective of single/three phase enclosure.

4I Earthing and Lightning Protection

Item No.	Description of Equipment Requirement	Unit	Quantity
4I	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.		
4I1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1
4I2	Lightning Protection System for complete substation (overheadearthwire or mast type)	Lot	1
4I3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2

4J Multicore Low Voltage Power & Control Cables

4J1 One (1) lot complete set of multicore low voltage auxiliary XLPE insulated power and control cables (IEC 60502) between all items of equipment supplied under the contract and for connection and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours& tags. The overall substation cable routing and core schedules shall also be provided.

Item No.	Description of Equipment Requirement	Unit	Quantity
4J1	**Multicore Cables for control, protection, metering & power circuits**		
	i. LV Control Cable	Lot	1
	ii. LV Power Cable	Lot	1

4K Batteries, Chargers and DC Distribution

4K1 One (1) lot of two (2) sets of 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed, tested and commissioned to provide all DC supplies to equipment including powering two (2) sets of 240V, 50Hz, 3kVA UPS (Inverter) for 60 minutes being supplied. One set shall be used as standby supply.
Necessary DC distribution switchboards shall be provided at the various place of the substation, according to the detail design.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium110V batteries complete, each capacity shall not be less than 400Ah at the 5-hour rate of discharge.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of battery chargers (IGBT type) complete, each float charge shall not be less than 150A rating and input voltage shall be three phase, 50Hz, 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller.

The DC distribution board shall be with 25% overall spare switches for future use.

iv. Two (2) sets of Online UPS (Inverter) 240V, 50Hz, 3kVA powered from 110V DC distribution board as bypass circuit for substation automation system.

Two (2) sets of batteries and battery chargers shall be located in the main control building and shall be used for the first main and second main DC supplies for 230kV switchyards.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) shall be incorporated in substation automation system.

4K2 One (1) lot of two (2) sets of 48V DC system and distribution equipment to be supplied installed and commissioned in the main control building for the new fiber optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of 48V battery charger, 90A and input 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if

required after calculation, shall be supplied within the same price.

iii. One (1) lot of 48V DC Distribution panel, with Digital Display & Controller.

The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 25% overall spare switches for future use.

48V DC system and distribution equipment shall be located in the Main Control Building.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

4L LVAC Distribution

4L1 One (1) lot of LVAC panels & switchboards (MCC type, LV S.W room, each panel & control room, generator room, etc.) with Digital Display & Controller, for 230/33kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this project. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.

Station auxiliary power (415V) shall be comprised: Aux. TR-1, Aux. TR-2 sides & Generator

All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the auto transformers (including one set of UPS/inverter backup powered from 110V DC system).

4L2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV earthing/auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check). Substation Automation System shall include the metering for all incoming LVAC source feeder (230kV part).

4M Civil Works, Building and Foundation

4M1 Complete Land Development with carried/dredged earth filling & necessary slope protection

4M2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 33kV GIS switchyards, Transformer

yard.

4M3 One (1) lot of complete design, supply and construction of all civil works, including 230kV, 132kV & 33kV gantry foundations, pole & tower foundations, 230kV, 132kV and 33kV equipment foundations, power transformers & auxiliary transformer foundations, oil pit, blast walls, substation main gate, security boundary walls and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing,property line demarcation and gravel surfacing, etc.

All necessary outdoor civil works for re- and de-installation and removal of the existing equipment/material/foundations/roads/fence/cables/cable routes, existing 230kV, 132kV & 33kV (indoor & outdoor) switchyard, existing transformers, transformer foundations (if required), etc. from the site. Cables, transformers & other equipment shall have to be returned to respective GMD. Necessary interim arrangement for dismantling & installation works for any lines'/feeders' by-pass arrangement (if required) are deemed included in contract scope.

4M4 One (1) lot of complete design, supply and construction of all civil items and facilities required for the 132kV GIS buildings cum main control building to install all control and protection panels including batteries & chargers, one manager's rooms, one in-charge's room, tea-room, store room, meeting room and etc., including foundation works, super structure works, EOT crane, lift, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

All necessary indoor civil works for re- and de-installation and removal of the existing equipment from the site.

132kV GIS & control building shall be multi-storied building, with future space provision as stated in the scope above (refer to building drawings for tender purpose, detail design of GIS building shall be finalized during execution stage).

The clearance between GIS and side walls (left, right) shall be minimum 4000mm, the clearance between GIS and periphery walls (top & bottom) shall be minimum 2700mm. GIS building size is defined based on each GIS bay width of 2.0m. In case of increase in building size due to increase of GIS bay width more than 2.0m, price variation in GIS building size shall not be allowed.

This item also includes a single-storied Ansar Barak including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, kitchen, floor finishing, rain water drainage system, lightning protection, etc. (building size of minimum 5.1mX20m, detail design shall be finalized during execution stage).

4M5 Compression test & uplift test of pile

4N Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system

Item No.	Description of Equipment Requirement	Unit	Quantity
4N	One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings including lighting (flood light; sodium/mercury) for security, roadway, switchyard auxiliary & other houses, Fire Fighting System & CCTV.Necessary Sizing calculation shall have to be submitted for approval during execution stage.		
4N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Battery Rooms, other rooms, etc.) and emergency DC lighting for Indoor (GIS & control room, generator room, auxiliary & other houses)	Lot	1
4N2	Lighting (Flood light LED type) for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor (at strategic locations for equipment operation and inspection)	Lot	1
4N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room		
	i) Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	0
	ii) Fire Fighting system For 230kV GIS Hall & Panel Room	Lot	0
	iii) Fire Fighting system For 132kV GIS Hall & Panel Room	Lot	1
	iv) Fire Fighting system For Control Room	Lot	1
4N4	Complete CCTV with motion sensor (each room and S/Y)	Lot	1

4O Telecommunication System Fibre optic multiplexer equipment for communication and protection

Item No.	Description of Equipment Requirement	Unit	Quantity
4O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations** - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system		
4O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising		
	i. ADM with TP unit with Panels (Front opening, Swing Frame type) & accessories	Set	04
	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	08
	vi. All other Accessories not included above	Lot	1
4O2	Other Indoor equipment, at Local end SS		

Item No.		Description of Equipment Requirement	Unit	Quantity
	i.	Primary phone (IP phone)	No.	06
	ii.	Secondary phone (2W phone with caller ID)	No.	10
	iii.	Indoor MDF	Set	1
4O3	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	10
4O4	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	Lot	1
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v.	Optical Booster, if required	Lot	1
	vi.	Outdoor termination box	Set	1
	vii.	Cables, ODF, MDF, panels as required	Lot	1
4O5	PLC equipment at Local end SS			
	i.	Indoor PLC Equipment with all accessories & Panels (Front opening, Swing Frame type)	Set	0
	ii.	Line matching unit	No.	0
	iii.	Cables & other accessories for complete PLCC system	Lot	0
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	0

4P SCADA system for Telecontrol and Telemetering

01 (One) lot of ~~extension/modification of~~ complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to provide the tele-control & tele-metering facilities required at the existing National Load Despatch Center (NLDC) Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration of Cox's Bazar 132/33kV Indoor GIS 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 NLDC SCADA/EMS system both in Master station at Aftabnagar, Rampura and Backup station at Siddhirganj are under the scope of the contractor.

Scope of supply work in Cox's Bazar 132/33kV Indoor GIS Substation shall include of 02 (two) no of industrial gateways with redundant Ethernet switches, 01 (one) hardware firewall, cables, separate panel with wiring & all other accessories with proper configuration as needed for the integration work. Therefore, necessary hardware & software shall be installed here (if required)

Item No.		Description of Equipment Requirement	Unit	Quantity
4P		**SCADA system for Telecontrol and Telemetering**		
4P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	2
	b)	Ethernet Switch	Set	2
	c)	Hardware Firewall	Lot	1
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1
	e)	Cables	Lot	1
	f)	All Other Accessories	Lot	1
	ii.	Integration work with Master & Backup NLDC including Engineering, Testing& Commissioning	Lot	1

4Q Generator for Emergency Aux. Power

Item No.	Description of Equipment Requirement	Unit	Quantity
4Q	**Generator for Emergency Aux. Power (with smoke reduction device)**		
4Q1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device	Set	1

4R Other Equipment

Item No.	Description of Equipment Requirement	Unit	Quantity
4R	**Other equipment**		
4R1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	1
4R2	Emergency Interphone (each room)	Lot	1

Section-V: Teknaf 132/33kV Indoor GIS

5A 400kV GIS Switchyard, structures & connections (Not scope of work)
(Deleted)

5B 245kV GIS Switchyard, structures & connections (Not scope of work)
(Deleted)

5C 145kV GIS Switchyard, structures & connections

145kV indoor Type Gas Insulated Switchgear (GIS)

The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

Item No.		Description of Equipment Requirement	Unit	Quantity
5C		**145 kV switchgear, equipment connection and steel structures (Technical data of CT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
5C1		**145kV GIS Line Feeder Bays, each comprises with:**	**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	145kV, 40kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	viii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	0
	x.	Local Control Cubicle	Set	1
	xi.	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
	xii.	Partial Discharge monitoring internal sensor	Lot	1
5C2		**145kV GIS Power Transformer Feeder Bays, each comprises with:**	**Set**	**02**
	i	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 3150A, 40kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	145kV, 40kA/3s single phase, Current Transformer	No.	3
	vii.	145kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3

Item No.		Description of Equipment Requirement	Unit	Quantity
	viii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	0
	ix.	Local Control Cubicle	Set	1
	x.	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
	xi.	Partial Discharge monitoring internal sensor	Lot	1
5C3	**145kV Bus Coupler Bays, comprises with:**		**Set**	**01**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase busbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	iv.	145kV, 40kA/3s single phase, Current Transformer	No.	06
	v.	Local Control Cubicle	Set	01
	vi.	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, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
5C4	**145kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	145kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iii.	145kV, 40kA/3s, three phase, make proof (high speed) 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
5C5	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
	AIS Switchgear, Equipment & Structure			
5C6	120kV rated voltage, 96kV (rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	12
5C7	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
5C8	**Insulator and fittings including all necessary clamps and connectors as**			

Item No.	Description of Equipment Requirement		Unit	Quantity
	required for completing 132kV Switchyard			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)	Lot	1
	iii.	Nut-bolt	Lot	1
5C9	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**			
	i.	Steel Structure for T/L with Nut & Bolts		
	a)	Gantry Column with single beam	No.	9
	b)	Beam	No.	6
	c)	Gantry Column with double beam	No.	0
	ii.	Equipment Structure with Nut & Bolts		
	a)	LA	No.	12
	b)	Outdoor CSE	No.	12
	iii.	Nut & Bolts	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1

5D **36kV Switchgears and Connections with Power Transformer & Earthing/ Auxiliary Transformers**

36kV Indoor Type Gas Insulated Switchgear (GIS)
(Deleted)

36kV Air Insulated Switchgear (AIS)

The 36kV outdoor AIS switchgears shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included in volume-3 and shall comprise the followings:

5D1 Two (2) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism

5D2 Four (4) sets of 36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch

5D3 Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection

5D4 Six (6) nos. of single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers

5D5 Twelve (12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection

5D6 Six (6) nos. of Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.

5D7 Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer

5D8 One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard, auxiliary transformer and 33kV Capacitor Bank connection

5D9 One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard, auxiliary transformer and 33kV Capacitor Bank connection (*1 lot= actual requirement + additional 20% of each type of clamp, connectors and fittings as spare)

5D10 One (1) lot of cables & terminations including other accessories for auxiliary transformer connection

5E Power Transformers & Auxiliary transformers

Item No.	Description of Equipment Requirement	Unit	Quantity
5E	**Power Transformers & Auxiliary transformers (Technical data of CT/BCT & VT shall be referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
5E1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer and Remote Tap Changer Control (RTCC) Panel.Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2
5E2	Auxiliary power transformer 33/0.415 kV, 350 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase 2-core current transformers in all bushings, associated outdoor neutral CTs, including all necessary connections & support structures. The auxiliary transformer capacity shall be validated by calculation during execution stage; and if required, higher capacity transformer shall have to be provided within same price.	Set	2
5E3	Design, supply and construction of Water Spray fire fighting system for 132kV Power transformers including water pipe network and reservoir at normal pressure for:		
	i. 132/33 kV Power Transformer	Set	0

Item No.	Description of Equipment Requirement	Unit	Quantity
5E4	Two (02) nos. of 33kV Capacitor Bank with associated equipment	Set	0

5F Control, Protection, Substation Automation & Metering

Item No.		Description of Equipment Requirement	Unit	Quantity
5F		**Control, Protection, Substation Automation & Metering**		
400kV Circuit (Deleted)				
230kV Circuits(Deleted)				
132kV Circuits				
5F1		**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay & Protection back up relay		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F2		**Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2), different make		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Automatic Voltage Regulator (AVR) with provision of auto/manual and independent/parallel operation of Tap Changer		
	v.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F3		**Control, Protection, Monitoring including SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles**	Set	0
		Each comprising		
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay & Protection back up relay		

Item No.		Description of Equipment Requirement	Unit	Quantity
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F4	**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**		Set	1
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F5	**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**		Set	0
		Each comprising		
	i.	BCU, Multi-function meter 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.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F6	**Busbar Protection including SAS Function (132kV Circuit)**		Set	1
		Each comprising		
	i.	Protection Relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit HMI		
	ii.	Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iii.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		

Item No.		Description of Equipment Requirement	Unit	Quantity
5F7	**Tariff metering comprises with:**			
	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
36kV Circuit				
5F8	**Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles**		Set	2
	Each comprising			
	i.	BCU, Multi-function meter and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (as backup: 87T,67,67N,50,50N,51,51N,49, 81O, 81U, 81R)		
	iii.	Auxiliary relays (TCS, Lockout, etc.) Selector switch for switching BBP, BFP, output contacts, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.) *** TTBs have to be placed at the front side of the respective panel. 2 nos. of associated Test plugs should be supplied for each substation as spares.		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
5F9	**Tariff metering comprises with:**			
	i.	Meters (Main & Check)	set	2
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
Substation Automation system comprises with			Lot	1
5F10	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	Lot	1
	iii.	GPS system (including lightning protection)	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
	v.	LCD Monitor, 75" 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	Engineering Software Tool	Set	1
	xi	Troubleshooting software tool	Set	1
	xii	Other Accessories (if any)	Lot	1

Note: Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVArhmeters for each 230kV line and transformer feeders. For each feeder minimum two meters (main & check & different manufacturer) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

Note: Only on/off monitoring of ES and measuring of bus PT shall be integrated with SAS within the contract price.

5G Digital Fault & Disturbance Recorder System

Item No.		Description of Equipment Requirement	Unit	Quantity
5G	**Digital Fault & Disturbance Recorder, each comprising**		**Lot**	**00**
	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	set	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables &Other Accessories	Lot	01

5H 230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL

5H1 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.
(Deleted)

5H2 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 2000 mm^2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution.

5H3 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)

(Deleted)

5H4 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)

5H5 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm^2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
The capacity & size of cable shall be finalized by calculation during execution. For 33kV transformer incomer feeders, three (03) runs of cable per phase shall have to be considered. For 33kV transformer outgoing feeders, two (02) runs of cable per phase shall have to be considered.
(Deleted)

5H6 The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.
The quantity of cable termination ends shall be quoted in 'nos'. (Payment will be at actual quantity basis if quantity increases or decreases during execution)
(Deleted)

5H7 The lot of Gas Insulated Line (GIL), three phase or single phase enclosure, for 230kV GIS connection circuits with necessary connecting terminal chambers including support structures, etc. for 3150A circuits of 8 nos. of feeders (06 nos. T/L & 02 nos. T/R). The Length of GIL shall be quoted in 'meter' and shall be different for each bay as per actual design. Actual payment shall be as per final design. GIL length shall be calculated considering the physical distance of connection for each bay/feeder/circuit, irrespective of single/three phase enclosure.

5I Earthing and Lightning Protection

Item No.	Description of Equipment Requirement	Unit	Quantity
5I	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.		
5I1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1
5I2	Lightning Protection System for complete substation (overheadearthwire or mast type)	Lot	1
5I3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2

5J Multicore Low Voltage Power & Control Cables

5J1 One (1) lot complete set of multicore low voltage auxiliary XLPE insulated power and control cables (IEC 60502) between all items of equipment supplied under the contract and for connection and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours& tags. The overall substation cable routing and core schedules shall also be provided.

Item No.	Description of Equipment Requirement	Unit	Quantity
5J1	**Multicore Cables for control, protection, metering & power circuits**		
	i. LV Control Cable	Lot	1
	ii. LV Power Cable	Lot	1

5K Batteries, Chargers and DC Distribution

5K1 One (1) lot of two (2) sets of 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed, tested and commissioned to provide all DC supplies to equipment including powering two (2) sets of 240V, 50Hz, 3kVA UPS (Inverter) for 60 minutes being supplied. One set shall be used as standby supply.
Necessary DC distribution switchboards shall be provided at the various place of the substation, according to the detail design.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium110V batteries complete, each capacity shall not be less than 350Ah at the 5-hour rate of discharge.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of battery chargers (IGBT type) complete, each float charge shall not be less than 120A rating and input voltage shall be three phase, 50Hz, 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller.

The DC distribution board shall be with 25% overall spare switches for future use.

iv. Two (2) sets of Online UPS (Inverter) 240V, 50Hz, 3kVA powered from 110V DC distribution board as bypass circuit for substation automation system.

Two (2) sets of batteries and battery chargers shall be located in the main control building and shall be used for the first main and second main DC supplies for 230kV switchyards.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) shall be incorporated in substation automation system.

5K2 One (1) lot of two (2) sets of 48V DC system and distribution equipment to be supplied installed and commissioned in the main control building for the new fiber optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

i. Two (2) sets of 100% Ni-cadmium48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per section 8 of Volume 2 of 3 of the biding document. The battery with higher capability, if required after calculation, shall be supplied within the same price.

ii. Two (2) sets of 48V battery charger, 90A and input 415V AC.

During execution stage the capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The rating shall be on the load and boost charging rate and charger with higher capability, if required after calculation, shall be supplied within the same price.

iii. One (1) lot of 48V DC Distribution panel, with Digital Display & Controller.

The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 25% overall spare switches for future use.

48V DC system and distribution equipment shall be located in the Main Control Building.

All DC status excluding control & protection (DC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

5L LVAC Distribution

5L1 One (1) lot of LVAC panels & switchboards (MCC type, LV S.W room, each panel & control room, generator room, etc.) with Digital Display & Controller, for 230/33kV

substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this project. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.

Station auxiliary power (415V) shall be comprised: Aux. TR-1, Aux. TR-2 sides & Generator

All AC status excluding control & protection (AC voltage status for each bus including coupling breaker on/off status, fail with alarm) shall be incorporated in substation automation system.

The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the auto transformers (including one set of UPS/inverter backup powered from 110V DC system).

5L2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV earthing/auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check). Substation Automation System shall include the metering for all incoming LVAC source feeder (230kV part).

5M Civil Works, Building and Foundation

5M1 Complete Land Development with carried/dredged earth filling & necessary slope protection

5M2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 33kV GIS switchyards, Transformer yard.

5M3 One (1) lot of complete design, supply and construction of all civil works, including 230kV, 132kV & 33kV gantry foundations, pole & tower foundations, 230kV, 132kV and 33kV equipment foundations, power transformers & auxiliary transformer foundations, oil pit, blast walls, substation main gate, security boundary walls and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing,property line demarcation and gravel surfacing, etc.

All necessary outdoor civil works for re- and de-installation and removal of the existing equipment/material/foundations/roads/fence/cables/cable routes, existing 230kV, 132kV & 33kV (indoor & outdoor) switchyard, existing transformers, transformer foundations (if required), etc. from the site. Cables, transformers & other equipment shall have to be returned to respective GMD. Necessary interim arrangement for dismantling & installation works for any lines'/feeders' by-pass arrangement (if required) are deemed included in contract scope.

5M4 One (1) lot of complete design, supply and construction of all civil items and facilities

required for the 132kV GIS buildings cum main control building to install all control and protection panels including batteries & chargers, one manager's rooms, one in-charge's room, tea-room, store room, meeting room and etc., including foundation works, super structure works, EOT crane, lift, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

All necessary indoor civil works for re- and de-installation and removal of the existing equipment from the site.

132kV GIS & control building shall be multi-storied building, with future space provision as stated in the scope above (refer to building drawings for tender purpose, detail design of GIS building shall be finalized during execution stage).

The clearance between GIS and side walls (left, right) shall be minimum 4000mm, the clearance between GIS and periphery walls (top & bottom) shall be minimum 2700mm. GIS building size is defined based on each GIS bay width of 2.0m. In case of increase in building size due to increase of GIS bay width more than 2.0m, price variation in GIS building size shall not be allowed.
This item also includes a single-storied Ansar Barak including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, kitchen, floor finishing, rain water drainage system, lightning protection, etc. (building size of minimum 5.1mX20m, detail design shall be finalized during execution stage)

5M5 Compression test & uplift test of pile

5N Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system

Item No.	Description of Equipment Requirement		Unit	Quantity
5N	One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings including lighting (flood light; sodium/mercury) for security, roadway, switchyard auxiliary & other houses, Fire Fighting System & CCTV.Necessary Sizing calculation shall have to be submitted for approval during execution stage.			
5N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Battery Rooms, other rooms, etc.) and emergency DC lighting for Indoor (GIS & control room, generator room, auxiliary & other houses)		Lot	1
5N2	Lighting (Flood light LED type) for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor (at strategic locations for equipment operation and inspection)		Lot	1
5N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room			
	i)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	0
	ii)	Fire Fighting system For 230kV GIS Hall & Panel Room	Lot	0
	iii)	Fire Fighting system For 132kV GIS Hall & Panel Room	Lot	1
	iv)	Fire Fighting system For Control Room	Lot	1
5N4	Complete CCTV with motion sensor (each room and S/Y)		Lot	1

5O Telecommunication System Fibre optic multiplexer equipment for communication and protection

Item No.		Description of Equipment Requirement	Unit	Quantity
5O		**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations** - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system		
5O1		Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising		
	i.	ADM with TP unit with Panels (Front opening, Swing Frame type) & accessories	Set	04
	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	08
	vi.	All other Accessories not included above	Lot	1
5O2		Other Indoor equipment, at Local end SS		
	i.	Primary phone (IP phone)	No.	06
	ii.	Secondary phone (2W phone with caller ID)	No.	10
	iii.	Indoor MDF	Set	1
5O3		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	10
5O4		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	Lot	1
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v.	Optical Booster, if required	Lot	1
	vi.	Outdoor termination box	Set	1
	vii.	Cables, ODF, MDF, panels as required	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
5O5	PLC equipment at Local end SS			
	i.	Indoor PLC Equipment with all accessories & Panels (Front opening, Swing Frame type)	Set	0
	ii.	Line matching unit	No.	0
	iii.	Cables & other accessories for complete PLCC system	Lot	0
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	0

5P SCADA system for Telecontrol and Telemetering

01 (One) lot of ~~extension/modification of~~ complete set of design, supply, delivery, installation, testing & commissioning of hardware and software to provide the tele-control & tele-metering facilities required at the existing National Load Despatch Center (NLDC) Master station at Aftabnagar, Rampura and Backup station at Siddhirganj for integration of Teknaf 132/33kV Indoor GIS 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 NLDC SCADA/EMS system both in Master station at Aftabnagar, Rampura and Backup station at Siddhirganj are under the scope of the contractor.

Scope of supply work in Teknaf 132/33kV Indoor GIS Substation shall include of 02 (two) no of industrial gateways with redundant Ethernet switches, 01 (one) hardware firewall, cables, separate panel with wiring & all other accessories with proper configuration as needed for the integration work. Therefore, necessary hardware & software shall be installed here (if required)

Item No.	Description of Equipment Requirement		Unit	Quantity
5P	**SCADA system for Telecontrol and Telemetering**			
5P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	2
	b)	Ethernet Switch	Set	2
	c)	Hardware Firewall	Lot	1
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1
	e)	Cables	Lot	1
	f)	All Other Accessories	Lot	1
	ii.	Integration work with Master & Backup NLDC including Engineering, Testing& Commissioning	Lot	1

5Q Generator for Emergency Aux. Power

Item No.	Description of Equipment Requirement	Unit	Quantity

Item No.	Description of Equipment Requirement	Unit	Quantity
5Q	**Generator for Emergency Aux. Power (with smoke reduction device)**		
5Q1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device	Set	1

5R Other Equipment

Item No.	Description of Equipment Requirement	Unit	Quantity
5R	**Other equipment**		
5R1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	1
5R2	Emergency Interphone (each room)	Lot	1

Section-VI 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. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Employer.

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE B

Tender PRICES& SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar&Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

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 Tender Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If 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 tender.

Pricing

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

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

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

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

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

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
SECTION-I	**Hi-Tech 230/33kV Gas Insulated Substation:**					
1A	**400kV GIS Switchyard (Future)**					
	420kV Outdoor Type Gas Insulated Switchgear (GIS)		0	Sets		
1B	**245kV GIS Switchyard, structures & connections**					
	245kV indoor Type Gas Insulated Switchgear (GIS)					
1B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure		2	Sets		
1B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure		2	Sets		
1B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure		1	Sets		
1B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local Control Cubicle and support structure		0	Sets		
1B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		2	Sets		
1B6	Busbar extension module		2	Sets		
	245kV Air Insulated Switchgear (AIS)					
1B7	198kV rated voltage, 158kV (rms) continuous operating voltage at		12	nos.		
1B8	Rigid tubular conductor and/or stranded conductors including					
1B8.1	Tubular Conductor and/or Flexible Conductor		1	lot		
1B9	Insulator and fittings including all necessary clamps and connectors					
1B9.1	Insulator		1	lot		
1B9.2	Fittings & Clamps, Connector		1	lot		
1B9.3	Nut-bolt		1	lot		
1B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer					
1B10.1	Steel Structure for T/L with Nut & Bolts					
1B10.1.a)	Gantry Column with single beam		9	Nos		
1B10.1.b)	Beam		6	Nos		
1B10.1.c)	Gantry Column with double beam		0	Nos		
1B10.2	Equipment Structure with Nut & Bolts					
1B10.2.a)	LA		12	Nos.		
1B10.2.b)	Outdoor CSE		0			
1B10.3	Nut & Bolts		1	lot		
1B10.4	LV power & control cable tray including fitting, fixing accessories		1	lot		
1B10.5	HV power Cable tray including fitting, fixing accessories		0	lot		
1C	**145kV Switchger & connection (N/A)**		0	Sets		
1D	**36kV Switchger & connection**				-	
1D1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism		2	sets		
1D2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector		4	sets		
1D3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary		2	sets		
1D4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers		6	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
1D5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer &		12	nos.		
1D6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type		6	nos.		
1D7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV		1	lot		
1D8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for		1	lot		
1D9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection		1	lot		
1D10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection		1	lot		
1E	**Power Transformers and Earthing/Auxiliary Transformers**					
1E1	230/33 kV, 120/140 MVA (ONAN/ONAF), three phase outdoor type		2	sets		
1E2	Auxiliary power transformer 33/0.415 kV, 350 kVA		2	sets		
1E3	Fire fighting system for 230/33 kV Power Transformer		2	sets		
1F	**Control, Protection, Substation Automation and Metering**					
	230kV Circuits					
1F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		2	sets		
1F2	Control, Protection, Monitoring including SAS Function for Power transformer (140MVA) circuits, along with Control & Protection		2	sets		
	Control, Monitoring, Protection & Substation Automation System for two (2) sets of 420kV bus coupler bays		0	lot		
	Control, Monitoring, Protection & Substation Automation System for two (2) sets of 420kV bus section bays		0	lot		
	Control, Monitoring, Protection & Substation Automation System for one (1) lot of 420KV busbars		0	lot		
	Tariff metering for 400kV system		0	lot		
	Digital Disturbance Recorder with Analysis Computor for 400kV system and 230kV system		0	lot		
	Line differential protection relays for the transmission lines to Meghnaghat-1/2 and Banskhali-1/2 at remote end substation		0	sets		
	245kV Circuits					
1F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		2	sets		
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		1	sets		
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		0	sets		
1F5	Busbar Protection including SAS Function (230kV Circuit)		1	sets		
1F6	Tariff meter					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
1F6.1	Meters (Main & Check)		4	sets		
1F6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
	36kV Circuits					
1F7	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles		2	sets		
1F8	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)		0	sets		
1F9	Tariff meter					
1F9.1	Meters (Main & Check)		2	sets		
1F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
1F10	**Substation Automation system**		1	lot		
1G1	**Digital Fault & Disturbance Recorder**		1	lot		
1H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**					
1H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.		0	m		
1H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.		0	m		
1H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
1H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
1H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		0	m		
1H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single		0	Nos.		
1H7	230kV, 3150A GIL		120	m		
1I	**Earthing and Lightning Protection system**					
1I1	Earthing system for complete substation		1	lot		
1I2	Lightning Protection System for complete substation		2	lot		
1I3	3-phase Portable earthing devices		2	sets		
1J	**Multicore Low Voltage Power & Control Cables**					
1J1.1	LV Control Cable		1	lot		
1J1.2	LV Power Cable		1	lot		
1K	**Batteries, chargers & DC distribution**					
1K1	110V Ni-cad Batteries with chargers and distribution boards					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
i	110V Ni-cad Batteries, 350Ah @ 5h		2	sets		
ii	120A Battery chargers		2	sets		
iii	DC Distribution Board		1	lot		
iv	3kVA, 240V, 50Hz UPS (inverter)		2	sets		
1K2	48V Ni-cad Batteries with chargers and distribution board					
i	48V Ni-cad Batteries, 200Ah @ 5h		2	sets		
ii	90A Battery chargers		2	sets		
iii	DC Distribution Board		1	lot		
1K3	Necessary modification & extension works in existing DCDB		0	lot		
1L	**LVAC Distribution**					
1L1	LVAC switchboard for substation services		1	lot		
1L2	Tariff metering panel		1	lot		
1M	**Civil Works, Building and Foundation (Refer to 1M of Schedule B4)**					
1M4	GIS cum control room building & Ansar barack					
ii	10 ton EOT crane		1	lot		
1N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**		1	lot		
1N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting		1	lot		
1N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor		1	lot		
1N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room					
1N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room		1	lot		
1N3.2	Fire Fighting system For 400kV GIS Hall & Panel Room		0	lot		
1N3.3	Fire Fighting system For Control Room		1	lot		
1N4	Complete CCTV with motion sensor (each room and S/Y)		1	lot		
1O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**					
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system		1	lot		
1P	**SCADA system for Telecontrol and Telemetering**					
1P1	SCADA system for Telecontrol and Telemetering		1	lot		
1Q	**Generator for Emergency Aux. Power**					-
1Q1	Generator for Emergency Aux. Power		1	set		
1R	**Other Equipment**					
1R1	Scissor Lift		1	set		
1R2	Emergency Interphone (each room)		1	lot		
	Total of Section-I					
	(Carried to Schedule-5:Grand summary)					
SECTION-II	**Section-II: Kaliakoir 230kV AIS Bay extension**					
2A	**400kV Switchyard, structures & connections (Deleted)**					
2B	**230kV Switchyard, structures & connections**					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
	230kV Air Insulated Switchgear, Equipment Connection and Steel Structure					
2B1	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, live tank type, single-pole operation, SF6 gas circuit breakers with spring-stored energy operating mechanism		3	Sets		
2B2	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors with motor-operated earthing switch.		2	Sets		
2B3	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors without earthing switch		6	Sets		
2B4	Single-phase, 5-core, 230kV, 50kA/1sec, 3000-1500/1A, 50Hz, 1425kVp BIL post type current transformer		12	Nos		
2B5	Single-phase, 3-core, 400kV, 50Hz, 1425kVp BIL, capacitor type voltage transformers.		6	Nos		
2B6	198kV rated voltage, 158kV(rms) continuous operating voltage at 50˚c 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.		6	Nos		
2B7	Deleted					
2B8	400kV post type support insulators required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.		1	lot		
2B9	rigid tubular bus [Aluminium of grade 63401 WP], flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 230kV busbar and switchgear connection as specified in the technical specifications and bid drawings. Bus capacity shall be minimum 4000A/50kA/1s. Existing Bus is Aluminium Tube with outer dia. 160mm.		1	lot		
2B10	Steel structures for gantry and equipment supports required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.		1	lot		
2C	**145kV GIS Switchyard, structures & connections (Deleted)**		0	Sets		
2D	**36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers (Deleted)**		0	Sets	-	
2E	**Power Transformers and Earthing/Auxiliary Transformers**		0	Sets		
2F	**Control, Protection, Substation Automation and Metering**					
	230kV Circuits					
2F1	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two (02) sets of 230KV overhead line circuits bays.		2	sets		
2F2	Renovation/Extension of existing Busbar protection for 230kV system.		1	lot		
2F3	Tariff metering panel for each 230-kV line feeders.		1	lot		
	Substation Automation System					
2F4	Extension of SAS including all required equipment & accessories		1	lot		
			0	lot		
2G	**Digital Fault & Disturbance Recorder**					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
2G1	Modification / extension of Digital Fault and Disturbance recorder (DFDR)		1	lot		
2H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**					
2H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.		900	m		
2H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.		0	m		
2H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		6	Nos.		
2H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
2H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		0	m		
2H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
2H7	230kV, 3150A GIL		0	m		
2I	**Earthing and Lightning Protection system**					
2I1	Earthing System for Extension part of Substation		1	lot		
2I2	Lightning Protection system for Extension part of Substation		1	lot		
2J	**Multicore Low Voltage Power & Control Cables**					
2J1	LV Power and Control Cables for completion of entire Bay Extension works		1	lot		
2K	**Batteries, chargers & DC distribution**					
2K1	Extension of existing 110V DC distribution board/ new DCDB panel		1	lot		
2K2	Extension of existing 48V DC distribution board/ new DCDB panel		1	lot		
2L	**LVAC Distribution**					
2L1	Extension of LVAC switchboard		1	lot		
2M	**Civil Works, Building and Foundation (Refer to 2M of Schedule B4)**					
2N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**		1	lot		
2N1	Indoor lighting (LED type), LV power supply, and emergency DC lighting for extension work.		1	lot		
2N2	Deleted		0	lot		
2N3	Lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection for extension work.		1	lot		
2N4	Deleted		0	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
2O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**					
2O1	One (01) complete lot of equipment for extension of existing fibre optic multiplexer equipment at local and remote end Substation for protection & communication, for required part of substation, shall be designed, supplied, delivered, installed, tested and commissioned and integrated into the existing system, under this contract. Fibre optic multiplexer equipment is to be provided for - 21 (or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) Distance relay carrier signal (main and back-up) SCADA data from switchgear and control system through SAS Hot-line telephone system Substation LAN system		1	lot		
2O2	Armoured Underground Optical Fibre (48 cores) cables from terminal box at gantry structure to MDF		1	lot		
2P	**SCADA system for Telecontrol and Telemetering**					
2P1	SCADA system for Telecontrol and Telemetering		1	lot		
2Q	**Generator for Emergency Aux. Power**		1	set		-
2Q1	Generator for Emergency Aux. Power		0	set		
2R	**Other Equipment**					
2R1	Scissor Lift		0	set		
2R2	Emergency Interphone (each room)		0	lot		
	Total of Section-II					
	(Carried to Schedule-5:Grand summary)					
SECTION-III	**Anwara 230/132/33kV Indoor GIS:**					
3A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**		0	Sets		
3B	**245kV GIS Switchyard, structures & connections**					
	245kV indoor Type Gas Insulated Switchgear (GIS)					
3B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure		8	Sets		
3B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure		2	Sets		
3B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure		2	Sets		
3B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local Control Cubicle and support structure		2	Sets		
3B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		4	Sets		
3B6	Busbar extension module		2	Sets		
	245kV Air Insulated Switchgear (AIS)					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
3B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		24	nos.		
3B8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard					
3B8.1	Tubular Conductor and/or Flexible Conductor		1	lot		
3B9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard					
3B9.1	Insulator		1	lot		
3B9.2	Fittings & Clamps, Connector		1	lot		
3B9.3	Nut-bolt		1	lot		
3B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard					
3B10.1	Steel Structure for T/L with Nut & Bolts					
3B10.1.a)	Gantry Column with single beam		13	Nos		
3B10.1.b)	Beam		10	Nos		
3B10.1.c)	Gantry Column with double beam		0	Nos		
3B10.2	Equipment Structure with Nut & Bolts					
3B10.2.a)	LA		24	Nos.		
3B10.2.b)	Outdoor CSE		0			
3B10.3	Nut & Bolts		1	lot		
3B10.4	LV power & control cable tray including fitting, fixing accessories		1	lot		
3B10.5	HV power Cable tray including fitting, fixing accessories		1	lot		
3C	**145kV GIS Switchyard, structures & connections**					
	145kV indoor Type Gas Insulated Switchgear (GIS)				-	
3C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure		2	Sets		
3C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure		4	Sets		
3C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure		1	Sets		
3C4	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure		0	Sets		
3C5	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		2	Sets		
3C6	Busbar extension module		2	Sets		
	145kV Air Insulated Switchgear (AIS)					
3C7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		18	nos.		
3C8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard					
3C8.1	Tubular Conductor and/or Flexible Conductor		1	lot		
3C9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard					
3C9.1	Insulator		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
3C9.2	Fittings & Clamps, Connector		1	lot		
3C9.3	Nut-bolt		1	lot		
3C10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard					
3C10.1	Steel Structure for T/L with Nut & Bolts					
3C10.1.a)	Gantry Column for single beam		8	Nos		
3C10.1.b)	Beam		6	Nos		
3C10.1.c)	Gantry Column with double beam		0	Nos		
3C10.2	Equipment Structure with Nut & Bolts					
3C10.2.a)	LA		18	Nos.		
3C10.2.b)	Outdoor CSE		18			
3C10.3	Nut & Bolts		1	lot		
3C10.4	LV power & control cable tray including fitting, fixing accessories		1	lot		
3C10.5	HV power Cable tray including fitting, fixing accessories		1	lot		
3D	**36kV Switchger & connection**					
3D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism		2	sets		
3D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch		4	sets		
3D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection		4	sets		
3D.4	Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism for auxiliary transformer feeder		2	sets		
3D.5	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers		12	nos.		
3D.6	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection		12	nos.		
3D.7	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.		6	nos.		
3D.8	Current transformer 36 kV, single-phase, 3-core, multi ratio, 10/1A, 800-1250/1-1A, 31.5kA/1sec, 50 Hz, 170/70 kV BIL, post type current transformer for auxiliary transformer feeder		6	nos.		
3D.9	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer		1	lot		
3D.10	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
3D.11	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. including otheraccessories for each connection as required for completing 36kVSwitchyard and auxiliary transformer connection		1	lot		
3D.12	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection		1	lot		
3E	**Power Transformers and Earthing/Auxiliary Transformers**					
3E.1	230/132/33 kV, 250/350 MVA (ONAN/ONAF), three phase outdoor type power (auto) transformer		2	sets		
3E.2	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer		2	sets		
3E.3	Auxiliary power transformer 33/0.415 kV, 400 kVA		2	sets		
3E.3	Water Spray fire fighting system for 230/132/33 kV Power Transformer		2	sets		
3F	**Control, Protection, Substation Automation and Metering**					
	145kV Circuits					
3F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		6	sets		
3F2	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles		2	sets		
3F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		2	sets		
3F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		2	sets		
3F5	Busbar Protection including SAS Function (230kV Circuit)		1	sets		
3F6	Tariff meter					
3F.6.1	Meters (Main & Check)		8	sets		
3F.6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
	145kV Circuits					
3F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		2	sets		
3F8	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles		2	sets		
3F9	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles		2	sets		
3F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		1	sets		
3F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		0	sets		
3F12	Busbar Protection including SAS Function (145kV Circuit)		1	sets		
3F13	Tariff meter					
3F.13.1	Meters (Main & Check)		6	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
3F.13.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
	36kV Circuits					
3F14	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles		4	sets		
3F15	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer		0	sets		
3F16	Tariff meter					
3F16.1	Meters (Main & Check)		4	sets		
3F16.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
3F17	**Substation Automation system**		1	lot		
3G	**Digital Fault & Disturbance Recorder**					
3G1	Digital Fault & Disturbance Recorder		1	lot		
3H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**					
3H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.		0	m		
3H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.		900	m		
3H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
3H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		12	Nos.		
3H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		0	m		
3H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
3H7	230kV, 3150A GIL		700	m		
3I	**Earthing and Lightning Protection system**					
3I1	Earthing system for complete substation		1	lot		
3I2	Lightning Protection System for complete substation		1	lot		-
3I3	3-phase Portable earthing devices		2	sets		
3J	**Multicore Low Voltage Power & Control Cables**					
3J1.1	LV Control Cable		1	lot		
3J1.2	LV Power Cable		1	lot		
3K	**Batteries, chargers & DC distribution**					
3K1	110V Ni-cad Batteries with chargers and distribution boards					
i	110V Ni-cad Batteries, 400Ah @ 5h		1	lot		
ii	150A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
iv	3kVA, 240V, 50Hz UPS (Inverter)		1	lot		
3K2	48V Ni-cad Batteries with chargers and distribution board					
i	48V Ni-cad Batteries, 200Ah @ 5h		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
ii	90A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
3K3	Necessary modification & extension works in existing DCDB		0	lot		
3L	**LVAC Distribution**					
3L1	LVAC switchboard for substation services		1	lot		
3L2	Tariff metering panel		1	lot		
3M	**Civil Works, Building and Foundation (Refer to 3M of Schedule**					
3M4	GIS cum control room building & Ansar Barack					
ii	10 ton EOT crane		1	lot		
vi	10 ton EOT crane		1	lot		
3N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**		1	lot		
3N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting		1	lot		
3N2	Lighting for outside building for security, roadway, switchyard and		1	lot		
3N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room					
3N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room		1	lot		
3N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room		1	lot		
3N3.3	Fire Fighting system For Control Room		1	lot		
3N4	Complete CCTV with motion sensor (each room and S/Y)		1	lot		
3O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**					
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system		1	lot		
3P	**SCADA system for Telecontrol and Telemetering**					
3P1	SCADA system for Telecontrol and Telemetering		1	lot		
3Q	**Generator for Emergency Aux. Power**					
3Q1	Generator for Emergency Aux. Power		1	set		
3R	**Other Equipment**					
3R1	Scissor Lift		1	set		
3R2	Emergency Interphone (each room)		1	lot		
	Total of Section-III					
	(Carried to Schedule-5:Grand summary)					
SECTION-IV	**Cox's Bazar (N) 132/33kV Indoor GIS**					
4A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**		0	Sets		
4B	**245kV GIS Switchyard, structures & connections (Not in scope)**		0	Sets		
4C	**145kV GIS Switchyard, structures & connections**					
	145kV indoor Type Gas Insulated Switchgear (GIS)				-	

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
4C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure		9	Sets		
4C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure		3	Sets		
4C3	145kV GIS Double Busbar , Capacitor Bank Bays with Local Control Cubicle and support structure		2	Sets		
4C4	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure		2	Sets		
4C5	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure		2	Sets		
4C6	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		4	Sets		
4C7	Busbar extension module		2	Sets		
	145kV Air Insulated Switchgear (AIS)					
4C8	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		39	nos.		
4C9	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard					
4C9.1	Tubular Conductor and/or Flexible Conductor		1	lot		
4C10	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard					
4C10.1	Insulator		1	lot		
4C10.2	Fittings & Clamps, Connector		1	lot		
4C10.3	Nut-bolt		1	lot		
4C11	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard					
4C11.1	Steel Structure for T/L with Nut & Bolts					
4C11.1.a)	Gantry Column for single beam		13	Nos		
4C11.1.b)	Beam		11	Nos		
4C11.1.c)	Gantry Column with double beam		0	Nos		
4C11.2	Equipment Structure with Nut & Bolts					
4C11.2.a)	LA		39	Nos.		
4C11.2.b)	Outdoor CSE		33	Nos.		
4C11.3	Nut & Bolts		1	lot		
4C11.4	LV power & control cable tray including fitting, fixing accessories		1	lot		
4C11.5	HV power Cable tray including fitting, fixing accessories		1	lot		
4D	**36kV Switchger & connection**					
4D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism		3	sets		
4D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch		6	sets		
4D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure		2	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
4D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure		9	nos.		
4D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure		15	nos.		
4D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.		9	nos.		
4D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer		1	lot		
4D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard		1	lot		
4D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. including otheraccessories for each connection as required for completing 36kVSwitchyard and auxiliary transformer connection		1	lot		
4D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection		1	lot		
4E	**Power Transformers and Earthing/Auxiliary Transformers**					
4E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer		3	sets		
4E.2	Auxiliary power transformer 33/0.415 kV, 400 kVA		2	sets		
4E.3	Water Spray fire fighting system		0	sets		
4E.4	132kV 50MVAR Capacitor Bank with associated equipment		2	sets		
4F	**Control, Protection, Substation Automation and Metering**					
	145kV Circuits					
4F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		8	sets		
4F2	Control, Protection, Monitoring including SAS Function for Power transformer circuits, along with Control & Protection Cubicles		3	sets		
4F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles		2	sets		
4F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		2	sets		
4F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		2	sets		
4F6	Busbar Protection including SAS Function (132kV Circuit)		1	sets		
4F7	Tariff meter					
4F7.1	Meters (Main & Check)		11	sets		
4F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
	36kV Circuits					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
4F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles		3	sets		
4F9	Tariff meter					
4F9.1	Meters (Main & Check)		3	sets		
4F9.2	Complete Panel (Front opening, Swing frame type) including wiring,		1	lot		
4F10	**Substation Automation system**		1	lot		
4G	**Digital Fault & Disturbance Recorder**					
4G1	Digital Fault & Disturbance Recorder		1	lot		
4H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**					
4H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.		0	m		
4H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.		1200	m		
4H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
4H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		33	Nos.		
4H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase		0	m		
4H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
4H7	230kV, 3150A GIL		0	m		
4I	**Earthing and Lightning Protection system**					
4I1	Earthing system for complete substation		1	lot		
4I2	Lightning Protection System for complete substation		1	lot		-
4I3	3-phase Portable earthing devices		2	sets		
4J	**Multicore Low Voltage Power & Control Cables**					
4J1.1	LV Control Cable		1	lot		
4J1.2	LV Power Cable		1	lot		
4K	**Batteries, chargers & DC distribution**					
4K1	110V Ni-cad Batteries with chargers and distribution boards					
i	110V Ni-cad Batteries, 400Ah @ 5h		1	lot		
ii	150A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
iv	3kVA, 240V, 50Hz UPS (Inverter)		1	lot		
4K2	48V Ni-cad Batteries with chargers and distribution board					
i	48V Ni-cad Batteries, 200Ah @ 5h		1	lot		
ii	90A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
4K3	Necessary modification & extension works in existing DCDB		0	lot		
4L	**LVAC Distribution**					
4L1	LVAC switchboard for substation services		1	lot		
4L2	Tariff metering panel		1	lot		
4M	**Civil Works, Building and Foundation (Refer to 4M of Schedule B4)**					
4M4	GIS cum control room building & Ansar barack					
ii	10 ton EOT crane		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
4N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**		1	lot		
4N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting		1	lot		
4N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor		1	lot		
4N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room					
4N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room		0	lot		
4N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room		1	lot		
4N3.3	Fire Fighting system For Control Room		1	lot		
4N4	Complete CCTV with motion sensor (each room and S/Y)		1	lot		
4O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**					
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system		1	lot		
4P	**SCADA system for Telecontrol and Telemetering**					
4P1	SCADA system for Telecontrol and Telemetering		1	lot		
4Q	**Generator for Emergency Aux. Power**					
4Q1	Generator for Emergency Aux. Power		1	set		
4R	**Other Equipment**					
4R1	Scissor Lift		1	set		
4R2	Emergency Interphone (each room)		1	lot		
	Total of Section-IV					
	(Carried to Schedule-5:Grand summary)					
SECTION-V	**Teknaf 132/33kV Indoor GIS**					
5A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**		0	Sets		
5B	**245kV GIS Switchyard, structures & connections (Deleted)**		0	Sets		
5C	**145kV GIS Switchyard, structures & connections**					
	145kV indoor Type Gas Insulated Switchgear (GIS)				-	
5C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure		2	Sets		
5C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure		2	Sets		
5C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure		1	Sets		
5C4	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure		2	Sets		
5C5	Busbar extension module		2	Sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
	145kV Air Insulated Switchgear (AIS)					
5C6	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		12	nos.		
5C7	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard					
5C7.1	Tubular Conductor and/or Flexible Conductor		1	lot		
5C8	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard					
5C8.1	Insulator		1	lot		
5C8.2	Fittings & Clamps, Connector		1	lot		
5C8.3	Nut-bolt		1	lot		
5C9	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard					
5C9.1	Steel Structure for T/L with Nut & Bolts					
5C9.1.a)	Gantry Column with single beam		9	Nos		
5C9.1.b)	Beam		6	Nos		
5C9.1.c)	Gantry Column with double beam		0	Nos		
5C9.2	Equipment Structure with Nut & Bolts					
5C9.2.a)	LA		12	Nos.		
5C9.2.b)	Outdoor CSE		12	Nos.		
5C9.3	Nut & Bolts		1	lot		
5C9.4	LV power & control cable tray including fitting, fixing accessories		1	lot		
5C9.5	HV power Cable tray including fitting, fixing accessories		1	lot		
5D	**36kV Switchger & connection**					
5D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism		2	sets		
5D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch		4	sets		
5D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure		2	sets		
5D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure		6	nos.		
5D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure		12	nos.		
5D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.		6	nos.		
5D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
5D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard		1	lot		
5D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection		1	lot		
5D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection		1	lot		
5E	**Power Transformers and Earthing/Auxiliary Transformers**					
5E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer		2	sets		
5E.2	Auxiliary power transformer 33/0.415 kV, 350 kVA		2	sets		
5E.3	Auxiliary power transformer 33/0.415 kV, 350 kVA		2	sets		
5E.3	Water Spray fire fighting system		0	sets		
5E.4	33kV Capacitor Bank with associated equipment		0	sets		
5F	**Control, Protection, Substation Automation and Metering**					
	145kV Circuits					
5F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		2	sets		
5F2	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles		2	sets		
5F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles		0	sets		
5F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		1	sets		
5F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		0	sets		
5F6	Busbar Protection including SAS Function (132kV Circuit)		1	sets		
5F7	Tariff meter					
5F7.1	Meters (Main & Check)		4	sets		
5F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
	36kV Circuits					
5F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles		2	sets		
5F9	Tariff meter					
5F9.1	Meters (Main & Check)		2	sets		
5F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories		1	lot		
5F10	Substation Automation system		1	lot		
5G	**Digital Fault & Disturbance Recorder**					
5G1	Digital Fault & Disturbance Recorder		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
5H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**					
5H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.		0	m		
5H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.		600	m		
5H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
5H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.		12	Nos.		
5H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		0	m		
5H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.		0	Nos.		
5H7	230kV, 3150A GIL		0	m		
5I	**Earthing and Lightning Protection system**					
5I1	Earthing system for complete substation		1	lot		
5I2	Lightning Protection System for complete substation		1	lot		-
5I3	3-phase Portable earthing devices		2	sets		
5J	**Multicore Low Voltage Power & Control Cables**					
5J1.1	LV Control Cable		1	lot		
5J1.2	LV Power Cable		1	lot		
5K	**Batteries, chargers & DC distribution**					
5K1	110V Ni-cad Batteries with chargers and distribution boards					
i	110V Ni-cad Batteries, 350Ah @ 5h		1	lot		
ii	120A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
iv	3kVA, 240V, 50Hz UPS (Inverter)		1	lot		
5K2	48V Ni-cad Batteries with chargers and distribution board					
i	48V Ni-cad Batteries, 200Ah @ 5h		1	lot		
ii	90A Battery chargers		1	lot		
iii	DC Distribution Board		1	lot		
5K3	Necessary modification & extension works in existing DCDB		0	lot		
5L	**LVAC Distribution**					
5L1	LVAC switchboard for substation services		1	lot		
5L2	Tariff metering panel		1	lot		
5M	**Civil Works, Building and Foundation (Refer to 5M of Schedule B4)**					
5M4	GIS cum control room building & Ansar barack					
ii	10 ton EOT crane		1	lot		
5N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**		1	lot		
5N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
5N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor		1	lot		
5N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room					
5N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room		0	lot		
5N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room		1	lot		
5N3.3	Fire Fighting system For Control Room		1	lot		
5N4	Complete CCTV with motion sensor (each room and S/Y)		1	lot		
5O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**					
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system		1	lot		
5P	**SCADA system for Telecontrol and Telemetering**					
5P1	SCADA system for Telecontrol and Telemetering		1	lot		
5Q	**Generator for Emergency Aux. Power**					
5Q1	Generator for Emergency Aux. Power		1	set		
5R	**Other Equipment**					
5R1	Scissor Lift		1	set		
5R2	Emergency Interphone (each room)		1	lot		
	Total of Section-V					
	(Carried to Schedule-5:Grand summary)					
SECTION-VI	**Mandatory Spares, Erection & Test Equipment**					
6.1	**420kV Gas Insulated Switchgear**		0	nos		
6.2	**245kV Gas Insulated Switchgear**					
6.2.1	Complete module for offered type Circuit Breaker (each type)		4	sets		
6.2.2	DS/ES Switch		4	sets		
6.2.3	DS/ES mechanism		4	sets		
6.2.4	HES Switch		4	sets		
6.2.5	HES mechanism		4	sets		
6.2.6	Each type of auxiliary contacts unit		4	sets		
6.2.7	Surge arrester		4	sets		
6.2.8	Complete Voltage transformer module		4	sets		
6.2.9	Complete Current transformer module		4	sets		
6.2.10	Closing coils		4	nos.		
6.2.11	Tripping coils		8	nos.		
6.2.12	Circuit breaker operating mechanism		4	nos.		
6.2.13	Disconnector drive		4	nos.		
6.2.14	Coils for Blocking magnet in disconnector drive		4	nos.		
6.2.15	Gas pressure monitoring system		4	nos.		
6.2.16	Pressure Relief Device		4	nos.		
6.2.17	Supporting insulator with barrier		8	nos.		
6.2.18	Barrier insulator or gas tight barrier		8	nos.		
6.2.19	Rubber gaskets “O” rings and seals for SF6 gas		1	lot/SS		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
6.2.20	All types of control valves for SF6 gas		1	lot/SS		
6.2.21	SF6 gas cylinders - 45 kg		8	nos.		
6.3	**145kV Gas Insulated Switchgear**					
6.3.1	Complete module for offered type Circuit Breaker (each type)		4	sets		
6.3.2	DS/ES Switch		4	sets		
6.3.3	DS/ES mechanism		4	sets		
6.3.4	HES Switch		4	sets		
6.3.5	HES mechanism		4	sets		
6.3.6	Each type of auxiliary contacts unit		4	sets		
6.3.7	Surge arrester		4	sets		
6.3.8	Complete Voltage transformer module		4	sets		
6.3.9	Complete Current transformer module		4	sets		
6.3.10	Closing coils		4	nos.		
6.3.11	Tripping coils		8	nos.		
6.3.12	Circuit breaker operating mechanism		4	nos.		
6.3.13	Disconnector drive		4	nos.		
6.3.14	Coils for Blocking magnet in disconnector drive		4	nos.		
6.3.15	Gas pressure monitoring system		4	nos.		
6.3.16	Pressure Relief Device		4	nos.		
6.3.17	Supporting insulator with barrier		8	nos.		
6.3.18	Barrier insulator or gas tight barrier		8	nos.		
6.3.19	Rubber gaskets “O” rings and seals for SF6 gas		1	lot/SS		
6.3.20	All types of control valves for SF6 gas		1	lot/SS		
6.3.21	SF6 gas cylinders - 45 kg		8	nos.		
6.4	**36kV Switchgears**					
6.4.1	36kV Vacuum Circuit Breaker with structure		3	sets		
6.4.2	36kV Disconnector Switch		3	sets		
6.4.3	36kV Load Beak Switch with fuse		2	sets		
6.4.4	36kV IVT (same as offered type)		3	nos.		
6.4.5	36kV Current Transformer (same as offered type)		3	nos.		
6.4.6	30kV Surge Arrester		3	nos.		
6.4.7	Closing coils for CB		5	nos.		
6.4.8	Tripping coils for CB		5	nos.		
6.5	**Protection and Control**					
6.5.1	Each type of Protection relay and AVR relay for 230/33kV Bangabandhu Hi-Tech SS (Bidder to list)		1	sets		
6.5.2	Each type of Protection relay and AVR relay for 230/132/33kV Anwara SS (Bidder to list)		1	sets		
6.5.3	Each type of Protection relay and AVR relay for 132/33kV Cox'sbazar SS (Bidder to list)		1	sets		
6.5.4	Each type of Protection relay and AVR relay for 132/33kV Teknaf SS (Bidder to list)		1	sets		
6.5.5	Bus bar Differential Relay (Central Unit)		1	sets		
6.5.6	Each type of Tripping relays (electrical reset) (Bidder to list)		5	sets		
6.5.7	Each type of Auxiliary relays (Bidder to list)		5	sets		
6.5.8	Each type of Trip circuit supervision relays (Bidder to list)		1	sets		
6.5.9	Each type of Bay Control Unit		1	sets		
6.5.10	Relay Test Block & socket		2	sets		
6.5.11	Each type of Switch (if applicable)		1	sets		
6.5.12	Each type of MCB		1	sets		
6.5.13	Each type of Lamps		5	sets		
6.5.14	Heater		10	nos.		
6.5.15	Humidity Sensors		10	nos.		
6.5.16	Humidity stat and thermostat		10	nos.		
6.5.17	Annunciator bulbs		10	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
6.5.18	Bulbs for discrepancy switches		10	nos.		
6.5.19	Multifunction Meter		5	nos.		
6.5.20	Tariff/Energy Meter		5	nos.		
6.5.21	Industrial PC		1	set		
6.5.22	Gateway Terminal		1	set		
6.5.23	Bay Ethernet Switches		2	nos.		
6.5.24	Optical connectors (one for each)		1	lot		
6.6	**DC & Charger Equipment**					
6.6.1	Each type of Printed Circuit Board		1	lot		
6.6.2	Miniature circuit breaker of each type and rating (Bidder to list all types)		1	lot		
6.7	**LVAC Equipment**					
6.7.1	Miniature circuit breaker of each type and rating (Bidder to list all types)		1	lot		
6.8	**Power, Control and Auxiliary Cables**					
6.8.1	Power Cables (245kV), 300m of each type		1	lot		
6.8.2	Power Cables (145kV), 300m of each type		1	lot		
6.8.3	Power Cables (36kV), 300m of each type		1	lot		
6.8.4	Control Cables, 200m of each type		1	lot		
6.8.5	LV cables, 200m of each type		1	lot		
6.8.6	Other cables (communication, etc.), 100m of each type		1	lot		
6.9	**Transformers and Shunt Reactor**					
	Auto Transformer					
6.9.2	Set of gaskets		1	no.		
6.9.3	Set of dial type thermometer with gaskets		1	no.		
6.9.4	Set of thermal image type indicator with gaskets		1	no.		
6.9.5	Set of Silica gel breather		1	no.		
6.9.6	Buchholz relay		1	no.		
6.9.7	Set of tap changer diverter switch		1	no.		
6.9.8	Tap changer control mechanism motor		1	no.		
6.9.9	Transformer oil 200 litter barrel		20	nos.		
	Earthing / Auxiliary Transformer					
6.9.10	Set of gaskets		1	no.		
6.9.11	Set of dial type thermometer with gaskets		1	no.		
6.9.12	Set of thermal image type indicator with gaskets		1	no.		
6.9.13	Set of Silica gel breather		1	no.		
6.9.14	Buchholz relay		1	no.		
6.9.15	Transformer oil 200 litter barrel		5	nos.		
	Shunt Reactor					
6.9.17	420kV bushing		0	no.		
6.9.18	set of gaskets for each reactor		0	no.		
6.9.19	Set of dial type thermometer with gaskets		0	no.		
6.9.20	Set of thermal image type indicator with gaskets		0	no.		
6.9.21	Set of Silica gel breather		0	no.		
6.9.22	Shunt reactor oil 200 litter barrel		0	nos.		
6.10	**Instruments for Communication & SCADA**					
6.10.1	Digital data (Communication) analyzer		1	lot		
6.10.2	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility		1	lot		
6.10.3	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)		1	lot		
6.10.4	Subscriber Module for DCS 255 Exchange		1	lot		
6.11	**Post Type Insulator**					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
6.11.1	For 420kV		0	nos.		
6.11.2	For 245kV		3	nos.		
6.11.3	For 145kV		3	nos.		
6.12	**Gas Insulated Line (GIL)**					
6.12.1	420kV, 4000A, GIL		0	m		
6.12.2	420kV, 2000A, GIL		0	m		
6.12.3	245kV, 3150A, GIL		20	m		
6.12.4	245kV, 2000A, GIL		0	m		
6.12.5	145kV, 3150A, GIL		0	m		
6.13	**Disc Insulator**					
6.13.1	Each type of Disc Insulator		20	nos.		
6.14	**Conductor**					
6.14.1	Each type of Bus Conductor		0	m		
6.14.2	Each size of Rigid Tubular Conductor		0	m		
6.15	**Clamp and Fitting**					
6.15.1	Each type of Clamps and Fittings (bidder to list) for each substation		10	nos.		
6.16	**Special tools / instruments for testing, operation and maintenance**					
6.16.1	SF6 Gas Treatment Plant For Gas Filling,Recovery,Evacuation,Filtering,Drying and Storage with necessary accessories (DILO)		4	sets		
6.16.2	1 cylinder of SF6 gas with valve		0	sets		
6.16.3	SF6 gas leakage detector (Infrared type)		0	sets		
6.16.4	SF6 density monitoring device		0	sets		
6.16.5	SF6 pressure monitring device		0	sets		
6.16.6	Offline Partial Discharge monitoring Device for GIS		0	sets		
6.16.7	Dew point Meter		0	sets		
6.16.8	Oxygen Analyzer		0	sets		
6.16.9	SF6 Multi-Analyser for measurement of %SF6, Moister and SO2 concetration		0	sets		
6.16.10	Portable vacuum pump suitable for SF6 circuit breaker		0	sets		
6.16.11	Contact resistance measurement test set (suitable for measurement down to 1 µ ohm at 10A d.c.)		0	sets		
6.16.12	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)		0	sets		
6.16.13	Earth resistance test set (range 10-100-1000 ohm: min scale division 0.1 ohm)		0	sets		
6.16.14	Clip-on mA meter (for spill current)		0	sets		
6.16.15	Thermovision Camera (Flir System)		0	sets		
6.16.16	Oil Insulation Tester		0	sets		
6.16.17	Circuit breaker operational analyzer with accessories including connecting lead		0	sets		
6.16.18	EMI Measuring device		0	sets		
6.16.19	Portable Lightning Arrester Diagnostic System (PLADS)		0	sets		
6.16.20	Set of Tools for GIS at each substation as per section-3, volume-2 and as offered by manufacturer		1	lot		
6.16.21	Set of Tools for each substation (as per table of section II, schedule A of volume 03)		0	sets		
6.16.22	Portable Earthing Leads		0	sets		
6.16.23	Advanced and automated meter testing set (CMC 430 + Test Universe for advanced meter testing + SEM 1 scanning equipment for meters)		0	sets		
6.16.24	Battery Capacity Tester TORKEL 860 (Battery Load Unit)		0	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	**Description**	**Code[1]**	**Qty. (1)**	**Unit**	**Foreign Currency**	
					Unit Price[1] CIP	**Total Price[1] CIP**
					(2)	***(1) x (2)***
6.16.25	CMC 356 (With complete license) + RelaySimTest (Software for system based protection testing) + CMGPS 588 (GPS controlled time reference)		0	sets		
6.16.26	Battery ground fault detector (BGFT, Megger)		0	sets		
6.16.27	CIBANO 500 (Test system for medium and high voltage circuit breaker) + CB MC2 (Main contact module for CIBANO 500) + CB TN3 (Transducer node for CIBANO 500) + PTM (Primary Test Manager software)		0	sets		
	Total of Section-4					
	(Carried to Schedule-5:Grand summary)					
					TOTAL OF SCHEDULE NO.1 (To be indicated in Schedule No.5 Ground Summary)	

Name of Bidder _____

Signature of Bidder _____

Notes:

Due to decrease or increase of any quantity mentioned above in unit "sets, nos., m, m², m³, liter, kg " during execution stage, the payment shall be at "-" Dash means included

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

[2] Specify currency in accordance with Bid Data Sheet 19.1

GIL length shall be measured from the last GIS equipment compartment to SF6/Air bushing

Country of Origin Declaration Form

Item	Description	Code	Country

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
SECTION-I	**Hi-Tech 230/33kV Gas Insulated Substation:**						
1A	**400kV GIS Switchyard (Future)**						
	420kV Outdoor Type Gas Insulated Switchgear (GIS)	0	Sets				
1B	**245kV GIS Switchyard, structures & connections**						
	245kV indoor Type Gas Insulated Switchgear (GIS)						
1B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
1B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
1B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				
1B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local Control Cubicle and support structure	0	Sets				
1B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
1B6	Busbar extension module	2	Sets				
	245kV Air Insulated Switchgear (AIS)						
1B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide	12	nos.				
1B8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV						
1B8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
1B9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
1B9.1	Insulator	1	lot				
1B9.2	Fittings & Clamps, Connector	1	lot				
1B9.3	Nut-bolt	1	lot				
1B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary						
1B10.1	Steel Structure for T/L with Nut & Bolts						
1B10.1.a)	Gantry Column with single beam	9	Nos				
1B10.1.b)	Beam	6	Nos				
1B10.1.c)	Gantry Column with double beam	0	Nos				
1B10.2	Equipment Structure with Nut & Bolts						
1B10.2.a)	LA	12	Nos.				
1B10.2.b)	Outdoor CSE	0					
1B10.3	Nut & Bolts	1	lot				
1B10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
1B10.5	HV power Cable tray including fitting, fixing accessories	0	lot				
1C	**145kV Switchger & connection (N/A)**	0	Sets				
1D	**36kV Switchger & connection**			-			
1D1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
1D2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector	4	sets				
1D3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection	2	sets				
1D4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers	6	nos.				
1D5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection	12	nos.				
1D6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
1D7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary	1	lot				
1D8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
1D9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing	1	lot				
1D10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
1E	**Power Transformers and Earthing/Auxiliary Transformers**						
1E1	230/33 kV, 120/140 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
1E2	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
1E3	Fire fighting system for 230/33 kV Power Transformer	2	sets				
1F	**Control, Protection, Substation Automation and Metering**						
	230kV Circuits						
1F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
1F2	Control, Protection, Monitoring including SAS Function for Power transformer (140MVA) circuits, along with Control & Protection Cubicles	2	sets				
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
1F5	Busbar Protection including SAS Function (230kV Circuit)	1	sets				
1F6	Tariff meter						
1F6.1	Meters (Main & Check)	4	sets				
1F6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
	36kV Circuits						
1F7	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	2	sets				
1F8	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)	0	sets				
1F9	Tariff meter						
1F9.1	Meters (Main & Check)	2	sets				
1F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
1F10	**Substation Automation system**	1	lot				
1G1	**Digital Fault & Disturbance Recorder**	1	lot				
1H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
1H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
1H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	0	m				
1H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
1H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
1H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
1H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
1H7	230kV, 3150A GIL	120	m				
1I	**Earthing and Lightning Protection system**						
1I1	Earthing system for complete substation	1	lot				
1I2	Lightning Protection System for complete substation	2	lot				
1I3	3-phase Portable earthing devices	2	sets				
1J	**Multicore Low Voltage Power & Control Cables**						
1J1.1	LV Control Cable	1	lot				
1J1.2	LV Power Cable	1	lot				
1K	**Batteries, chargers & DC distribution**						
1K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 350Ah @ 5h	2	sets				
ii	120A Battery chargers	2	sets				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (inverter)	2	sets				
1K2	48V Ni-cad Batteries with chargers and distribution board						

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
i	48V Ni-cad Batteries, 200Ah @ 5h	2	sets				
ii	90A Battery chargers	2	sets				
iii	DC Distribution Board	1	lot				
1K3	Necessary modification & extension works in existing DCDB	0	lot				
1L	**LVAC Distribution**						
1L1	LVAC switchboard for substation services	1	lot				
1L2	Tariff metering panel	1	lot				
1M	**Civil Works, Building and Foundation (Refer to 1M of Schedule B4)**						
1M4	GIS cum control room building & Ansar barack						
ii	10 ton EOT crane	1	lot				
1N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
1N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
1N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
1N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
1N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	1	lot				
1N3.2	Fire Fighting system For 400kV GIS Hall & Panel Room	0	lot				
1N3.3	Fire Fighting system For Control Room	1	lot				
1N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
1O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	1	lot				
1P	**SCADA system for Telecontrol and Telemetering**						
1P1	SCADA system for Telecontrol and Telemetering	1	lot				
1Q	**Generator for Emergency Aux. Power**				-		
1Q1	Generator for Emergency Aux. Power	1	set				
1R	**Other Equipment**						
1R1	Scissor Lift	1	set				
1R2	Emergency Interphone (each room)	1	lot				
	Total of Section-I						
	(Carried to Schedule-5:Grand summary)						
SECTION-II	**Section-II: Kaliakoir 230kV AIS Bay extension**						
2A	**400kV Switchyard, structures & connections (Deleted)**						
2B	**230kV Switchyard, structures & connections**						
	230kV Air Insulated Switchgear, Equipment Connection and Steel Structure						
2B1	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, live tank type, single-pole operation, SF6 gas circuit breakers with spring-stored energy operating mechanism	3	Sets				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2B2	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors with motor-operated earthing switch.	2	Sets				
2B3	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors without earthing switch	6	Sets				
2B4	Single-phase, 5-core, 230kV, 50kA/1sec, 3000-1500/1A, 50Hz, 1425kVp BIL post type current transformer	12	Nos				
2B5	Single-phase, 3-core, 400kV, 50Hz, 1425kVp BIL, capacitor type voltage transformers.	6	Nos				
2B6	198kV rated voltage, 158kV(rms) continuous operating voltage at 50˚c 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.	6	Nos				
2B7	Deleted						
2B8	400kV post type support insulators required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.	1	lot				
2B9	rigid tubular bus [Aluminium of grade 63401 WP], flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 230kV busbar and switchgear connection as specified in the technical specifications and bid drawings. Bus capacity shall be minimum 4000A/50kA/1s. Existing Bus is Aluminium Tube with outer dia. 160mm.	1	lot				
2B10	Steel structures for gantry and equipment supports required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.	1	lot				
2C	**145kV GIS Switchyard, structures & connections (Deleted)**	0	Sets				
2D	**36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers (Deleted)**	0	Sets	-			
2E	**Power Transformers and Earthing/Auxiliary Transformers**	0	Sets				
2F	**Control, Protection, Substation Automation and Metering**						
	230kV Circuits						
2F1	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two (02) sets of 230KV overhead line circuits bays.	2	sets				
2F2	Renovation/Extension of existing Busbar protection for 230kV system.	1	lot				
2F3	Tariff metering panel for each 230kV line feeders.	1	lot				
	Substation Automation System						
2F4	Extension of SAS including all required equipment & accessories	1	lot				
		0	lot				
2G	**Digital Fault & Disturbance Recorder**						
2G1	Modification / extension of Digital Fault and Disturbance recorder (DFDR)	1	lot				
2H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	900	m				
2H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	0	m				
2H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	6	Nos.				
2H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
2H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
2H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
2H7	230kV, 3150A GIL	0	m				
2I	**Earthing and Lightning Protection system**						
2I1	Earthing System for Extension part of Substation	1	lot				
2I2	Lightning Protection system for Extension part of Substation	1	lot				
2J	**Multicore Low Voltage Power & Control Cables**						
2J1	LV Power and Control Cables for completion of entire Bay Extension works	1	lot				
2K	**Batteries, chargers & DC distribution**						
2K1	Extension of existing 110V DC distribution board/ new DCDB panel	1	lot				
2K2	Extension of existing 48V DC distribution board/ new DCDB panel	1	lot				
2L	**LVAC Distribution**						
2L1	Extension of LVAC switchboard	1	lot				
2M	**Civil Works, Building and Foundation (Refer to 2M of Schedule B4)**						
2N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
2N1	Indoor lighting (LED type), LV power supply, and emergency DC lighting for extension work.	1	lot				
2N2	Deleted	0	lot				
2N3	Lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection for extension work.	1	lot				
2N4	Deleted	0	lot				
2O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2O1	One (01) complete lot of equipment for extension of existing fibre optic multiplexer equipment at local and remote end Substation for protection & communication, for required part of substation, shall be designed, supplied, delivered, installed, tested and commissioned and integrated into the existing system, under this contract. Fibre optic multiplexer equipment is to be provided for - 21 (or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) Distance relay carrier signal (main and back-up) SCADA data from switchgear and control system through SAS Hot-line telephone system Substation LAN system	1	lot				
2O2	Armoured Underground Optical Fibre (48 cores) cables from terminal box at gantry structure to MDF	1	lot				
2P	**SCADA system for Telecontrol and Telemetering**						
2P1	SCADA system for Telecontrol and Telemetering	1	lot				
2Q	**Generator for Emergency Aux. Power**	1	set		-		
2Q1	Generator for Emergency Aux. Power	0	set				
2R	**Other Equipment**						
2R1	Scissor Lift	0	set				
2R2	Emergency Interphone (each room)	0	lot				
	Total of Section-II						
	(Carried to Schedule-5:Grand summary)						
SECTION-III	**Anwara 230/132/33kV Indoor GIS:**						
3A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
3B	**245kV GIS Switchyard, structures & connections**						
	245kV indoor Type Gas Insulated Switchgear (GIS)						
3B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure	8	Sets				
3B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
3B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure	2	Sets				
3B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local Control Cubicle and support structure	2	Sets				
3B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	4	Sets				
3B6	Busbar extension module	2	Sets				
	245kV Air Insulated Switchgear (AIS)						
3B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	24	nos.				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3B8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
3B8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
3B9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
3B9.1	Insulator	1	lot				
3B9.2	Fittings & Clamps, Connector	1	lot				
3B9.3	Nut-bolt	1	lot				
3B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
3B10.1	Steel Structure for T/L with Nut & Bolts						
3B10.1.a)	Gantry Column with single beam	13	Nos				
3B10.1.b)	Beam	10	Nos				
3B10.1.c)	Gantry Column with double beam	0	Nos				
3B10.2	Equipment Structure with Nut & Bolts						
3B10.2.a)	LA	24	Nos.				
3B10.2.b)	Outdoor CSE	0					
3B10.3	Nut & Bolts	1	lot				
3B10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
3B10.5	HV power Cable tray including fitting, fixing accessories	1	lot				
3C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)			-			
3C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
3C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	4	Sets				
3C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				
3C4	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure	0	Sets				
3C5	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
3C6	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
3C7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	18	nos.				
3C8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
3C8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
3C9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
3C9.1	Insulator	1	lot				
3C9.2	Fittings & Clamps, Connector	1	lot				
3C9.3	Nut-bolt	1	lot				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3C10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
3C10.1	Steel Structure for T/L with Nut & Bolts						
3C10.1.a)	Gantry Column for single beam	8	Nos				
3C10.1.b)	Beam	6	Nos				
3C10.1.c)	Gantry Column with double beam	0	Nos				
3C10.2	Equipment Structure with Nut & Bolts						
3C10.2.a)	LA	18	Nos.				
3C10.2.b)	Outdoor CSE	18					
3C10.3	Nut & Bolts	1	lot				
3C10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
3C10.5	HV power Cable tray including fitting, fixing accessories	1	lot				
3D	**36kV Switchger & connection**						
3D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				
3D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	4	sets				
3D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection	4	sets				
3D.4	Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism for auxiliary transformer feeder	2	sets				
3D.5	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers	12	nos.				
3D.6	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection	12	nos.				
3D.7	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
3D.8	Current transformer 36 kV, single-phase, 3-core, multi ratio, 10/1A, 800-1250/1-1A, 31.5kA/1sec, 50 Hz, 170/70 kV BIL, post type current transformer for auxiliary transformer feeder	6	nos.				
3D.9	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer	1	lot				
3D.10	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
3D.11	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. includingother accessories for each connection as required for completing36kV Switchyard and auxiliary transformer connection	1	lot				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3D.12	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
3E	**Power Transformers and Earthing/Auxiliary Transformers**						
3E.1	230/132/33 kV, 250/350 MVA (ONAN/ONAF), three phase outdoor type power (auto) transformer	2	sets				
3E.2	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
3E.3	Auxiliary power transformer 33/0.415 kV, 400 kVA	2	sets				
3E.3	Water Spray fire fighting system for 230/132/33 kV Power Transformer	2	sets				
3F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
3F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	6	sets				
3F2	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	2	sets				
3F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	2	sets				
3F5	Busbar Protection including SAS Function (230kV Circuit)	1	sets				
3F6	Tariff meter						
3F.6.1	Meters (Main & Check)	8	sets				
3F.6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	145kV Circuits						
3F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
3F8	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F9	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
3F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
3F12	Busbar Protection including SAS Function (145kV Circuit)	1	sets				
3F13	Tariff meter						
3F.13.1	Meters (Main & Check)	6	sets				
3F.13.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3F14	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	4	sets				
3F15	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer	0	sets				
3F16	Tariff meter						
3F16.1	Meters (Main & Check)	4	sets				
3F16.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
3F17	**Substation Automation system**	1	lot				
3G	**Digital Fault & Disturbance Recorder**						
3G1	Digital Fault & Disturbance Recorder	1	lot				
3H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
3H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
3H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	900	m				
3H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
3H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	12	Nos.				
3H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
3H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
3H7	230kV, 3150A GIL	700	m				
3I	**Earthing and Lightning Protection system**						
3I1	Earthing system for complete substation	1	lot				
3I2	Lightning Protection System for complete substation	1	lot		-		
3I3	3-phase Portable earthing devices	2	sets				
3J	**Multicore Low Voltage Power & Control Cables**						
3J1.1	LV Control Cable	1	lot				
3J1.2	LV Power Cable	1	lot				
3K	**Batteries, chargers & DC distribution**						
3K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 400Ah @ 5h	1	lot				
ii	150A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
3K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
3K3	Necessary modification & extension works in existing DCDB	0	lot				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3L	**LVAC Distribution**						
3L1	LVAC switchboard for substation services	1	lot				
3L2	Tariff metering panel	1	lot				
3M	**Civil Works, Building and Foundation (Refer to 3M of Schedule**						
3M4	GIS cum control room building & Ansar Barack						
ii	10 ton EOT crane	1	lot				
vi	10 ton EOT crane	1	lot				
3N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
3N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
3N2	Lighting for outside building for security, roadway, switchyard and	1	lot				
3N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
3N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	1	lot				
3N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
3N3.3	Fire Fighting system For Control Room	1	lot				
3N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
3O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system	1	lot				
3P	**SCADA system for Telecontrol and Telemetering**						
3P1	SCADA system for Telecontrol and Telemetering	1	lot				
3Q	**Generator for Emergency Aux. Power**						
3Q1	Generator for Emergency Aux. Power	1	set				
3R	**Other Equipment**						
3R1	Scissor Lift	1	set				
3R2	Emergency Interphone (each room)	1	lot				
	Total of Section-III						
	(Carried to Schedule-5:Grand summary)						
SECTION-IV	**Cox's Bazar (N) 132/33kV Indoor GIS**						
4A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
4B	**245kV GIS Switchyard, structures & connections (Not in scope)**	0	Sets				
4C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)			-			

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	9	Sets				
4C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	3	Sets				
4C3	145kV GIS Double Busbar , Capacitor Bank Bays with Local Control Cubicle and support structure	2	Sets				
4C4	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	2	Sets				
4C5	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure	2	Sets				
4C6	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	4	Sets				
4C7	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
4C8	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	39	nos.				
4C9	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
4C9.1	Tubular Conductor and/or Flexible Conductor	1	lot				
4C10	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
4C10.1	Insulator	1	lot				
4C10.2	Fittings & Clamps, Connector	1	lot				
4C10.3	Nut-bolt	1	lot				
4C11	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
4C11.1	Steel Structure for T/L with Nut & Bolts						
4C11.1.a)	Gantry Column for single beam	13	Nos				
4C11.1.b)	Beam	11	Nos				
4C11.1.c)	Gantry Column with double beam	0	Nos				
4C11.2	Equipment Structure with Nut & Bolts						
4C11.2.a)	LA	39	Nos.				
4C11.2.b)	Outdoor CSE	33	Nos.				
4C11.3	Nut & Bolts	1	lot				
4C11.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
4C11.5	HV power Cable tray including fitting, fixing accessories	1	lot				
4D	**36kV Switchger & connection**						
4D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	3	sets				
4D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	6	sets				
4D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure	2	sets				
4D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure	9	nos.				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure	15	nos.				
4D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	9	nos.				
4D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary	1	lot				
4D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
4D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. includingother accessories for each connection as required for completing36kV Switchyard and auxiliary transformer connection	1	lot				
4D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
4E	**Power Transformers and Earthing/Auxiliary Transformers**						
4E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	3	sets				
4E.2	Auxiliary power transformer 33/0.415 kV, 400 kVA	2	sets				
4E.3	Water Spray fire fighting system	0	sets				
4E.4	132kV 50MVAR Capacitor Bank with associated equipment	2	sets				
4F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
4F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	8	sets				
4F2	Control, Protection, Monitoring including SAS Function for Power transformer circuits, along with Control & Protection Cubicles	3	sets				
4F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles	2	sets				
4F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	2	sets				
4F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	2	sets				
4F6	Busbar Protection including SAS Function (132kV Circuit)	1	sets				
4F7	Tariff meter						
4F7.1	Meters (Main & Check)	11	sets				
4F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						
4F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	3	sets				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4F9	Tariff meter						
4F9.1	Meters (Main & Check)	3	sets				
4F9.2	Complete Panel (Front opening, Swing frame type) including wiring,	1	lot				
4F10	**Substation Automation system**	1	lot				
4G	**Digital Fault & Disturbance Recorder**						
4G1	Digital Fault & Disturbance Recorder	1	lot				
4H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
4H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
4H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	1200	m				
4H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE	0	Nos.				
4H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE	33	Nos.				
4H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase	0	m				
4H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
4H7	230kV, 3150A GIL	0	m				
4I	**Earthing and Lightning Protection system**						
4I1	Earthing system for complete substation	1	lot				
4I2	Lightning Protection System for complete substation	1	lot		-		
4I3	3-phase Portable earthing devices	2	sets				
4J	**Multicore Low Voltage Power & Control Cables**						
4J1.1	LV Control Cable	1	lot				
4J1.2	LV Power Cable	1	lot				
4K	**Batteries, chargers & DC distribution**						
4K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 400Ah @ 5h	1	lot				
ii	150A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
4K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
4K3	Necessary modification & extension works in existing DCDB	0	lot				
4L	**LVAC Distribution**						
4L1	LVAC switchboard for substation services	1	lot				
4L2	Tariff metering panel	1	lot				
4M	**Civil Works, Building and Foundation (Refer to 4M of Schedule B4)**						
4M4	GIS cum control room building & Ansar barack						
ii	10 ton EOT crane	1	lot				
4N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
4N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
4N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
4N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	0	lot				
4N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
4N3.3	Fire Fighting system For Control Room	1	lot				
4N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
4O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	1	lot				
4P	**SCADA system for Telecontrol and Telemetering**						
4P1	SCADA system for Telecontrol and Telemetering	1	lot				
4Q	**Generator for Emergency Aux. Power**						
4Q1	Generator for Emergency Aux. Power	1	set				
4R	**Other Equipment**						
4R1	Scissor Lift	1	set				
4R2	Emergency Interphone (each room)	1	lot				
	Total of Section-IV						
	(Carried to Schedule-5:Grand summary)						
SECTION-V	**Teknaf 132/33kV Indoor GIS**						
5A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
5B	**245kV GIS Switchyard, structures & connections (Deleted)**	0	Sets				
5C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)			-			
5C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
5C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
5C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				
5C4	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
5C5	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
5C6	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	12	nos.				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5C7	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
5C7.1	Tubular Conductor and/or Flexible Conductor	1	lot				
5C8	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
5C8.1	Insulator	1	lot				
5C8.2	Fittings & Clamps, Connector	1	lot				
5C8.3	Nut-bolt	1	lot				
5C9	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
5C9.1	Steel Structure for T/L with Nut & Bolts						
5C9.1.a)	Gantry Column with single beam	9	Nos				
5C9.1.b)	Beam	6	Nos				
5C9.1.c)	Gantry Column with double beam	0	Nos				
5C9.2	Equipment Structure with Nut & Bolts						
5C9.2.a)	LA	12	Nos.				
5C9.2.b)	Outdoor CSE	12	Nos.				
5C9.3	Nut & Bolts	1	lot				
5C9.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
5C9.5	HV power Cable tray including fitting, fixing accessories	1	lot				
5D	**36kV Switchger & connection**						
5D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				
5D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	4	sets				
5D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure	2	sets				
5D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure	6	nos.				
5D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure	12	nos.				
5D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
5D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer	1	lot				
5D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection	1	lot				
5D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
5E	**Power Transformers and Earthing/Auxiliary Transformers**						
5E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
5E.2	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
5E.3	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
5E.3	Water Spray fire fighting system	0	sets				
5E.4	33kV Capacitor Bank with associated equipment	0	sets				
5F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
5F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
5F2	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles	2	sets				
5F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles	0	sets				
5F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
5F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
5F6	Busbar Protection including SAS Function (132kV Circuit)	1	sets				
5F7	Tariff meter						
5F7.1	Meters (Main & Check)	4	sets				
5F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						
5F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	2	sets				
5F9	Tariff meter						
5F9.1	Meters (Main & Check)	2	sets				
5F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
5F10	Substation Automation system	1	lot				
5G	**Digital Fault & Disturbance Recorder**						
5G1	Digital Fault & Disturbance Recorder	1	lot				
5H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
5H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	600	m				
5H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
5H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	12	Nos.				
5H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
5H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
5H7	230kV, 3150A GIL	0	m				
5I	**Earthing and Lightning Protection system**						
5I1	Earthing system for complete substation	1	lot				
5I2	Lightning Protection System for complete substation	1	lot		-		
5I3	3-phase Portable earthing devices	2	sets				
5J	**Multicore Low Voltage Power & Control Cables**						
5J1.1	LV Control Cable	1	lot				
5J1.2	LV Power Cable	1	lot				
5K	**Batteries, chargers & DC distribution**						
5K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 350Ah @ 5h	1	lot				
ii	120A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
5K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
5K3	Necessary modification & extension works in existing DCDB	0	lot				
5L	**LVAC Distribution**						
5L1	LVAC switchboard for substation services	1	lot				
5L2	Tariff metering panel	1	lot				
5M	**Civil Works, Building and Foundation (Refer to 5M of Schedule B4)**						
5M4	GIS cum control room building & Ansar barack						
ii	10 ton EOT crane	1	lot				
5N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
5N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
5N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
5N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	0	lot				
5N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
5N3.3	Fire Fighting system For Control Room	1	lot				
5N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
5O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	1	lot				
5P	**SCADA system for Telecontrol and Telemetering**						
5P1	SCADA system for Telecontrol and Telemetering	1	lot				
5Q	**Generator for Emergency Aux. Power**						
5Q1	Generator for Emergency Aux. Power	1	set				
5R	**Other Equipment**						
5R1	Scissor Lift	1	set				
5R2	Emergency Interphone (each room)	1	lot				
	Total of Section-V						
	(Carried to Schedule-5:Grand summary)						
SECTION-VI	**Mandatory Spares, Erection & Test Equipment**						
6.1	**420kV Gas Insulated Switchgear**	0	nos				
6.2	**245kV Gas Insulated Switchgear**						
6.2.1	Complete module for offered type Circuit Breaker (each type)	4	sets				
6.2.2	DS/ES Switch	4	sets				
6.2.3	DS/ES mechanism	4	sets				
6.2.4	HES Switch	4	sets				
6.2.5	HES mechanism	4	sets				
6.2.6	Each type of auxiliary contacts unit	4	sets				
6.2.7	Surge arrester	4	sets				
6.2.8	Complete Voltage transformer module	4	sets				
6.2.9	Complete Current transformer module	4	sets				
6.2.10	Closing coils	4	nos.				
6.2.11	Tripping coils	8	nos.				
6.2.12	Circuit breaker operating mechanism	4	nos.				
6.2.13	Disconnector drive	4	nos.				
6.2.14	Coils for Blocking magnet in disconnector drive	4	nos.				
6.2.15	Gas pressure monitoring system	4	nos.				
6.2.16	Pressure Relief Device	4	nos.				
6.2.17	Supporting insulator with barrier	8	nos.				
6.2.18	Barrier insulator or gas tight barrier	8	nos.				
6.2.19	Rubber gaskets “O” rings and seals for SF6 gas	1	lot/SS				
6.2.20	All types of control valves for SF6 gas	1	lot/SS				
6.2.21	SF6 gas cylinders - 45 kg	8	nos.				
6.3	**145kV Gas Insulated Switchgear**						

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.3.1	Complete module for offered type Circuit Breaker (each type)	4	sets				
6.3.2	DS/ES Switch	4	sets				
6.3.3	DS/ES mechanism	4	sets				
6.3.4	HES Switch	4	sets				
6.3.5	HES mechanism	4	sets				
6.3.6	Each type of auxiliary contacts unit	4	sets				
6.3.7	Surge arrester	4	sets				
6.3.8	Complete Voltage transformer module	4	sets				
6.3.9	Complete Current transformer module	4	sets				
6.3.10	Closing coils	4	nos.				
6.3.11	Tripping coils	8	nos.				
6.3.12	Circuit breaker operating mechanism	4	nos.				
6.3.13	Disconnector drive	4	nos.				
6.3.14	Coils for Blocking magnet in disconnector drive	4	nos.				
6.3.15	Gas pressure monitoring system	4	nos.				
6.3.16	Pressure Relief Device	4	nos.				
6.3.17	Supporting insulator with barrier	8	nos.				
6.3.18	Barrier insulator or gas tight barrier	8	nos.				
6.3.19	Rubber gaskets "O" rings and seals for SF6 gas	1	lot/SS				
6.3.20	All types of control valves for SF6 gas	1	lot/SS				
6.3.21	SF6 gas cylinders - 45 kg	8	nos.				
6.4	**36kV Switchgears**						
6.4.1	36kV Vacuum Circuit Breaker with structure	3	sets				
6.4.2	36kV Disconnector Switch	3	sets				
6.4.3	36kV Load Beak Switch with fuse	2	sets				
6.4.4	36kV IVT (same as offered type)	3	nos.				
6.4.5	36kV Current Transformer (same as offered type)	3	nos.				
6.4.6	30kV Surge Arrester	3	nos.				
6.4.7	Closing coils for CB	5	nos.				
6.4.8	Tripping coils for CB	5	nos.				
6.5	**Protection and Control**						
6.5.1	Each type of Protection relay and AVR relay for 230/33kV Bangabandhu Hi-Tech SS (Bidder to list)	1	sets				
6.5.2	Each type of Protection relay and AVR relay for 230/132/33kV Anwara SS (Bidder to list)	1	sets				
6.5.3	Each type of Protection relay and AVR relay for 132/33kV Cox'sbazar SS (Bidder to list)	1	sets				
6.5.4	Each type of Protection relay and AVR relay for 132/33kV Teknaf SS (Bidder to list)	1	sets				
6.5.5	Bus bar Differential Relay (Central Unit)	1	sets				
6.5.6	Each type of Tripping relays (electrical reset) (Bidder to list)	5	sets				
6.5.7	Each type of Auxiliary relays (Bidder to list)	5	sets				
6.5.8	Each type of Trip circuit supervision relays (Bidder to list)	1	sets				
6.5.9	Each type of Bay Control Unit	1	sets				
6.5.10	Relay Test Block & socket	2	sets				
6.5.11	Each type of Switch (if applicable)	1	sets				
6.5.12	Each type of MCB	1	sets				
6.5.13	Each type of Lamps	5	sets				
6.5.14	Heater	10	nos.				
6.5.15	Humidity Sensors	10	nos.				
6.5.16	Humidity stat and thermostat	10	nos.				
6.5.17	Annunciator bulbs	10	nos.				
6.5.18	Bulbs for discrepancy switches	10	nos.				
6.5.19	Multifunction Meter	5	nos.				
6.5.20	Tariff/Energy Meter	5	nos.				

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.5.21	Industrial PC	1	set				
6.5.22	Gateway Terminal	1	set				
6.5.23	Bay Ethernet Switches	2	nos.				
6.5.24	Optical connectors (one for each)	1	lot				
6.6	**DC & Charger Equipment**						
6.6.1	Each type of Printed Circuit Board	1	lot				
6.6.2	Miniature circuit breaker of each type and rating (Bidder to list all types)	1	lot				
6.7	**LVAC Equipment**						
6.7.1	Miniature circuit breaker of each type and rating (Bidder to list all types)	1	lot				
6.8	**Power, Control and Auxiliary Cables**						
6.8.1	Power Cables (245kV), 300m of each type	1	lot				
6.8.2	Power Cables (145kV), 300m of each type	1	lot				
6.8.3	Power Cables (36kV), 300m of each type	1	lot				
6.8.4	Control Cables, 200m of each type	1	lot				
6.8.5	LV cables, 200m of each type	1	lot				
6.8.6	Other cables (communication, etc.), 100m of each type	1	lot				
6.9	**Transformers and Shunt Reactor**						
	Auto Transformer						
6.9.2	Set of gaskets	1	no.				
6.9.3	Set of dial type thermometer with gaskets	1	no.				
6.9.4	Set of thermal image type indicator with gaskets	1	no.				
6.9.5	Set of Silica gel breather	1	no.				
6.9.6	Buchholz relay	1	no.				
6.9.7	Set of tap changer diverter switch	1	no.				
6.9.8	Tap changer control mechanism motor	1	no.				
6.9.9	Transformer oil 200 litter barrel	20	nos.				
	Earthing / Auxiliary Transformer						
6.9.10	Set of gaskets	1	no.				
6.9.11	Set of dial type thermometer with gaskets	1	no.				
6.9.12	Set of thermal image type indicator with gaskets	1	no.				
6.9.13	Set of Silica gel breather	1	no.				
6.9.14	Buchholz relay	1	no.				
6.9.15	Transformer oil 200 litter barrel	5	nos.				
	Shunt Reactor						
6.9.17	420kV bushing	0	no.				
6.9.18	set of gaskets for each reactor	0	no.				
6.9.19	Set of dial type thermometer with gaskets	0	no.				
6.9.20	Set of thermal image type indicator with gaskets	0	no.				
6.9.21	Set of Silica gel breather	0	no.				
6.9.22	Shunt reactor oil 200 litter barrel	0	nos.				
6.10	**Instruments for Communication & SCADA**						
6.10.1	Digital data (Communication) analyzer	1	lot				
6.10.2	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility	1	lot				
6.10.3	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)	1	lot				
6.10.4	Subscriber Module for DCS 255 Exchange	1	lot				
6.11	**Post Type Insulator**						
6.11.1	For 420kV	0	nos.				
6.11.2	For 245kV	3	nos.				
6.11.3	For 145kV	3	nos.				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.12	**Gas Insulated Line (GIL)**						
6.12.1	420kV, 4000A, GIL	0	m				
6.12.2	420kV, 2000A, GIL	0	m				
6.12.3	245kV, 3150A, GIL	20	m				
6.12.4	245kV, 2000A, GIL	0	m				
6.12.5	145kV, 3150A, GIL	0	m				
6.13	**Disc Insulator**						
6.13.1	Each type of Disc Insulator	20	nos.				
6.14	**Conductor**						
6.14.1	Each type of Bus Conductor	0	m				
6.14.2	Each size of Rigid Tubular Conductor	0	m				
6.15	**Clamp and Fitting**						
6.15.1	Each type of Clamps and Fittings (bidder to list) for each substation	10	nos.				
6.16	**Special tools / instruments for testing, operation and maintenance**						
6.16.1	SF6 Gas Treatment Plant For Gas Filling,Recovery,Evacuation,Filtering,Drying and Storage with necessary accessories (DILO)	4	sets				
6.16.2	1 cylinder of SF6 gas with valve	0	sets				
6.16.3	SF6 gas leakage detector (Infrared type)	0	sets				
6.16.4	SF6 density monitoring device	0	sets				
6.16.5	SF6 pressure monitring device	0	sets				
6.16.6	Offline Partial Discharge monitoring Device for GIS	0	sets				
6.16.7	Dew point Meter	0	sets				
6.16.8	Oxygen Analyzer	0	sets				
6.16.9	SF6 Multi-Analyser for measurement of %SF6, Moister and SO2 concetration	0	sets				
6.16.10	Portable vacuum pump suitable for SF6 circuit breaker	0	sets				
6.16.11	Contact resistance measurement test set (suitable for measurement down to 1 µ ohm at 10A d.c.)	0	sets				
6.16.12	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)	0	sets				
6.16.13	Earth resistance test set (range 10-100-1000 ohm: min scale division 0.1 ohm)	0	sets				
6.16.14	Clip-on mA meter (for spill current)	0	sets				
6.16.15	Thermovision Camera (Flir System)	0	sets				
6.16.16	Oil Insulation Tester	0	sets				
6.16.17	Circuit breaker operational analyzer with accessories including connecting lead	0	sets				
6.16.18	EMI Measuring device	0	sets				
6.16.19	Portable Lightning Arrester Diagnostic System (PLADS)	0	sets				
6.16.20	Set of Tools for GIS at each substation as per section-3, volume-2 and as offered by manufacturer	1	lot				
6.16.21	Set of Tools for each substation (as per table of section II, schedule A of volume 03)	0	sets				
6.16.22	Portable Earthing Leads	0	sets				
6.16.23	Advanced and automated meter testing set (CMC 430 + Test Universe for advanced meter testing + SEM 1 scanning equipment for meters)	0	sets				
6.16.24	Battery Capacity Tester TORKEL 860 (Battery Load Unit)	0	sets				
6.16.25	CMC 356 (With complete license) + RelaySimTest (Software for system based protection testing) + CMGPS 588 (GPS controlled time reference)	0	sets				
6.16.26	Battery ground fault detector (BGFT, Megger)	0	sets				

Schedules of Rates and Prices

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.16.27	CIBANO 500 (Test system for medium and high voltage circuit breaker) + CB MC2 (Main contact module for CIBANO 500) + CB TN3 (Transducer node for CIBANO 500) + PTM (Primary Test Manager software)	0	sets				
	Total of Section-4						
	(Carried to Schedule-5:Grand summary)						
TOTAL OF SCHEDULE NO.2 (To be indicated in Schedule No.5 Ground Summary)							

Name of Bidder _____

Signature of Bidder _____

Notes:

Due to decrease or increase of any quantity mentioned above in unit "sets, nos., m, m², m³, liter, kg " during execution stage, the "-" Dash means included

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

[2] Specify currency in accordance with Bid Data Sheet 19.1

GIL length shall be measured from the last GIS equipment compartment to SF6/Air bushing

Schedules of Rates and Prices

Schedule 3: Design Services

No.	Description	Unit	Qty	Unit Price [1]		Total Price [1]	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
			(1)	(2)	(3)	(1) X (2)	(1) X (3)
SECTION-I	**Hi-Tech 230/33kV Gas Insulated Substation:**						
a)	Design and engineering services, local and foreign part	Lump sum	1				
SECTION-II	**Section-II: Kaliakoir 230kV AIS Bay extension**						
a)	Design and engineering services, local and foreign part	Lump sum	1				
SECTION-III	**Anwara 230/132/33kV Indoor GIS:**						
a)	Design and engineering services, local and foreign part	Lump sum	1				
b)	Surge Arrester design, calculation for Voltage rating, MCOV, Discharge class, residual voltage, etc.	Lump sum	1				
SECTION-IV	**Cox's Bazar (N) 132/33kV Indoor GIS**						
a)	Design and engineering services, local and foreign part	Lump sum	1				
SECTION-V	**Teknaf 132/33kV Indoor GIS**						
a)	Design and engineering services, local and foreign part	Lump sum	1				
	TOTAL OF SCHEDULE NO.3 (To be indicated in Schedule No.5 Ground Summary)						

Name of Bidder _____

Signature of Bidder _____

Notes:

[1] Specify currency in accordance with Bid Data Sheet 19.1

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
SECTION-I	**Hi-Tech 230/33kV Gas Insulated Substation:**						
1A	**400kV GIS Switchyard (Future)**						
	420kV Outdoor Type Gas Insulated Switchgear (GIS)	0	Sets				
1B	**245kV GIS Switchyard, structures & connections**						
	245kV indoor Type Gas Insulated Switchgear (GIS)						
1B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
1B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
1B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				
1B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local Control Cubicle and support structure	0	Sets				
1B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
1B6	Busbar extension module	2	Sets				
	245kV Air Insulated Switchgear (AIS)						
1B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	12	nos.				
1B8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
1B8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
1B9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
1B9.1	Insulator	1	lot				
1B9.2	Fittings & Clamps, Connector	1	lot				
1B9.3	Nut-bolt	1	lot				
1B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
1B10.1	Steel Structure for T/L with Nut & Bolts						
1B10.1.a)	Gantry Column with single beam	9	Nos				
1B10.1.b)	Beam	6	Nos				
1B10.1.c)	Gantry Column with double beam	0	Nos				
1B10.2	Equipment Structure with Nut & Bolts						
1B10.2.a)	LA	12	Nos.				
1B10.2.b)	Outdoor CSE	0					
1B10.3	Nut & Bolts	1	lot				
1B10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
1B10.5	HV power Cable tray including fitting, fixing accessories	0	lot				
1C	**145kV Switchger & connection (N/A)**	0	Sets				
1D	**36kV Switchger & connection**			-			
1D1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
1D2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector	4	sets				
1D3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection	2	sets				
1D4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers	6	nos.				
1D5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection	12	nos.				
1D6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
1D7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary	1	lot				
1D8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
1D9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection	1	lot				
1D10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
1E	**Power Transformers and Earthing/Auxiliary Transformers**						
1E1	230/33 kV, 120/140 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
1E2	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
1E3	Fire fighting system for 230/33 kV Power Transformer	2	sets				
1F	**Control, Protection, Substation Automation and Metering**						
	230kV Circuits						
1F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
1F2	Control, Protection, Monitoring including SAS Function for Power transformer (140MVA) circuits, along with Control & Protection Cubicles	2	sets				
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
1F5	Busbar Protection including SAS Function (230kV Circuit)	1	sets				
1F6	Tariff meter						
1F6.1	Meters (Main & Check)	4	sets				
1F6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
1F7	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	2	sets				
1F8	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)	0	sets				
1F9	Tariff meter						
1F9.1	Meters (Main & Check)	2	sets				
1F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
1F10	**Substation Automation system**	1	lot				
1G1	**Digital Fault & Disturbance Recorder**	1	lot				
1H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL (Deleted)**	0	sets				
1I	**Earthing and Lightning Protection system**						
1I1	Earthing system for complete substation	1	lot				
1I2	Lightning Protection System for complete substation	2	lot				
1I3	3-phase Portable earthing devices	2	sets				
1J	**Multicore Low Voltage Power & Control Cables**						
1J1.1	LV Control Cable	1	lot				
1J1.2	LV Power Cable	1	lot				
1K	**Batteries, chargers & DC distribution**						
1K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 350Ah @ 5h	2	sets				
ii	120A Battery chargers	2	sets				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (inverter)	2	sets				
1K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	2	sets				
ii	90A Battery chargers	2	sets				
iii	DC Distribution Board	1	lot				
1K3	Necessary modification & extension works in existing DCDB	0	lot				
1L	**LVAC Distribution**						
1L1	LVAC switchboard for substation services	1	lot				
1L2	Tariff metering panel	1	lot				
1M	**Civil Works, Building and Foundation**						
1M1	Complete land development and slope protection	Deleted	Deleted				
1M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 132kV GIS switchyards, Transformer yard	1	lot				
1M3*	Complete civil items required for outdoor works						
i	Outdoor gantry foundation in 230kV switchyard						
a)	Gantry column	9	nos.				
ii	Outdoor equipment foundation in 230kV switchyard						
a)	LA	12	nos.				
iii	Outdoor gantry foundation in 33kV switchyard	1	lot				
iv	Outdoor equipment foundation 33kV switchyard	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
v	Transformer foundation	2	nos.				
vi	Blast wall with foundation	2	nos.				
vii	Boundary wall for overall plan	600	meter				
viii	Substation main gate	1	nos.				
ix	Chain link fencing including gates	100	meter				
x	Approach road (pavement width 6m)	20	meter				
xi	Internal road						
a)	6m wide road	100	meter				
b)	4.5m wide road	600	meter				
c)	1.5 walk way	10	meter				
xii	Cable trench/tunnel with soakpit						
a)	Cable Trench for LV power & control cable	100	meter				
xiii	Surface drain	500	meter				
xiv	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	1	lot				
xv	Gravel laying in switchyard area	350	sqm				
xvi	Septic tank and soak way	2	nos				
xvii	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	1	lot				
xviii	Guard house	1	nos				
xix	Sentry post	4	nos				
xx	Car port	1	nos				
1M4**	GIS cum control room building & Ansar barack						
i	Two storied 230kV GIS building (35mX12m)	840	sqm				
ii	10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	1	lot				
iii	Three storied 230kV control room building (20mX12m)	720	sqm				
iv	Lift (6 person)	1	lot				
v	Single Storied Ansar Barack (5.1mx20m)	102	sqm				
1M5	Testing of Foundation						
a)	Compression test of pile	2	nos				
b)	Uplift test of pile	1	nos				
	* actual payment shall be as per actual work at site						
	** mesurement method = clear length x clear width x no. of story						
1N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
1N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
1N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
1N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
1N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	1	lot				
1N3.2	Fire Fighting system For 400kV GIS Hall & Panel Room	0	lot				
1N3.3	Fire Fighting system For Control Room	1	lot				
1N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
1O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	1	lot				
1P	**SCADA system for Telecontrol and Telemetering**						
1P1	SCADA system for Telecontrol and Telemetering	1	lot				
1Q	**Generator for Emergency Aux. Power**				-		
1Q1	Generator for Emergency Aux. Power	1	set				
1R	**Other Equipment**						
1R1	Scissor Lift	1	set				
1R2	Emergency Interphone (each room)	1	lot				
	Total of Section-I						
	(Carried to Schedule-5:Grand summary)						
SECTION-II	**Section-II: Kaliakoir 230kV AIS Bay extension**						
2A	**400kV Switchyard, structures & connections (Deleted)**						
2B	**230kV Switchyard, structures & connections**						
	230kV Air Insulated Switchgear, Equipment Connection and Steel Structure						
2B1	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, live tank type, single-pole operation, SF6 gas circuit breakers with spring-stored energy	3	Sets				
2B2	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors with motor-operated	2	Sets				
2B3	230kV, 3000A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors without earthing	6	Sets				
2B4	Single-phase, 5-core, 230kV, 50kA/1sec, 3000-1500/1A, 50Hz, 1425kVp BIL post type current transformer	12	Nos				
2B5	Single-phase, 3-core, 400kV, 50Hz, 1425kVp BIL, capacitor type voltage transformers.	6	Nos				
2B6	198kV rated voltage, 158kV(rms) continuous operating voltage at 50˚c 10kA nominal discharge current, 50Hz, Heavy duty station	6	Nos				
2B7	Deleted						
2B8	400kV post type support insulators required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.	1	lot				
2B9	rigid tubular bus [Aluminium of grade 63401 WP], flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 230kV busbar and switchgear connection as specified in the technical specifications and bid drawings. Bus capacity shall be minimum 4000A/50kA/1s. Existing Bus is Aluminium Tube with outer dia. 160mm.	1	lot				
2B10	Steel structures for gantry and equipment supports required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.	1	lot				
2C	**145kV GIS Switchyard, structures & connections (Deleted)**	0	Sets				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2D	**36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers (Deleted)**	0	Sets	-			
2E	**Power Transformers and Earthing/Auxiliary Transformers**	0	Sets				
2F	**Control, Protection, Substation Automation and Metering**						
	230kV Circuits						
2F1	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two (02) sets of 230KV overhead line circuits bays.	2	sets				
2F2	Renovation/Extension of existing Busbar protection for 230kV system.	1	lot				
2F3	Tariff metering panel for each 230kV line feeders.	1	lot				
	Substation Automation System						
2F4	Extension of SAS including all required equipment & accessories	1	lot				
		0	lot				
2G	**Digital Fault & Disturbance Recorder**						
2G1	Modification / extension of Digital Fault and Disturbance recorder (DFDR)	1	lot				
2H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
2H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	900	m				
2H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	0	m				
2H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	6	Nos.				
2H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
2H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
2H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
2H7	230kV, 3150A GIL	0	m				
2I	**Earthing and Lightning Protection system**						
2I1	Earthing System for Extension part of Substation	1	lot				
2I2	Lightning Protection system for Extension part of Substation	1	lot				
2J	**Multicore Low Voltage Power & Control Cables**						
2J1	LV Power and Control Cables for completion of entire Bay Extension works	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2K	**Batteries, chargers & DC distribution**						
2K1	Extension of existing 110V DC distribution board/ new DCDB panel	1	lot				
2K2	Extension of existing 48V DC distribution board/ new DCDB panel	1	lot				
2L	**LVAC Distribution**						
2L1	Extension of LVAC switchboard	1	lot				
2M	**Civil Works, Building and Foundation**						
2M1*	Complete land development and slope protection						
i	Complete compacted land development with carried/dredged earthfilling	11,000	cubic meter				
ii	Slpoe protection						
a)	Slpoe (1V:2H) protection with CC block	1,800	sqm				
2M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 132kV GIS switchyards, Transformer yard	1	lot				
2M3*	Complete civil items required for outdoor works						
i	Outdoor gantry foundation in 230kV switchyard						
a)	Gantry column	9	nos.				
ii	Outdoor equipment foundation 230kV switchyard						
a)	CB	3	set**				
b)	DS with ES	2	set**				
c)	DS without ES	6	set**				
d)	CT	12	nos				
e)	CVT	6	nos				
f)	LA	6	nos				
g)	PI	1	lot				
iii	Security boundary wall for overall plan						
a)	Boundary wall with RCC retaining wall	360	meter				
b)	Boundary wall without retaining wall	100	meter				
iv	Internal road						
a)	4.5m wide road	200	meter				
v	Cable trench/tunnel with soakpit						
a)	Cable trench for HV Power cable	300	meter				
b)	Cable trench for LV power & control cable	300	meter				
vi	Surface drain	350	meter				
vii	Substation surface finishing with drainage system including outlet (excluding surface drain)	1	lot				
viii	Gravelling in switchyard area	3000	sqm				
2M4	GIS cum control room building & Ansar Barack	Deleted	Deleted				
2M5	Testing of foundation						
i	Uplift test of pile	1	nos				
	* actual payment shall be as per actual work at site						
	** one set includes foundation for three phases of a circuit						
2N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
2N1	Indoor lighting (LED type), LV power supply, and emergency DC lighting for extension work.	1	lot				
2N2	Deleted	0	lot				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
2N3	Lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection for extension work.	1	lot				
2N4	Deleted	0	lot				
2O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
2O1	One (01) complete lot of equipment for extension of existing fibre optic multiplexer equipment at local and remote end Substation for protection & communication, for required part of substation, shall be designed, supplied, delivered, installed, tested and commissioned and integrated into the existing system, under this contract. Fibre optic multiplexer equipment is to be provided for - 21 (or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) Distance relay carrier signal (main and back-up) SCADA data from switchgear and control system through SAS Hot-line telephone system Substation LAN system	1	lot				
2O2	Armoured Underground Optical Fibre (48 cores) cables from terminal box at gantry structure to MDF	1	lot				
2P	**SCADA system for Telecontrol and Telemetering**						
2P1	SCADA system for Telecontrol and Telemetering	1	lot				
2Q	**Generator for Emergency Aux. Power**	1	set				
2Q1	Generator for Emergency Aux. Power	0	set				
2R	**Other Equipment**						
2R1	Scissor Lift	0	set				
2R2	Emergency Interphone (each room)	0	lot				
	Total of Section-II						
	(Carried to Schedule-5:Grand summary)						
SECTION-III	**Anwara 230/132/33kV Indoor GIS:**			-			
3A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
3B	**245kV GIS Switchyard, structures & connections**						
	245kV indoor Type Gas Insulated Switchgear (GIS)						
3B1	245kV GIS Double Busbar , 245kV Line Feeder Bay with Local Control Cubicle and support structure	8	Sets				
3B2	245kV GIS Double Busbar, 245kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
3B3	245kV GIS Double Busbar , 245kV Bus Coupler Bay with Local Control Cubicle and support structure	2	Sets				
3B4	245kV GIS Double Busbar , 245kV Bus Section Bay with Local	2	Sets				
3B5	245kV GIS Double Busbar , 245kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	4	Sets				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3B6	Busbar extension module	2	Sets				
	245kV Air Insulated Switchgear (AIS)						
3B7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	24	nos.				
3B8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
3B8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
3B9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
3B9.1	Insulator	1	lot				
3B9.2	Fittings & Clamps, Connector	1	lot				
3B9.3	Nut-bolt	1	lot				
3B10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
3B10.1	Steel Structure for T/L with Nut & Bolts						
3B10.1.a)	Gantry Column with single beam	13	Nos				
3B10.1.b)	Beam	10	Nos				
3B10.1.c)	Gantry Column with double beam	0	Nos				
3B10.2	Equipment Structure with Nut & Bolts						
3B10.2.a)	LA	24	Nos.				
3B10.2.b)	Outdoor CSE	0					
3B10.3	Nut & Bolts	1	lot				
3B10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
3B10.5	HV power Cable tray including fitting, fixing accessories	1	lot				
3C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)						
3C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
3C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	4	Sets				
3C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				
3C4	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure	0	Sets				
3C5	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
3C6	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
3C7	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	18	nos.				
3C8	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV						
3C8.1	Tubular Conductor and/or Flexible Conductor	1	lot				
3C9	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3C9.1	Insulator	1	lot				
3C9.2	Fittings & Clamps, Connector	1	lot				
3C9.3	Nut-bolt	1	lot				
3C10	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
3C10.1	Steel Structure for T/L with Nut & Bolts						
3C10.1.a)	Gantry Column with single beam	8	Nos				
3C10.1.b)	Beam	6	Nos				
3C10.1.c)	Gantry Column with double beam	0	Nos				
3C10.2	Equipment Structure with Nut & Bolts						
3C10.2.a)	LA	18	Nos.				
3C10.2.b)	Outdoor CSE	18					
3C10.3	Nut & Bolts	1	lot				
3C10.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
3C10.5	HV power Cable tray including fitting, fixing accessories	1	lot				
3D	**36kV Switchger & connection**						
3D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				
3D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	4	sets				
3D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection	4	sets				
3D.4	Two (2) sets of 36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, gang operated, gas or vacuum circuit breaker with spring-stored energy operating mechanism for auxiliary transformer feeder	2	sets				
3D.5	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers	12	nos.				
3D.6	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection	12	nos.				
3D.7	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
3D.8	Current transformer 36 kV, single-phase, 3-core, multi ratio, 10/1A, 800-1250/1-1A, 31.5kA/1sec, 50 Hz, 170/70 kV BIL, post type current transformer for auxiliary transformer feeder	6	nos.				
3D.9	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer	1	lot				
3D.10	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3D.11	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. including otheraccessories for each connection as required for completing 36kVSwitchyard and auxiliary transformer connection	1	lot				
3D.12	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
3E	**Power Transformers and Earthing/Auxiliary Transformers**						
3E.1	230/132/33 kV, 250/350 MVA (ONAN/ONAF), three phase outdoor type power (auto) transformer	2	sets				
3E.2	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
3E.3	Auxiliary power transformer 33/0.415 kV, 400 kVA	2	sets				
3E.3	Water Spray fire fighting system for 230/132/33 kV Power Transformer	2	sets				
3F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
3F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	6	sets				
3F2	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	2	sets				
3F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	2	sets				
3F5	Busbar Protection including SAS Function (230kV Circuit)	1	sets		-		
3F6	Tariff meter						
3F.6.1	Meters (Main & Check)	8	sets				
3F.6.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	145kV Circuits						
3F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
3F8	Control, Protection, Monitoring including SAS Function for Power transformer (350MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F9	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles	2	sets				
3F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
3F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
3F12	Busbar Protection including SAS Function (145kV Circuit)	1	sets				
3F13	Tariff meter						
3F.13.1	Meters (Main & Check)	6	sets				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3F.13.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						
3F14	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	4	sets				
3F15	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer	0	sets				
3F16	Tariff meter						
3F16.1	Meters (Main & Check)	4	sets				
3F16.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
3F17	**Substation Automation system**	1	lot				
3G	**Digital Fault & Disturbance Recorder**						
3G1	Digital Fault & Disturbance Recorder	1	lot				
3H	**Terminations and GIL**						
3H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV	0	m				
3H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV	900	m				
3H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal	0	Nos.				
3H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	12	Nos.				
3H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
3H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
3H7	230kV, 3150A GIL	700	m				
3I	**Earthing and Lightning Protection system**						
3I1	Earthing system for complete substation	1	lot				
3I2	Lightning Protection System for complete substation	1	lot				
3I3	3-phase Portable earthing devices	2	sets				
3J	**Multicore Low Voltage Power & Control Cables**						
3J1.1	LV Control Cable	1	lot				
3J1.2	LV Power Cable	1	lot				
3K	**Batteries, chargers & DC distribution**						
3K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 400Ah @ 5h	1	lot				
ii	150A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
3K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot	-			
3K3	Necessary modification & extension works in existing DCDB	0	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
3L	**LVAC Distribution**						
3L1	LVAC switchboard for substation services	1	lot				
3L2	Tariff metering panel	1	lot				
3M	**Civil Works, Building and Foundation**						
3M1*	Complete land development and slope protection						
i.	Complete compacted land development with carried/dredged earthfilling including approach road	5,66,999	Cube meter				
ii.	Slpoe protection including approach road						
a)	Slpoe (1V:2H) protection with turfing	18,360	sqm				
3M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 132kV GIS switchyards, Transformer yard	1	lot				
3M3*	Complete civil items required for outdoor works						
i	Outdoor gantry foundation in 230kV switchyard						
a)	Gantry column	13	nos.				
ii	Outdoor equipment foundation in 230kV switchyard						
a)	LA	24	nos.				
iii	Outdoor gantry foundation in 132kV switchyard						
a)	Gantry column	8	nos.				
iv	Outdoor equipment foundation in 132kV switchyard						
a)	LA	18	nos.				
b)	CSE	18	nos.				
v	Outdoor gantry foundation in 33kV switchyard	1	lot				
vi	Outdoor equipment foundation in 33kV switchyard	1	lot				
vii	Transformer foundation	4	nos.				
viii	Blast wall with foundation	6	nos.				
ix	Boundary wall for overall plan	1150	meter				
x	Substation main gate	1	nos.				
xi	Chain link fencing including gates	100	meter				
xii	Approach road (pavement width 6m)	30	meter				
xiii	Internal road						
a)	6m wide road	100	meter				
b)	4.5m wide road	1100	meter				
c)	1.5m walk way	10	meter				
xiv	Cable trench/tunnel with soakpit						
a)	Cable trench for HV power cable	450	meter				
b)	Cable trench for LV power & control cable	400	meter				
xv	Surface drain	1150	meter				
xvi	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	1	lot				
xvii	Gravelling in switchyard area	650	sqm				
xviii	Septic tank and soak way	4	nos				
xix	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	1	lot				
xx	Guard house	1	nos				
xxi	Sentry post	4	nos				
xxii	Car port	1	nos				
xxiii	RCC culvert (top width 8m)	15	meter				
xxiv	Property line demarkation	1111	meter				
3M4**	GIS cum control room building & Ansar Barack						
i	Two storied 230kV GIS building (55mX12m)	1320	sqm				
ii	10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	1	lot				
iii	Three storied 230kV control room building (20mx12m)	720	sqm				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
iv	Elevator system (capacity: 6 people)	1	lot				
v	Two storied 132kV GIS building (45mX12m)	1080	sqm				
vi	10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	1	lot				
vii	Three storied 132kV control room building (20mx12m)	720	sqm				
viii	Elevator system (capacity: 6 people)	1	lot				
ix	Single Storied Ansar Barack (5.1mx20m)	102	sqm				
3M5	Testing of foundation						
i	Compression test of pile	4	nos				
ii	Uplift test of pile	2	nos				
	* actual payment shall be as per actual work at site						
	** mesurement method = clear length x clear width x no. of story						
3N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
3N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
3N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
3N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
3N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	1	lot				
3N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
3N3.3	Fire Fighting system For Control Room	1	lot				
3N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
3O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system	1	lot				
3P	**SCADA system for Telecontrol and Telemetering**						
3P1	SCADA system for Telecontrol and Telemetering	1	lot				
3Q	**Generator for Emergency Aux. Power**						
3Q1	Generator for Emergency Aux. Power	1	set				
3R	**Other Equipment**						
3R1	Scissor Lift	1	set				
3R2	Emergency Interphone (each room)	1	lot				
	Total of Section-III						
	(Carried to Schedule-5:Grand summary)						
SECTION-IV	**Cox's Bazar (N) 132/33kV Indoor GIS**						

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
4B	**245kV GIS Switchyard, structures & connections (Not in scope)**	0	Sets				
4C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)						
4C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	9	Sets				
4C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	3	Sets				
4C3	145kV GIS Double Busbar , Capacitor Bank Bays with Local Control Cubicle and support structure	2	Sets				
4C4	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	2	Sets				
4C5	145kV GIS Double Busbar , 145kV Bus Section Bay with Local Control Cubicle and support structure	2	Sets				
4C6	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	4	Sets		-		
4C7	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
4C8	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	39	nos.				
4C9	Rigid tubular conductor and/or stranded conductors including						
4C9.1	Tubular Conductor and/or Flexible Conductor	1	lot				
4C10	Insulator and fittings including all necessary clamps and connectors						
4C10.1	Insulator	1	lot				
4C10.2	Fittings & Clamps, Connector	1	lot				
4C10.3	Nut-bolt	1	lot				
4C11	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
4C11.1	Steel Structure for T/L with Nut & Bolts						
4C11.1.a)	Gantry Column with single beam	13	Nos				
4C11.1.b)	Beam	11	Nos				
4C11.1.c)	Gantry Column with double beam	0	Nos				
4C11.2	Equipment Structure with Nut & Bolts						
4C11.2.a)	LA	39	Nos.				
4C11.2.b)	Outdoor CSE	33	Nos.				
4C11.3	Nut & Bolts	1	lot				
4C11.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
4C11.5	HV power Cable tray including fitting, fixing accessories	1	lot				
4D	**36kV Switchger & connection**						
4D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	3	sets				
4D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	6	sets				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure	2	sets				
4D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure	9	nos.				
4D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure	15	nos.				
4D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	9	nos.				
4D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer	1	lot				
4D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
4D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures including gantry, cable trays, nuts & bolts, etc. including otheraccessories for each connection as required for completing 36kVSwitchyard and auxiliary transformer connection	1	lot				
4D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
4E	**Power Transformers and Earthing/Auxiliary Transformers**						
4E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	3	sets				
4E.2	Auxiliary power transformer 33/0.415 kV, 400 kVA	2	sets				
4E.3	Water Spray fire fighting system	0	sets				
4E.4	132kV 50MVAR Capacitor Bank with associated equipment	2	sets				
4F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
4F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	8	sets				
4F2	Control, Protection, Monitoring including SAS Function for Power transformer circuits, along with Control & Protection Cubicles	3	sets				
4F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles	2	sets				
4F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	2	sets				
4F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	2	sets				
4F6	Busbar Protection including SAS Function (132kV Circuit)	1	sets				
4F7	Tariff meter						
4F7.1	Meters (Main & Check)	11	sets				
4F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
	36kV Circuits						
4F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	3	sets				
4F9	Tariff meter			-			
4F9.1	Meters (Main & Check)	3	sets				
4F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
4F10	**Substation Automation system**	1	lot				
4G	**Digital Fault & Disturbance Recorder**						
4G1	Digital Fault & Disturbance Recorder	1	lot				
4H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
4H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
4H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	1200	m				
4H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
4H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	33	Nos.				
4H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
4H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
4H7	230kV, 3150A GIL	0	m				
4I	**Earthing and Lightning Protection system**						
4I1	Earthing system for complete substation	1	lot				
4I2	Lightning Protection System for complete substation	1	lot				
4I3	3-phase Portable earthing devices	2	sets				
4J	**Multicore Low Voltage Power & Control Cables**						
4J1.1	LV Control Cable	1	lot				
4J1.2	LV Power Cable	1	lot				
4K	**Batteries, chargers & DC distribution**						
4K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 400Ah @ 5h	1	lot				
ii	150A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
4K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
4K3	Necessary modification & extension works in existing DCDB	0	lot				
4L	**LVAC Distribution**						
4L1	LVAC switchboard for substation services	1	lot				
4L2	Tariff metering panel	1	lot				
4M	**Civil Works, Building and Foundation**						
4M1*	Complete land development and slope protection						
i.	Complete compacted land development with carried/dredged earthfilling including approach road	1,88,606	Cube meter				
ii	Slpoe protection including approach road						
a)	Slpoe (1V:2H) protection with turfing	10,987	sqm				
4M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 132kV GIS switchyards, Transformer yard	1	lot				
4M3*	Complete civil items required for outdoor works						
i	Outdoor gantry foundation in 132kV switchyard						
a)	Gantry column	13	nos.				
ii	Outdoor equipment foundation in 132kV switchyard						
a)	LA	39	nos.				
b)	CSE	33	nos.				
iii	Outdoor gantry foundation in 33kV switchyard	1	lot				
iv	Outdoor equipment foundation in 33kV switchyard	1	lot				
v	Transformer foundation	3	nos.				
vi	Blast wall with foundation	4	nos.				
vii	Boundary wall for overall plan	800	meter				
viii	Substation main gate	1	nos.				
ix	Chain link fencing including gates	100	meter				
x	Approach road (pavement width 6m)	150	meter				
xi	Internal road						
b)	6m wide road	200	meter				
c)	4.5m wide road	800	meter				
xii	Cable Trench						
a)	Cable trench for HV power cable	200	meter				
b)	Cable trench for LV power & control cable	200	meter				
xiii	Surface drain	800	meter				
xiv	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	1	lot				
xv	Gravelling in switchyard area	1350	sqm				
xvi	Septic tank and soak way	2	nos				
xvii	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	1	lot				
xviii	Guard house	1	nos				
xix	Sentry post	4	nos				
xx	Car port	1	nos				
xxi	Property line demarkation	795	meter				
xxii	Retaininy wall for approach road	150	meter				
4M4**	GIS cum control room buiding & Ansar Barack						
i	Two storied 132kV GIS building (35mx12m)	840	sqm				
ii	10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	1	lot				
iii	Three storied 132kV control room buiding (20mx12m)	720	sqm				
iv	Lift (6 person)	1	lot				
v	Single Storied Ansar Barack (5.1mx20m)	102	sqm				
4M5	Testing of Foundation						
i	Compression test of pile	2	nos				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
ii	Uplift test of pile	2	nos				
	* actual payment shall be as per actual work at site						
	** mesurement method = clear length x clear width x no. of story						
4N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot		-		
4N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				
4N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
4N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
4N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	0	lot				
4N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
4N3.3	Fire Fighting system For Control Room	1	lot				
4N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
4O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system	1	lot				
4P	**SCADA system for Telecontrol and Telemetering**						
4P1	SCADA system for Telecontrol and Telemetering	1	lot				
4Q	**Generator for Emergency Aux. Power**						
4Q1	Generator for Emergency Aux. Power	1	set				
4R	**Other Equipment**						
4R1	Scissor Lift	1	set				
4R2	Emergency Interphone (each room)	1	lot				
	Total of Section-IV						
	(Carried to Schedule-5:Grand summary)						
SECTION-V	**Teknaf 132/33kV Indoor GIS**						
5A	**400kV GIS Switchyard, structures & connections (Not scope of work) (Deleted)**	0	Sets				
5B	**245kV GIS Switchyard, structures & connections (Deleted)**	0	Sets				
5C	**145kV GIS Switchyard, structures & connections**						
	145kV indoor Type Gas Insulated Switchgear (GIS)						
5C1	145kV GIS Double Busbar , 145kV Line Feeder Bay with Local Control Cubicle and support structure	2	Sets				
5C2	145kV GIS Double Busbar, 145kV Transformer Bay with Local Control Cubicle and support structure	2	Sets				
5C3	145kV GIS Double Busbar , 145kV Bus Coupler Bay with Local Control Cubicle and support structure	1	Sets				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5C4	145kV GIS Double Busbar , 145kV Bus VT with Busbar ES circuit Bay with Local Control Cubicle and support structure	2	Sets				
5C5	Busbar extension module	2	Sets				
	145kV Air Insulated Switchgear (AIS)						
5C6	198kV rated voltage, 158kV (rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	12	nos.				
5C7	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard						
5C7.1	Tubular Conductor and/or Flexible Conductor	1	lot				
5C8	Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard						
5C8.1	Insulator	1	lot				
5C8.2	Fittings & Clamps, Connector	1	lot				
5C8.3	Nut-bolt	1	lot				
5C9	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						
5C9.1	Steel Structure for T/L with Nut & Bolts						
5C9.1.a)	Gantry Column with single beam	9	Nos				
5C9.1.b)	Beam	6	Nos				
5C9.1.c)	Gantry Column with double beam	0	Nos				
5C9.2	Equipment Structure with Nut & Bolts						
5C9.2.a)	LA	12	Nos.				
5C9.2.b)	Outdoor CSE	12	Nos.				
5C9.3	Nut & Bolts	1	lot				
5C9.4	LV power & control cable tray including fitting, fixing accessories	1	lot				
5C9.5	HV power Cable tray including fitting, fixing accessories	1	lot				
5D	**36kV Switchger & connection**						
5D.1	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, gas or vacuum circuit breaker with spring-stored energy operating mechanism	2	sets				
5D.2	36kV, 3000A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch	4	sets				
5D.3	36kV, 800A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnector with earth switch for Auxiliary connection with support structure	2	sets				
5D.4	single-phase, 2-secondary windings (33/√3kV / 110/√3V / 110/√3V), 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive voltage transformers with support structure	6	nos.				
5D.5	30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arrester for 33kV incomer & Auxiliary connection with support structure	12	nos.				
5D.6	Current transformer 36 kV, single-phase, 4-core, multi ratio, 3000-2500/1-1-1-1A, 31.5 kA / 1 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5D.7	Auxiliary side connection between 36kV terminal to switches including necessary fittings, insulators, structures, conductors, fuse and 36kV XLPE cable etc. for 2 sets of 33/0.415kV Auxiliary transformer	1	lot				
5D.8	One (1) lot of stranded flexible conductors or tubular conductors including other accessories for each connection as required for completing 36kV Switchyard	1	lot				
5D.9	One (1) lot of insulators, post insulators, fittings, clamps, connectors, steel structures, cable trays, nuts & bolts, etc. including other accessories for each connection as required for completing 36kV Switchyard and auxiliary transformer connection	1	lot				
5D.10	One (1) lot of cables & terminations including other accessories for auxiliary transformer connection	1	lot				
5E	**Power Transformers and Earthing/Auxiliary Transformers**						
5E.1	132/33 kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformer	2	sets				
5E.2	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
5E.3	Auxiliary power transformer 33/0.415 kV, 350 kVA	2	sets				
5E.3	Water Spray fire fighting system	0	sets				
5E.4	33kV Capacitor Bank with associated equipment	0	sets				
5F	**Control, Protection, Substation Automation and Metering**						
	145kV Circuits						
5F1	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	2	sets				
5F2	Control, Protection, Monitoring including SAS Function for Power transformer (120MVA) circuits, along with Control & Protection Cubicles	2	sets				
5F3	Control, Protection, Monitoring including CSD & SAS Function for Capacitor Bank circuits, along with Control & Protection Cubicles	0	sets				
5F4	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	1	sets				
5F5	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	0	sets				
5F6	Busbar Protection including SAS Function (132kV Circuit)	1	sets				
5F7	Tariff meter						
5F7.1	Meters (Main & Check)	4	sets				
5F7.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
	36kV Circuits						
5F8	Control, Monitoring, Protection & SAS function for 33kV incomer feeder power system, along with Control & Protection Cubicles	2	sets				
5F9	Tariff meter						
5F9.1	Meters (Main & Check)	2	sets				
5F9.2	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	1	lot				
5F10	Substation Automation system	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5G	**Digital Fault & Disturbance Recorder**						
5G1	Digital Fault & Disturbance Recorder	1	lot				
5H	**230kV & 132kV & 33kV Power Cables, associated Outdoor Terminations and GIL**						
5H1	2000 mm2 (least), 245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, single phase XLPE cable.	0	m				
5H2	2000 mm2 (least), 145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 650/275kV BIL, single phase XLPE cable.	600	m				
5H3	245 kV, 2,000A, 50kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
5H4	145 kV, 2,000A, 40kA/ 1 sec, 50Hz, 1,050/460 kV BIL, cable terminal end & associated support structures for single phase XLPE cable.	12	Nos.				
5H5	36kV, 800mm2, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.	0	m				
5H6	36kV, 31.5kA/ 1 sec, 50Hz, 170/70 kV BIL, appropriate current capacity cable terminal end & associated support structures for single phase XLPE cable.	0	Nos.				
5H7	230kV, 3150A GIL	0	m				
5I	**Earthing and Lightning Protection system**						
5I1	Earthing system for complete substation	1	lot				
5I2	Lightning Protection System for complete substation	1	lot				
5I3	3-phase Portable earthing devices	2	sets				
5J	**Multicore Low Voltage Power & Control Cables**						
5J1.1	LV Control Cable	1	lot				
5J1.2	LV Power Cable	1	lot				
5K	**Batteries, chargers & DC distribution**						
5K1	110V Ni-cad Batteries with chargers and distribution boards						
i	110V Ni-cad Batteries, 350Ah @ 5h	1	lot				
ii	120A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
iv	3kVA, 240V, 50Hz UPS (Inverter)	1	lot				
5K2	48V Ni-cad Batteries with chargers and distribution board						
i	48V Ni-cad Batteries, 200Ah @ 5h	1	lot				
ii	90A Battery chargers	1	lot				
iii	DC Distribution Board	1	lot				
5K3	Necessary modification & extension works in existing DCDB	0	lot				
5L	**LVAC Distribution**						
5L1	LVAC switchboard for substation services	1	lot				
5L2	Tariff metering panel	1	lot				
5M	**Civil Works, Building and Foundation**						
5M1*	Complete land development and slope protection						
i	Complete compacted land development with carried/dredged earthfilling including approach road	70,750	Cube meter				
ii	Slpoe protection including approach road						
a)	Slpoe (1V:2H) protection with turfing	4,450	sqm				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV & 132kV GIS switchyards, Transformer yard	1	lot				
5M3*	Complete civil items required for outdoor works						
i	Outdoor gantry foundation in 132kV switchyard						
a)	Gantry column	9	nos.				
ii	Outdoor equipment foundation in 132kV switchyard						
a)	LA	12	nos.				
b)	CSE	12	nos.				
iii	Outdoor gantry foundation in 33kV switchyard	1	lot				
iv	Outdoor equipment foundation 33kV switchyard	1	lot				
v	Transformer foundation	2	nos.				
vi	Blast wall with foundation	3	nos.				
vii	Boundary wall for overall plan	600	meter				
viii	Substation main gate	1	nos.				
ix	Chain link fencing including gates	100	meter				
x	Approach road (pavement width 6m)	20	meter				
xi	Internal road						
a)	6m wide road	200	meter				
b)	4.5m wide road	600	meter				
c)	1.5m walk way	10	meter				
xii	Cable trench/tunnel with soakpit						
a)	Cable trench for HV power cable	100	meter				
b)	Cable trench for LV power & control cable	100	meter				
xiii	Surface drain	600	meter				
xiv	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	1	lot				
xv	Gravelling in switchyard area	1000	sqm				
xvi	Septic tank and soak way	2	nos				
xvii	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	1	lot				
xviii	Guard house	1	nos				
xix	Sentry post	4	nos				
xx	Car port	1	nos				
xxi	Culvert (top width 8m)	10	meter				
xxii	Property line demarkation	620	meter				
5M4**	GIS cum control room building & Ansar barack						
i	Two storied 132kV GIS building (35mx12m)	840	sqm				
ii	10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	1	lot				
iii	Three storied 132kV control room building (20mx12m)	720	sqm				
iv	Lift (6 person)	1	lot				
v	Single Storied Ansar Barack (5.1mx20m)	102	sqm				
5M5	Testing of foundation						
i	Compression test of pile	3	nos				
ii	Uplift test of pile	2	nos				
	* actual payment shall be as per actual work at site						
	** mesurement method = clear length x clear width x no. of story						
5N	**Building Lighting, Switchyard lighting, Small Power, Air Conditioning, Ventilation, Fire Fighting & CCTV system**	1	lot				
5N1	Indoor Lighting (LED type), small power, air conditioning and Ventilation and emergency DC lighting	1	lot				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
5N2	Lighting for outside building for security, roadway, switchyard and emergency DC lighting for Outdoor	1	lot				
5N3	Fire Alarm & Fire Fighting system for GIS Hall & Control Room						
5N3.1	Fire Fighting system For 230kV GIS Hall & Panel Room	0	lot				
5N3.2	Fire Fighting system For 132kV GIS Hall & Panel Room	1	lot				
5N3.3	Fire Fighting system For Control Room	1	lot				
5N4	Complete CCTV with motion sensor (each room and S/Y)	1	lot				
5O	**Telecommunication System Fibre optic multiplexer equipment for communication and protection**						
	Telecommunication System Fibre optic multiplexer equipment for communication and protection for - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system -Substation LAN system	1	lot				
5P	**SCADA system for Telecontrol and Telemetering**						
5P1	SCADA system for Telecontrol and Telemetering	1	lot				
5Q	**Generator for Emergency Aux. Power**						
5Q1	Generator for Emergency Aux. Power	1	set				
5R	**Other Equipment**						
5R1	Scissor Lift	1	set				
5R2	Emergency Interphone (each room)	1	lot				
	Total of Section-V						
	(Carried to Schedule-5:Grand summary)						
SECTION-VI	**Mandatory Spares, Erection & Test Equipment**						
6.1	**420kV Gas Insulated Switchgear**	0	nos				
6.2	**245kV Gas Insulated Switchgear**						
6.2.1	Complete module for offered type Circuit Breaker (each type)	4	sets				
6.2.2	DS/ES Switch	4	sets				
6.2.3	DS/ES mechanism	4	sets				
6.2.4	HES Switch	4	sets				
6.2.5	HES mechanism	4	sets				
6.2.6	Each type of auxiliary contacts unit	4	sets				
6.2.7	Surge arrester	4	sets				
6.2.8	Complete Voltage transformer module	4	sets				
6.2.9	Complete Current transformer module	4	sets				
6.2.10	Closing coils	4	nos.				
6.2.11	Tripping coils	8	nos.				
6.2.12	Circuit breaker operating mechanism	4	nos.				
6.2.13	Disconnector drive	4	nos.				
6.2.14	Coils for Blocking magnet in disconnector drive	4	nos.				
6.2.15	Gas pressure monitoring system	4	nos.				
6.2.16	Pressure Relief Device	4	nos.				
6.2.17	Supporting insulator with barrier	8	nos.				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.2.18	Barrier insulator or gas tight barrier	8	nos.				
6.2.19	Rubber gaskets "O" rings and seals for SF6 gas	1	lot/SS				
6.2.20	All types of control valves for SF6 gas	1	lot/SS				
6.2.21	SF6 gas cylinders - 45 kg	8	nos.				
6.3	**145kV Gas Insulated Switchgear**						
6.3.1	Complete module for offered type Circuit Breaker (each type)	4	sets				
6.3.2	DS/ES Switch	4	sets				
6.3.3	DS/ES mechanism	4	sets				
6.3.4	HES Switch	4	sets				
6.3.5	HES mechanism	4	sets				
6.3.6	Each type of auxiliary contacts unit	4	sets				
6.3.7	Surge arrester	4	sets				
6.3.8	Complete Voltage transformer module	4	sets				
6.3.9	Complete Current transformer module	4	sets				
6.3.10	Closing coils	4	nos.				
6.3.11	Tripping coils	8	nos.				
6.3.12	Circuit breaker operating mechanism	4	nos.				
6.3.13	Disconnector drive	4	nos.				
6.3.14	Coils for Blocking magnet in disconnector drive	4	nos.				
6.3.15	Gas pressure monitoring system	4	nos.				
6.3.16	Pressure Relief Device	4	nos.				
6.3.17	Supporting insulator with barrier	8	nos.				
6.3.18	Barrier insulator or gas tight barrier	8	nos.				
6.3.19	Rubber gaskets "O" rings and seals for SF6 gas	1	lot/SS				
6.3.20	All types of control valves for SF6 gas	1	lot/SS				
6.3.21	SF6 gas cylinders - 45 kg	8	nos.				
6.4	**36kV Switchgears**						
6.4.1	36kV Vacuum Circuit Breaker with structure	3	sets				
6.4.2	36kV Disconnector Switch	3	sets				
6.4.3	36kV Load Beak Switch with fuse	2	sets				
6.4.4	36kV IVT (same as offered type)	3	nos.				
6.4.5	36kV Current Transformer (same as offered type)	3	nos.				
6.4.6	30kV Surge Arrester	3	nos.				
6.4.7	Closing coils for CB	5	nos.				
6.4.8	Tripping coils for CB	5	nos.				
6.5	**Protection and Control**						
6.5.1	Each type of Protection relay and AVR relay for 230/33kV Bangabandhu Hi-Tech SS (Bidder to list)	1	sets				
6.5.2	Each type of Protection relay and AVR relay for 230/132/33kV Anwara SS (Bidder to list)	1	sets				
6.5.3	Each type of Protection relay and AVR relay for 132/33kV Cox'sbazar SS (Bidder to list)	1	sets				
6.5.4	Each type of Protection relay and AVR relay for 132/33kV Teknaf SS (Bidder to list)	1	sets				
6.5.5	Bus bar Differential Relay (Central Unit)	1	sets				
6.5.6	Each type of Tripping relays (electrical reset) (Bidder to list)	5	sets				
6.5.7	Each type of Auxiliary relays (Bidder to list)	5	sets				
6.5.8	Each type of Trip circuit supervision relays (Bidder to list)	1	sets				
6.5.9	Each type of Bay Control Unit	1	sets				
6.5.10	Relay Test Block & socket	2	sets				
6.5.11	Each type of Switch (if applicable)	1	sets				
6.5.12	Each type of MCB	1	sets				
6.5.13	Each type of Lamps	5	sets				
6.5.14	Heater	10	nos.				
6.5.15	Humidity Sensors	10	nos.				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.5.16	Humidity stat and thermostat	10	nos.				
6.5.17	Annunciator bulbs	10	nos.				
6.5.18	Bulbs for discrepancy switches	10	nos.				
6.5.19	Multifunction Meter	5	nos.				
6.5.20	Tariff/Energy Meter	5	nos.				
6.5.21	Industrial PC	1	set				
6.5.22	Gateway Terminal	1	set				
6.5.23	Bay Ethernet Switches	2	nos.				
6.5.24	Optical connectors (one for each)	1	lot				
6.6	**DC & Charger Equipment**						
6.6.1	Each type of Printed Circuit Board	1	lot				
6.6.2	Miniature circuit breaker of each type and rating (Bidder to list all types)	1	lot				
6.7	**LVAC Equipment**						
6.7.1	Miniature circuit breaker of each type and rating (Bidder to list all types)	1	lot				
6.8	**Power, Control and Auxiliary Cables**						
6.8.1	Power Cables (245kV), 300m of each type	1	lot				
6.8.2	Power Cables (145kV), 300m of each type	1	lot				
6.8.3	Power Cables (36kV), 300m of each type	1	lot				
6.8.4	Control Cables, 200m of each type	1	lot				
6.8.5	LV cables, 200m of each type	1	lot				
6.8.6	Other cables (communication, etc.), 100m of each type	1	lot				
6.9	**Transformers and Shunt Reactor**						
	Auto Transformer						
6.9.2	Set of gaskets	1	no.				
6.9.3	Set of dial type thermometer with gaskets	1	no.				
6.9.4	Set of thermal image type indicator with gaskets	1	no.				
6.9.5	Set of Silica gel breather	1	no.				
6.9.6	Buchholz relay	1	no.				
6.9.7	Set of tap changer diverter switch	1	no.				
6.9.8	Tap changer control mechanism motor	1	no.				
6.9.9	Transformer oil 200 litter barrel	20	nos.				
	Earthing / Auxiliary Transformer						
6.9.10	Set of gaskets	1	no.				
6.9.11	Set of dial type thermometer with gaskets	1	no.				
6.9.12	Set of thermal image type indicator with gaskets	1	no.				
6.9.13	Set of Silica gel breather	1	no.				
6.9.14	Buchholz relay	1	no.				
6.9.15	Transformer oil 200 litter barrel	5	nos.				
	Shunt Reactor						
6.9.17	420kV bushing	0	no.				
6.9.18	set of gaskets for each reactor	0	no.				
6.9.19	Set of dial type thermometer with gaskets	0	no.				
6.9.20	Set of thermal image type indicator with gaskets	0	no.				
6.9.21	Set of Silica gel breather	0	no.				
6.9.22	Shunt reactor oil 200 litter barrel	0	nos.				
6.10	**Instruments for Communication & SCADA**						
6.10.1	Digital data (Communication) analyzer	1	lot				
6.10.2	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility	1	lot				
6.10.3	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)	1	lot				

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.10.4	Subscriber Module for DCS 255 Exchange	1	lot				
6.11	**Post Type Insulator**						
6.11.1	For 420kV	0	nos.				
6.11.2	For 245kV	3	nos.				
6.11.3	For 145kV	3	nos.				
6.12	**Gas Insulated Line (GIL)**						
6.12.1	420kV, 4000A, GIL	0	m				
6.12.2	420kV, 2000A, GIL	0	m				
6.12.3	245kV, 3150A, GIL	20	m				
6.12.4	245kV, 2000A, GIL	0	m				
6.12.5	145kV, 3150A, GIL	0	m				
6.13	**Disc Insulator**						
6.13.1	Each type of Disc Insulator	20	nos.				
6.14	**Conductor**						
6.14.1	Each type of Bus Conductor	0	m				
6.14.2	Each size of Rigid Tubular Conductor	0	m				
6.15	**Clamp and Fitting**						
6.15.1	Each type of Clamps and Fittings (bidder to list) for each substation	10	nos.				
6.16	**Special tools / instruments for testing, operation and maintenance**						
6.16.1	SF6 Gas Treatment Plant For Gas Filling,Recovery,Evacuation,Filtering,Drying and Storage with necessary accessories (DILO)	4	sets				
6.16.2	1 cylinder of SF6 gas with valve	0	sets				
6.16.3	SF6 gas leakage detector (Infrared type)	0	sets				
6.16.4	SF6 density monitoring device	0	sets				
6.16.5	SF6 pressure monitring device	0	sets				
6.16.6	Offline Partial Discharge monitoring Device for GIS	0	sets				
6.16.7	Dew point Meter	0	sets				
6.16.8	Oxygen Analyzer	0	sets				
6.16.9	SF6 Multi-Analyser for measurement of %SF6, Moister and SO2 concetration	0	sets				
6.16.10	Portable vacuum pump suitable for SF6 circuit breaker	0	sets				
6.16.11	Contact resistance measurement test set (suitable for measurement down to 1 μ ohm at 10A d.c.)	0	sets				
6.16.12	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)	0	sets				
6.16.13	Earth resistance test set (range 10-100-1000 ohm: min scale division 0.1 ohm)	0	sets				
6.16.14	Clip-on mA meter (for spill current)	0	sets				
6.16.15	Thermovision Camera (Flir System)	0	sets				
6.16.16	Oil Insulation Tester	0	sets				
6.16.17	Circuit breaker operational analyzer with accessories including connecting lead	0	sets				
6.16.18	EMI Measuring device	0	sets				
6.16.19	Portable Lightning Arrester Diagnostic System (PLADS)	0	sets				
6.16.20	Set of Tools for GIS at each substation as per section-3, volume-2 and as offered by manufacturer	1	lot				
6.16.21	Set of Tools for each substation (as per table of section II, schedule A of volume 03)	0	sets				
6.16.22	Portable Earthing Leads	0	sets				
6.16.23	Advanced and automated meter testing set (CMC 430 + Test Universe for advanced meter testing + SEM 1 scanning equipment for meters)	0	sets				

Schedules of Rates and Prices

Schedule No. 4. Installation and Other Services

Item	Description	Qty. (1)	Unit	Foreign Currency		Local Currency (in BDT)	
				EXW Unit Price[1]	EXW Total Price[1]	EXW Unit Price	EXW Total Price
				(2)	*(1) x (2)*	(3)	*(1) x (3)*
6.16.24	Battery Capacity Tester TORKEL 860 (Battery Load Unit)	0	sets				
6.16.25	CMC 356 (With complete license) + RelaySimTest (Software for system based protection testing) + CMGPS 588 (GPS controlled time reference)	0	sets				
6.16.26	Battery ground fault detector (BGFT, Megger)	0	sets				
6.16.27	CIBANO 500 (Test system for medium and high voltage circuit breaker) + CB MC2 (Main contact module for CIBANO 500) + CB TN3 (Transducer node for CIBANO 500) + PTM (Primary Test Manager software)	0	sets				
	Total of Section-4						
	(Carried to Schedule-5:Grand summary)						
	TOTAL OF SCHEDULE NO.4						
	(To be indicated in Schedule No.5 Ground Summary)						

Name of Bidder _____

Signature of Bidder _____

Notes:

Culvert price shall be paid on actual basis considering the length.

Due to decrease or increase of any quantity mentioned above in unit "sets, nos., m, m^2, m^3, liter, kg " during execution stage, "-" Dash means included

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

[2] Specify currency in accordance with Bid Data Sheet 19.1

Schedules of Rates and Prices

Schedule 5: Grand Summary

Schedule No	Description	Total Price	
		Foreign Currency (in…….)	Local Currency (in BDT)
Section-I: Hi-Tech 230/33kV Gas Insulated Substation:			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-1			
Section-II: Kaliakoir 230kV AIS Bay extension			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-2			
Section-III: Anwara 230/132/33kV Indoor GIS:			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-3			
Section-IV: Cox's Bazar (N) 132/33kV Indoor GIS			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-4			
Section-V:Teknaf 132/33kV Indoor GIS			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		

Schedule 5: Grand Summary

Schedule No	Description	Total Price	
		Foreign Currency (in…….)	Local Currency (in BDT)
Schedule No. 4:	Installation and Other Services		
Total of Section-5			
Section VI: Mandatory Spares, Erection & Test Equipment			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Total of Section-6			
GRAND TOTAL (Schedule No.1 to Schedule No.4 (to Letter of Price Bid)			

Name of Bidder _____

Signature of Bidder _____

Schedule B6 - Recommended Spare Parts

Item	Description	Qty	Unit Price [1]		Total Price
			CIF or CIP (foreign parts)	EXW (local parts)	
		(1)	*(2)*	*(optional)*	*(1) x (2) or (3)*

Name of Bidder _____

Signature of Bidder _____

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE C

COMPLETION TIME SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

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 Tenderer)

Site	**A* Latest Access Permitted**	**B* Guaranteed Arrival of first shipment**	**C* Guaranteed Completion**	**D* Target Completion**
Chattogram	7 days from the contract effective date		36(Thirty six months)	

* 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.

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE C-1(Substation Part)

BAR CHART PROGRAMME OF KEY ACTIVITIES

	Time Period in month																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	.	.	.	..	.	32	33	34	35	36
Equipment Design																														
Drawings of single line diagram																														
Drawings of 230kV, 132V and 33kV Switchgear Layout																														
Drawings of 230/132kV Power Transformer																														
Drawings of 230/33kV Power Transformer																														
Drawings of 132/33kV Power Transformer																														
Manufacture of 230kV,132kV &33kV Switchgear																														
Manufacture of 230/132kV Power Transformer																														
Manufacture of 230/33kV Power Transformer																														
Manufacture of 132/33kV Power Transformer																														
Manufacture of Control, Protection, and Metering System																														
Factory Acceptance Test																														
Delivery of equpment to site																														
Building & Foundation Design																														
Calculation/Drawings of gantry structures and equipment supports																														
Calculaiton /Drawings of GIS/control building																														
Calculaiton /Drawings of earthing System																														
Construction and Installation Works																														
Site Survey																														
Geo-technical survey																														
Switchyard																														
- Piling																														
- Foundation works incl. earthing																														
- Cable trenches																														
- Gantry and equpment support installation																														
switchgear equipment installation																														
Transformer installation																														
- GIS, and other AIS Installation																														
Construction of Control Building/GIS Bulding																														
Cable laying & Termination																														
Installation of LVAC & DC system																														
Installation of Indoor equipment (Control, protection, metering,SAS etc.)																														
Testing & Commissioning																														

Note: Time to complete the plant and services from the effective date is 36(thirty six) months.

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 shall have right to choose one or more of them, or can ask for replacement.
Prior to signing the Contract, the corresponding Appendix-5 to the Deed of Agreement shall be completed, listing the approved manufacturers for each (major) item concerned. For the items not listed in Appendix-5 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	**Auto transformer 230/132/33 kV**				
i.	Complete				
ii.	Tap Changer				
iii.	Bushing: HV/LV/TV/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.	Bucholz Relay				
xxiv.	Membrane				
1.2	**Power transformer 132/33 kV**				
i.	Complete				
ii.	Tap Changer				
iii.	Bushing: HV/LV/TV/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.	Bucholz Relay				
xxiv.	Membrane				
1.3	**Power transformer 230/33 kV**				
i.	Complete				
ii.	Tap Changer				
iii.	Bushing: HV/LV/TV/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.	Bucholz Relay				
xxiv.	Membrane				
1.4	**Auxiliary Power /Zigzag Transformer**				
i.	Auxiliary power transformer 400kVA, 33/0.415 kV				
2. Shunt/Bus Reactor					
i.	Complete				
ii.	Bushing HV/NV				
iii.	Copper Winding				
iv.	Winding Insulation Material				
v.	Porcelain for insulators				
vi.	Core plates				
vii.	Radiators				
viii.	Reactor Oil				
ix.	Oil valves				
x.	Tank				
xi.	Temperature Indicator				
xii.	PRD				

xiii.	Oil Valve				
xiv.	Gas/Oil actuated relay				
xv.	Remote control panel				
xvi.	Indicating Instruments				
3. 420 kV Equipment					
3.1	400kV GIS				
	GIS 400 kV Complete				
	Enclosure				
	SF_6				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnector				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				
3.2	400kV AIS				
3.2.1	Circuit breakers 400 kV				
	Drive Mechanism				
	Interrupter Chamber				
	Insulator				
3.2.2	Disconnectors400 kV				
	Drive Mechanism				
	Male-Female Contact				
	Insulator				
3.2.3	Current transformers 400 kV				
	Core				
	Winding				

	Insulator				
3.2.4	Voltage transformers 400 kV				
	Core				
	Winding				
	Insulator				
3.2.5	Surge arresters 400 kV				
	ZnO Resistor Block				
	Housing				
	Surge Counter				
4. 245 kV Equipment					
4.1	230kV GIS				
	GIS 230 kV Complete				
	Enclosure				
	SF_6				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnector				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				
4.2	230kV AIS				
4.2.1	Circuit breakers 230 kV				
	Drive Mechanism				
	Interrupter Chamber				
	Insulator				
4.2.2	Disconnector 230 kV				
	Drive Mechanism				
	Male-Female Contact				

	Insulator				
4.2.3	Current transformers 230 kV				
	Core				
	Winding				
	Insulator				
4.2.4	Voltage transformers 230 kV				
	Core				
	Winding				
	Insulator				
4.2.5	Surge arresters 230 kV				
	ZnO Resistor Block				
	Housing				
	Surge Counter				
5. 145 kV Equipment					
5.1	132kV GIS				
	GIS 132 kV Complete				
	Enclosure				
	SF_6				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnector				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				
5.2	132kV AIS				
5.2.1	Circuit breakers 132 kV				
	Drive Mechanism				
	Interrupter				

	Chamber				
	Insulator				
5.2.2	Disconnectors132 kV				
	Drive Mechanism				
	Male-Female Contact				
	Insulator				
5.2.3	Current transformers 132 kV				
	Core				
	Winding				
	Insulator				
5.2.4.	Voltage transformers 132 kV				
	Core				
	Winding				
	Insulator				
5.2.5	Surge arresters 132 kV				
	ZnO Resistor Block				
	Housing				
	Surge Counter				
6. 33 kV Equipment					
6.1	Circuit breakers 33 kV				
6.2	Disconnectors 33 kV				
6.3	Current transformers 33 kV				
6.4	Voltage transformers 33 kV				
6.5	Surge arresters 33 kV				
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	Fiber optic Cable				
9.7	Laptop				
10.Telecommunication Equipment					
10.1	Communication equipment				
10.2	Multiplexer				
10.3	Fiber Optic cable				
10.4	PLC Communication				
10.5	Complete				

10.6	Panel				
10.7	Line matching Unit				
10.8	Surge arrester				
10.9	Wave Trap				
11. XLPE Cable & Cable Termination Kit& Cable Trays					
XLPE Cable					
11.1	400kV				
11.2	230kV				
11.3	132kV				
11.4	33kV				
Outdoor Cable Sealing End/ Cable Termination Kit (AIS)					
11.5	400kV				
11.6	230kV				
11.7	132kV				
11.8	33kV				
Indoor Cable Sealing End/ Cable Termination Kit (GIS)					
11.9	400kV				
11.10	230kV				
11.11	132kV				
11.12	33kV				
11.13	Cable Trays for Power Cables				
12.Auxiliary Power Supply Equipment					
12.1	ACU 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				
	Tubular conductor				
	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				
Name of Bidder:					
Signature of Bidder:					

Schedule E
Technical Particulars and Guarantees

GTP & requirement Form: Transformer

230/132/33kV, 250/350MVA, 3-Phase Auto Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Autotransformer three-phase, oil immersed, with tertiary winding, 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		Auto plus stabilizing	
1.9	Tertiary winding function		Stabilizing winding & auxiliary power supply	
1.10	Thermal insulation class		A	
1.11	Installation requirement		Outdoor	
2	**Ratings and properties**			
2.1	Voltage ratio at no load and at principle tap HV/MV/LV	kV/kV/kV	230/132/33kV	
2.2	Rated voltage of windings: HV winding MV winding LV - stabilizing winding	 kV kV kV	 230 132 33	
2.3	Rated power: a) Primary / secondary winding b) Tertiary - minimum	 MVA MVA	 350 / 350 ≥ 70	
2.4	Rated power by cooling ONAN /ONAF a) Primary / secondary winding Tertiary – minimum	 MVA MVA	 250 / 350 ≥ 50 / ≥ 70	
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	 Insert Insert Insert Insert	
2.6	**Tap changer:**			
	a) 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 350 MVA, all taps	
	Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts		Insert	
	Type test certificate reference		Insert	
	Motor Drive Unit Make /Type Number		Insert	
2.7	AVR relay			
	a) Manufacturer's Name		Shall be from tap changer manufacturer	
	b) Country Of Origin		Insert	
	c) 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		YNa0d1	
2.11	Low voltage winding connection (LV)		Open delta, with four terminals	
2.12	Type of cooling		ONAN/ONAF	
2.13	Line drop compensation	Yes/No	Yes	
2.14	Whether automatic control required and		Yes, 110V, 50Hz	
2.15	Whether separate remote control panel	Yes/No	Yes	
2.16	Whether provision for supervisory control	Yes/No	Yes	
2.17	Whether marshalling kiosk required	Yes/No	Yes (Tank Side, Cubicle)	
2.18	Number of transformers for which automatic control is to be suitable			
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 – MV, on the basis of rated power with on-load tap changer in middle position in extreme plus position in extreme minus position	% % %	**13 ±10 %**	
3.1.2	HV – LV, on the basis of rated power with on-load tap changer in middle position	%	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.3	MV – LV, on the basis of rated power 'x' MWA with on-load tap changer in middle position	%	Insert	
3.1.4	Maximum Impedance between HV – MV over tapping range Corresponding tap	%	Insert Insert	
3.1.5	Minimum Impedance between HV – MV over tapping range Corresponding tap	%	Insert Insert	
3.2	**Zero-sequence impedance, with tap changer in middle position:** a) HV/MV HV/LV MV/LV	 % % %	 Insert Insert Insert	
3.3	**Autotransformer capacity to withstand external short circuits**			
3.3.1	Short-circuit duration	s	3	
3.3.2	Symmetrical short-circuit with-stand capacity during indicated period: a) HV winding MV winding LV winding Pre-fault voltage	 kA kA kA p.u.	 50 40 31.5 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: a) HV winding MV winding LV winding Pre-fault voltage	 kA kA kA p.u.	 Insert	
3.4	**Guaranteed losses**			
3.4.1	No-load losses with tap changer in nominal position: a) at rated voltage and rated frequency at 110 % rated voltage, at rated frequency	 kW kW	 Insert Insert	
	No-load losses with tap changer in plus (+) extreme position:	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	No-load losses with tap changer in minus (-) extreme position:	kW	Insert	
	Average No-Load Loss **(this value will be evaluated)**	kW	Insert	
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			
	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
	On-load losses at 75°C, with tap changer in plus (+) extreme position	kW	Insert	
	On-load losses at 75°C, with tap changer in minus (-) extreme position	kW	Insert	
	Average On-load losses **(this value will be evaluated)**	kW	Insert	
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 %	%	10	
3.4.7	Ancillary equipment (fans, pumps,heaters,etc.)			
3.4.8	Load of ancillary equipment **(this value will be evaluated)**	kW	Insert	
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		
3.6	**Insulation level**			
3.6.1	High voltage (HV)		LI 1050, AC 460	
3.6.2	Medium voltage (MV)		LI 650, AC 275	
3.6.3	Low voltage (LV)		LI 170, AC 70	
3.6.4	Neutral		LI 170, AC 70	
3.6.5	Induced voltage (ACSD, ACLD)	kV	In acc. To IEC 60076-3	
3.7	**The highest voltage for equipment**			
3.7.1	High voltage (HV)	kV	245	
3.7.2	Medium voltage (MV)	kV	145	
3.7.3	Neutral	kV	36	
3.7.4	Low voltage (LV)	kV	36	
3.8	**Regulation at 75°C and normal ratio –** (A) At unity power factor (B) At 0.8 lagging power factor	 % %	 Insert Insert	
3.9	**Efficiencies**			
3.9.1	If cosφ = 1.0 and:			
3.9.2	If cosφ = 0.8 (inductive) and: a) 25 % load of the rated value		 Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	50 % load of the rated value 75 % load of the rated value 100 % load of the rated value		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	a) cosφ = 1.00		Insert	
3.10.2	cosφ = 0.95 (inductive)		Insert	
3.10.3	cosφ = 0.90 (inductive)		Insert	
3.10.4	cosφ = 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 rise under service conditions stated in Schedule of Technical Requirement: a) CMR b) ONAN rating	˚C ˚C	≤ 50 ≤ 50	
3.12.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement:	˚C	≤ 60	
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	≤ 73	
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)	˚C	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: a) 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	MVA %	Compliant to IEC 60076-7	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	by 2.5°C at rated power (in % of the rated voltage)			
3.14	Guaranteed value of overloads in % of the rated power		Insert	
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		Insert	
3.14.1.1	After operation under 15 min a) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.1.2	After operation under 20 min a) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.1.3	After operation under 120 min a) full rated power 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 a) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.2.2	After operation under 20 min a) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.2.3	After operation under 120 min a) full rated power ¾ rated power ½ 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: a) with all cooling groups in operation (excluding stand-by cooling group) with one cooling group out of operation with two cooling groups out of operation		 Insert Insert Insert	
4	**Oil**			
4.1	New		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	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		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 (2 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	mm	Ø 50	
5.1.10.2	Length	mm	125	
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	
5.1.14	Full vacuum withstand 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 porcelain/ composite silicon		Insert	
5.1.19	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		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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.5	Rated current	A	≥ 2000	
5.2.6	Rated short-circuit current (2 s)	kA rms	50	
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	
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 porcelain/ composite silicon		Insert	
5.2.19	De-rating Factor		Insert	
5.3	**MV bushings**			
5.3.1	Quantity		3	
5.3.2	Class	kV	145	
5.3.3	Manufacturer		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	≥ 2000	
5.3.6	Rated short-circuit current (2 s)	kA rms	50	
5.3.7	Rated lightning impulse withstand voltage	kV peak	650	
5.3.8	Rated switching impulse withstand voltage	kV peak	-	
5.3.9	Rated power frequency withstand voltage	kV rms	275	
5.3.10	Connectors			
5.3.10.1	Shape	mm	Ø 50	
5.3.10.2	Length	mm	125	
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 porcelain/ composite silicon		Insert	
5.3.19	De-rating Factor		Insert	
5.4	**LV bushings**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.4.1	Quantity		4	
5.4.2	Class	kV	36	
5.4.3	Manufacturer		Insert	
5.4.4	Type:		RIP with Composite Silicon Rubber Housing	
5.4.4.1	Single Flange or Double Flange		Insert	
5.4.4.2	Draw lead type or Solid Type		Insert	
5.4.4.3	Type: Oil to Oil or Oil to Air or Oil to SF6		Insert	
5.4.5	Rated current	A	≥ 2000	
5.4.6	Rated short-circuit current (2 s)	kA rms	50	
5.4.7	Rated lightning impulse withstand voltage	kV peak	170	
5.4.8	Rated switching impulse withstand voltage	kV peak	-	
5.4.9	Rated power frequency withstand voltage	kV rms	70	
5.4.10	Connectors			
5.4.10.1	Shape	mm	Flat	
5.4.10.2	Length	mm	Insert	
5.4.10.3	Adjusted for Cu wire		Cu wire	
5.4.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.4.12	Total Creepage distance of outdoor shedding	mm	Insert	
5.4.13	Protective Creepage distance of shedding	mm	Insert	
5.4.14	Full vacuum withstand of complete bushing		Yes	
5.4.15	Total length of insulator	mm	Insert	
5.4.16	Weight of insulator	kg	Insert	
5.4.17	Electrostatic capacity of complete bushings	pF	Insert	
5.4.18	Manufacturer of porcelain/ composite silicon		Insert	
5.4.19	De-rating Factor		Insert	
6	**Design Data**			
6.1	Maximum flux density in the legs a) At rated voltage, frequency & normal ratio At 105 % of the rated voltage Volts/turn	 T T V	 Insert Insert Insert	
6.2	Maximum flux density in the yokes: a) At rated voltage, frequency & normal ratio At 105 % of the rated voltage Volts/turn	 T T V	 Insert Insert Insert	
6.3	Maximum current density in windings at rated power and normal tap changer position: a) HV winding MV winding LV – stabilizing winding	 A/mm^{2}A/m m^{2}A/mm^2	 Insert Insert Insert	
6.3.1	Magnetising current (10agneti) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage	 % % %	 Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	at 1.1 x nominal voltage at 1.2 x nominal voltage	%	Insert	
6.3.2	Harmonic component of magnetizing current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	 % %	 <10% <3%	
6.4	Winding resistance at 75°C and middle tap changer position: a) HV winding MV winding b) LV - stabilizing winding	 Ω Ω Ω	 Insert Insert Insert	
6.5	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding (c) Free buckling force	 kN N/m2 KN	 Insert Insert Insert	
6.6	Designed safety margin	%	Insert	
6.7	ZnO block to limit distributed impulse [tap winding/other]		No	
6.8	X/R ratio		Insert	
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 Specific loss of core steel at 1.7 T inductance	Watts/kg Watts/kg	< 0.85 < 1.11	
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) MV (C) LV		 Insert Insert Insert	
6.10.2	Insulation of (a) HV windings (b) MV windings (c) LV windings		 Thermally upgraded insulation paper	
6.10.3	Type of Winding connections (brazed or crimped or others)			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	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 type		Insert	
6.10.6	MV winding type		Insert	
6.10.7	LV – stabilizing winding type		Insert	
6.10.8	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*	
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: c) Highest point of HV bushing Highest point of tank Highest point of conservator Highest point of lifting hook for removal of core and oil assembly	 mm mm mm mm	 Insert* Insert* Insert* Insert*	
7.10	Outer dimensions: d) Length Width	 mm mm	 Insert* Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	
7.12	Maximum shipping dimensions of tank: e) Outside height Outside width Outside length	 mm mm mm	 Insert Insert 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	≥ 1200	
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)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		In all phases, 2 cores: Core-1,2: 1200/1, 5P20, 30VA Core-3: Phase-B: for WTI Burden & other characteristics shall be defined in design stage	
10.2	CT in MV bushings, for protection, WTI and/or Tap Changer		In all phases, 2 cores: Core-1,2: 2000/1, 5P20, 30VA Core-3: Phase-B: for WTI Core-4: Phase-C: for AVR Burden & other characteristics shall be defined in design stage	
10.3	CT in LV bushing , for protection		In all phases, 2 cores: Core-1,2: 2000/1, 5P20, 30VA Core-3: Phase-B: for WTI Burden & other characteristics shall be defined in design stage	
10.4	CT in neutral bushing, for protection		In all phases, 2 cores: Core-1,2: 2000/1, 5P20, 30VA Burden & other characteristics shall be defined in design 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 nos. (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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	Bucholz relay bypass valve	Nos.	Insert	
13	**Oil Preservation system & Dehydrating breather**			
13.1	Main Tank and HV cable Box		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 Bottom Top	 mm mm mm	 Insert Insert Insert	
14.3	Material of the autotransformer 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	0.3	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 Tank is Designed c) At Full Vacuum	 mm mm mm	 < IEC < IEC < IEC	
15	**Conservator**			
15.1	Type		With diaphragm	
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 transformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: a) Maximum diagraph stress at highest working pressure Diagraph construction details Type of diagraph material		 Insert Insert 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/m2	Insert	
17.2	OLTC	kN/m2	Insert	
17.3	HV Cable Box	kN/m2	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
19.3	Average daily temperature	°C	+ 35	
19.4	Average annual temperature	°C	+ 25	
19.5	Minimum ambient temperature	°C	– 5	
19.6	Tertiary winding		Will be used	
19.7	Parallel operation		Yes	
19.8	External cooling medium		Air	
19.9	Average air temperature in anyone year not			
19.10	Consideration for Exposure to Sunshine		+ 35	
19.11	Consideration for Restricted Air Circulation		Required	
20	**Test & Short Circuit Withstand Requirement**			
20.1	Brief description of transformer or parts thereof		Test Reference	
20.2	Similar Design Transformer (as per IEC			
20.2.1	Testing Authority		STL Lab, insert Name	
20.2.2	certificate reference		Insert	
20.2.3	Contact address of test Lab		Insert	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	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 estimatedvalues only. Actual values shall be measured during execution of the contract (manufacturing of the equipment) and shall be included on the name plate.*

GTP & requirement Form: Transformer

230/33kV, 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		Insert	
1.9	Tertiary winding function		NA	
1.10	Thermal insulation class		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	230/33kV	
2.2	Rated voltage of windings: 1. HV winding 2. MV winding	 kV kV	 230 33	
2.3	Rated power: b) Primary / secondary winding c) Tertiary - minimum	 MVA MVA	 140 / 140 NA	
2.4	Rated power by cooling ONAN / ONAF d) Primary / secondary winding 3. Tertiary – minimum	 MVA MVA	 120/140 NA	
2.5	Rated current on HV/ LV windings at CMR e) HV at Highest Voltage Tap f) HV at Nominal Voltage Tap g) HV at Lowest Voltage Tap h) LV	 A A A A	 Insert Insert Insert Insert	
2.6	**Tap changer:**			
	e) Manufacturer		Insert	
	4. Country of origin		Insert	
	5. Model designation		insert	
	6. Type of tap changing		On-load Local, remote, supervisory electrical and hand operation	
	7. DS Type and Number		Vacuum Tap Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	8. Tap changer location		At High voltage side	
	9. Type of voltage regulation		C.F.V.V.	
	10. Tapping range	%	±10	
	11. Tapping step size	%	1.25	
	12. Number of tapping steps	Nos.	Insert	
	13. Rating		Rated power 140 MVA, all taps	
	14. Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts		Insert	
	15. Type test certificate reference		Insert	
	16. Motor Drive Unit Make /Type Number		Insert	
2.7	AVR relay			
	d) Manufacturer's Name		Shall be from tap changer manufacturer	
	e) Country Of Origin		Insert	
	f) 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)	
2.18	Number of transformers for which automatic control is to be suitable			
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	 % % %	**13 ±10 %**	
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:** f) HV/LV	 %	 Insert	
3.3	**Power transformer capacity to withstand external short circuits**			
3.3.1	Short-circuit duration	s	3	
3.3.2	Symmetrical short-circuit with-stand capacity during indicated period: g) HV winding 17. LV winding 18. Pre-fault voltage	 kA kA p.u.	 50 31.5 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: h) HV winding 19. LV winding 20. Pre-fault voltage	 kA kA p.u.		
3.4	**Guaranteed losses**			
3.4.1	No-load losses with tap changer in nominal position: i) at rated voltage and rated frequency 21. at 110 % rated voltage, at rated frequency	 kW kW	 Insert Insert	
	No-load losses with tap changer in plus (+) extreme position:	kW	Insert	
	No-load losses with tap changer in minus (-) extreme position:	kW	Insert	
	Average No-Load Loss **(this value will be evaluated)**	kW	Insert	
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			
	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
	On-load losses at 75°C, with tap changer in plus (+) extreme position	kW	Insert	
	On-load losses at 75°C, with tap changer in minus (-) extreme position	kW	Insert	
	Average On-load losses **(this value will be evaluated)**	kW	Insert	
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 ***(this value will be evaluated)***	kW	Insert	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 170, AC 70	
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	36	
3.8	**Regulation at 75°C and normal ratio –** (A) At unity power factor (B) At 0.8 lagging power factor	 % %		
3.9	**Efficiencies**			
3.9.1	If cosφ = 1.0 and: j) 25 % load of the rated value 22. 50 % load of the rated value 23. 75 % load of the rated value 24. 100 % load of the rated value		 Insert Insert Insert Insert	
3.9.2	If cosφ = 0.8 (inductive) and: k) 25 % load of the rated value 25. 50 % load of the rated value 26. 75 % load of the rated value 27. 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	l) cosφ = 1.00		Insert	
3.10.2	28. cosφ = 0.95 (inductive)		Insert	
3.10.3	29. cosφ = 0.90 (inductive)		Insert	
3.10.4	30. cosφ = 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 rise under service conditions stated in Schedule of Technical Requirement: a) CMR b) 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	
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	≤ 73	
3.12.5	Winding insulation temperature capacity	˚C	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)	˚C	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: m) Continuous overload at the highest winding temperature which exceeds by 2.5°C the guaranteed limit value 31. 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 n) full rated power 32. ¾ rated power 33. ½ rated power		 Insert Insert Insert	
3.14.1.2	After operation under 20 min o) full rated power 34. ¾ rated power 35. ½ rated power		 Insert Insert Insert	
3.14.1.3	After operation under 120 min p) full rated power 36. ¾ rated power 37. 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 38. ¾ rated power 39. ½ rated power		 Insert Insert Insert	
3.14.2.2	After operation under 20 min r) full rated power 40. ¾ rated power 41. ½ rated power		 Insert Insert Insert	
3.14.2.3	After operation under 120 min s) full rated power 42. ¾ rated power 43. ½ rated power		 Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: t) with all cooling groups in operation (excluding stand-by cooling group) 44. with one cooling group out of operation 45. 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 (2 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	mm	Ø 50	
5.1.10.2	Length	mm	125	
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	
5.1.14	Full vacuum withstand 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 porcelain/ composite silicon rubber		Insert	
5.1.19	De-rating Factor		Insert	
5.2	**Neutral bushing (identical as LV bushing)**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	≥ 3150	
5.2.6	Rated short-circuit current (2 s)	kA rms	≥ 78	
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	
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 porcelain/ composite silicon rubber		Insert	
5.2.19	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	≥ 3150	
5.3.6	Rated short-circuit current (2 s)	kA rms	≥ 78	
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	mm	Ø 50	
5.3.10.2	Length	mm	125	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.3.16	Weight of insulator	kg	Insert	
5.3.17	Electrostatic capacity of complete bushings	pF	Insert	
5.3.18	Manufacturer of porcelain/ composite silicon rubber		Insert	
5.3.19	De-rating Factor		Insert	
6	**Design Data**			
6.1	Maximum flux density in the legs u) At rated voltage, frequency & normal ratio 46. At 105 % of the rated voltage 47. Volts/turn	 T T V	 Insert Insert Insert	
6.2	Maximum flux density in the yokes: v) At rated voltage, frequency & normal ratio 48. At 105 % of the rated voltage 49. Volts/turn	 T T V	 Insert Insert Insert	
6.3	Maximum current density in windings at rated power and normal tap changer position: w) HV winding 50. LV winding	 A/mm^2 A/mm^2	 Insert Insert	
6.3.1	Magnetising current (magneti) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage at 1.1 x nominal voltage at 1.2 x nominal voltage	 % % % %	 Insert Insert Insert Insert	
6.3.2	Harmonic component of magnetizing current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	 % %	 <10% <3%	
6.4	Winding resistance at 75°C and middle tap changer position: x) HV winding 51. LV winding	 Ω Ω	 Insert Insert	
6.5	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding (c) Free buckling force	 kN N/m2 KN	 Insert Insert Insert	
6.6	Designed safety margin	%	Insert	
6.7	ZnO block to limit distributed impulse [tap winding/other]		No	
6.8	X/R ratio		Insert	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.9.9	Core Loss at W17/50 Specific loss of core steel at 1.7 T inductance	Watts/kg Watts/kg	< 0.85 < 1.11	
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 type		Insert	
6.10.6	LV winding type		Insert	
6.10.7	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*	
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: y) Highest point of HV bushing 52. Highest point of tank 53. Highest point of conservator 54. Highest point of lifting hook for removal of core and oil assembly	 mm mm mm mm	 Insert* Insert* Insert* Insert*	
7.10	Outer dimensions: z) Length 55. Width	 mm mm	 Insert* Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.12	Maximum shipping dimensions of tank: aa) Outside height 56. Outside width 57. Outside length	 mm mm mm	 Insert Insert 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		In all phases, 2 cores: Core-1,2: 600/1, 5P20, 30VA Core-3: Phase-B: for WTI Burden & other characteristics shall be defined in design stage	
10.2	CT in LV bushings, for protection, WTI and/or Tap Changer		In all phases, 2 cores: Core-1,2: 3000/1, 5P20, 30VA Core-3: Phase-B: for WTI Core-4: Phase-C: for AVR Burden & other characteristics shall be defined in design stage	
10.3	CT in neutral bushing , for protection		In all phases, 2 cores: Core-1,2: 3000/1, 5P20, 30VA Burden & other characteristics shall be defined in design stage	
11	**Layout**			
11.1	Primary winding bushings		Longitudinal axis	
11.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 nos. (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	Bucholz relay bypass valve	Nos.	Insert	
13	**Oil Preservation system & Dehydrating breather**			
13.1	Main Tank and HV cable Box		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: bb) Sides 58. Bottom 59. Top	 mm mm mm	 Insert Insert Insert	
14.3	Material of the autotransformer tank		Insert	
14.4	Wheels			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	0.3	
14.8	Oil Sealing System (Type) c) Main Tank d) Other parts		 Gasket/Welded Gasket	
14.9	Oil Sealing System (Gasket Material: Material used for gaskets for oil tight joints) e) Main Tank f) Bushings g) Other Parts h) 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 Tank is Designed c) At Full Vacuum	 mm mm mm	 < IEC < IEC < IEC	
15	**Conservator**			
15.1	Type		With diaphragm	
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 transformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: cc) Maximum diagraph stress at highest working pressure 60. Diagraph construction details 61. Type of diagraph material		 Insert Insert 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/m2	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
17.2	OLTC	kN/m2	Insert	
17.3	HV Cable Box	kN/m2	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	
19.6	Tertiary winding		Will be used	
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 - Average in one year	 °C °C	 + 45 + 35	
19.10	Consideration for Exposure to Sunshine		+ 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	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 estimatedvalues only. Actual values shall be measured during execution of the contract (manufacturing of the equipment) and shall be included on the name plate.*

GTP & requirement Form: Transformer

132/33kV, 80/120MVA, 3-Phase Power Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		Insert	
1.9	Tertiary winding function		NA	
1.10	Thermal insulation class		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	132/33kV	
2.2	Rated voltage of windings: HV winding MV winding	 kV kV	 132 33	
2.3	Rated power: dd) Primary / secondary winding ee) Tertiary - minimum	 MVA MVA	 120 / 120 NA	
2.4	Rated power by cooling ONAN / ONAF ff) Primary / secondary winding Tertiary – minimum	 MVA MVA	 80/120 NA	
2.5	Rated current on HV/ LV windings at CMR i) HV at Highest Voltage Tap j) HV at Nominal Voltage Tap k) HV at Lowest Voltage Tap l) LV	 A A A A	 Insert Insert Insert Insert	
2.6	**Tap changer:**			
	gg) Manufacturer		Insert	
	Country of origin		Insert	
	Model designation		insert	
	Type of tap changing		On-load Local, remote, supervisory electrical and hand operation	
	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Number of tapping steps	Nos.	Insert	
	Rating		Rated power 120 MVA, all taps	
	Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts		Insert	
	Type test certificate reference		Insert	
	Motor Drive Unit Make /Type Number		Insert	
2.7	AVR relay			
	g) Manufacturer's Name		Shall be from tap changer manufacturer	
	h) Country Of Origin		Insert	
	i) 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)	
2.18	Number of transformers for which automatic control is to be suitable			
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	% % %	**13 ±10 %**	
3.1.2	Maximum Impedance between HV – LV over tapping range Corresponding tap	%	Insert Insert	
3.2	**Zero-sequence impedance, with tap changer in middle position at 120MVA base:** hh) HV/LV	%	Insert	
3.3	**Power transformer capacity to withstand external short circuits**			
3.3.1	Short-circuit duration	s	3	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.2	Symmetrical short-circuit with-stand capacity during indicated period: ii) HV winding LV winding Pre-fault voltage	 kA kA p.u.	 40 31.5 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: jj) HV winding LV winding Pre-fault voltage	 kA kA p.u.		
3.4	**Guaranteed losses**			
3.4.1	No-load losses with tap changer in nominal position: kk) at rated voltage and rated frequency at 110 % rated voltage, at rated frequency	 kW kW	 Insert Insert	
	No-load losses with tap changer in plus (+) extreme position:	kW	Insert	
	No-load losses with tap changer in minus (-) extreme position:	kW	Insert	
	Average No-Load Loss **(this value will be evaluated)**	kW	Insert	
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			
	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
	On-load losses at 75°C, with tap changer in plus (+) extreme position	kW	Insert	
	On-load losses at 75°C, with tap changer in minus (-) extreme position	kW	Insert	
	Average On-load losses **(this value will be evaluated)**	kW	Insert	
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 ***(this value will be evaluated)***	kW	Insert	
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 650, AC 275	
3.6.2	Low voltage (LV)		LI 170, AC 70	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.6.3	Neutral		LI 170, AC 70	
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	145	
3.7.2	Low voltage (LV)	kV	36	
3.7.3	Neutral	kV	36	
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 cosφ = 1.0 and: ll) 25 % load of the rated value 50 % load of the rated value 75 % load of the rated value 100 % load of the rated value		 Insert Insert Insert Insert	
3.9.2	If cosφ = 0.8 (inductive) and: mm) 25 % load of the rated value 50 % load of the rated value 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	nn) cosφ = 1.00		Insert	
3.10.2	cosφ = 0.95 (inductive)		Insert	
3.10.3	cosφ = 0.90 (inductive)		Insert	
3.10.4	cosφ = 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 rise under service conditions stated in Schedule of Technical Requirement: c) CMR d) 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	
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	≤ 73	
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)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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: oo) 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 pp) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.1.2	After operation under 20 min qq) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.1.3	After operation under 120 min rr) full rated power 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 ss) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.2.2	After operation under 20 min tt) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	
3.14.2.3	After operation under 120 min uu) full rated power ¾ rated power ½ rated power		 Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: vv) with all cooling groups in operation (excluding stand-by cooling group) 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	145	
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	≥ 1600	
5.1.6	Rated short circuit current (2 s)	kA rms	≥ 40	
5.1.7	Rated lightning impulse withstand voltage	kV peak	650	
5.1.8	Rated switching impulse withstand voltage	kV peak	N/A	
5.1.9	Rated power frequency withstand voltage	kV rms	275	
5.1.10	Connectors			
5.1.10.1	Shape	mm	Ø 50	
5.1.10.2	Length	mm	125	
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	
5.1.14	Full vacuum withstand 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 porcelain/ composite silicon rubber		Insert	
5.1.19	De-rating Factor		Insert	
5.2	**Neutral bushing (identical as LV bushing)**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 (2 s)	kA rms	≥ 63	
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	
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 porcelain/ composite silicon rubber		Insert	
5.2.19	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 (2 s)	kA rms	≥ 63	
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	mm	Ø 50	
5.3.10.2	Length	mm	125	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.3.16	Weight of insulator	kg	Insert	
5.3.17	Electrostatic capacity of complete bushings	pF	Insert	
5.3.18	Manufacturer of porcelain/ composite silicon rubber		Insert	
5.3.19	De-rating Factor		Insert	
6	**Design Data**			
6.1	Maximum flux density in the legs ww) At rated voltage, frequency & normal ratio At 105 % of the rated voltage Volts/turn	 T T V	 Insert Insert Insert	
6.2	Maximum flux density in the yokes: xx) At rated voltage, frequency & normal ratio At 105 % of the rated voltage Volts/turn	 T T V	 Insert Insert Insert	
6.3	Maximum current density in windings at rated power and normal tap changer position: yy) HV winding LV winding	 A/mm^2 A/mm^2	 Insert Insert	
6.3.1	Magnetising current (magneti) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage at 1.1 x nominal voltage at 1.2 x nominal voltage	 % % % %	 Insert Insert Insert Insert	
6.3.2	Harmonic component of magnetizing current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	 % %	 <10% <3%	
6.4	Winding resistance at 75°C and middle tap changer position: zz) HV winding LV winding	 Ω Ω	 Insert Insert	
6.5	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding (c) Free buckling force	kN N/m2 KN	Insert Insert Insert	
6.6	Designed safety margin	%	Insert	
6.7	ZnO block to limit distributed impulse [tap winding/other]		No	
6.8	X/R ratio		Insert	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.9.9	Core Loss at W17/50 Specific loss of core steel at 1.7 T inductance	Watts/kg W/kg	< 0.85 < 1.11	
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 type		Insert	
6.10.5	LV winding type		Insert	
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*	
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: aaa) Highest point of HV bushing Highest point of tank Highest point of conservator Highest point of lifting hook for removal of core and oil assembly	 mm mm mm mm	 Insert* Insert* Insert* Insert*	
7.10	Outer dimensions: bbb) Length Width	 mm mm	 Insert* Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.12	Maximum shipping dimensions of tank: ccc) Outside height Outside width Outside length	 mm mm mm	 Insert Insert 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		In all phases, 2 cores: Core-1,2: 800/1, 5P20, 30VA Core-3: Phase-B: for WTI Burden & other characteristics shall be defined in design stage	
10.2	CT in LV bushings, for protection, WTI and/or Tap Changer		In all phases, 2 cores: Core-1,2: 2400/1, 5P20, 30VA Core-3: Phase-B: for WTI Core-4: Phase-C: for AVR Burden & other characteristics shall be defined in design stage	
10.3	CT in neutral bushing , for protection		In all phases, 2 cores: Core-1,2: 2400/1, 5P20, 30VA Burden & other characteristics shall be defined in design 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 nos. (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	Bucholz relay bypass valve	Nos.	Insert	
13	**Oil Preservation system & Dehydrating breather**			
13.1	Main Tank and HV cable Box		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: ddd) Sides Bottom Top	 mm mm mm	 Insert Insert Insert	
14.3	Material of the autotransformer 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14.7	Over-pressure withstand of the complete transformer	bar	0.3	
14.8	Oil Sealing System (Type) e) Main Tank f) Other parts		A. Gasket/Welded B. Gasket	
14.9	Oil Sealing System (Gasket Material: Material used for gaskets for oil tight joints) i) Main Tank j) Bushings k) Other Parts l) 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 Tank is Designed c) At Full Vacuum	mm mm mm	< IEC < IEC < IEC	
15	**Conservator**			
15.1	Type		With diaphragm	
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 transformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: eee) Maximum diagraph stress at highest working pressure Diagraph construction details Type of diagraph material		 Insert Insert 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/m2	Insert	
17.2	OLTC	kN/m2	Insert	
17.3	HV Cable Box	kN/m2	Insert	
18	**Noise level & interference**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
19.6	Tertiary winding		Will be used	
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 - Average in one year	 °C °C	 + 45 + 35	
19.10	Consideration for Exposure to Sunshine		+ 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	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 estimatedvalues only. Actual values shall be measured during execution of the contract (manufacturing of the equipment) and shall be included on the name plate.*

GTP & requirement Form: *Earthing Transformer (Zigzag)*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.2	Type		Earthing transformer three-phase, oil immersed, two windings, without tertiary winding, 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	Insert (As per BoQ)	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage of windings: 62. MV winding 63. LV winding	 kV V	 33 415	
2.4	Tap changer: 64. Type of tap changing 65. Tapping range 66. Tapping step 67. Rating	 % %	 Off-load ±5 2.5 Insert (Rated power all taps as per BoQ) (Calculation is required for verifying capacity)	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		ZNyn11	
2.7	Percentage Impedance	%	5 (±10%)	
3	**Special technical requirements**			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: 68. MV winding 69. LV winding	 kA kA	 31.5 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	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.3	Insulation level			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.1	Medium voltage (MV)		LI 170 AC 70	
3.3.2	Low voltage (LV)		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	≤ 50	
3.5.2	Winding	K	≤ 55	
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	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	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36	
5.1.3	Manufacturer		Insert	
5.1.4	Type		Insert	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 200	
5.1.7	Rated short circuit current (3 s)	kA rms	31.5	
5.1.8	Rated lightning impulse withstand voltage	kV peak	170	
5.1.9	Rated switching impulse withstand voltage	kV peak	N.A.	
5.1.10	Rated power frequency withstand voltage	kV rms	70	
5.1.11	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		Insert	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 800	
5.2.7	Rated short-circuit current (3 s)	kA rms	15	
5.2.8	Rated lightning impulse withstand voltage	kV peak	N.A.	
5.2.9	Rated switching impulse withstand voltage	kV peak	-	
5.2.10	Rated power frequency withstand voltage	kV rms	3	
5.2.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	**Design data**			
6.1	Maximum flux density, at rated voltage	TT	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.2	Maximum current density in windings at rated power and normal tap changer position: 70. MV winding 71. LV winding	 A/mm^2 A/mm^2	 < 4 < 4	
6.4	Winding resistance at 75°C and middle tap changer position: 72. MV winding 73. LV winding	 Ω Ω	 Insert Insert	
6.5	Zero sequence impedance	Ω	Insert	
6.6	Current density in the interconnected star winding at rated short time current	A	Insert	
6.7	Current density in the interconnected star winding: a) At CMR b) At 10s fault rating simultaneously	 A A	 Insert Insert	
6.8	Rated earth fault current for 10s duration	A	>500	
6.9	Rated short time (10s) current at neutral	A	Insert	
7	**Weights and dimensions**			
7.1	Total weight of transformer, equipped for service	kg	*Insert	
7.10	Height from foundation to highest point of HV bushing	mm	*Insert	
7.11	Outer dimensions: 74. Length 75. Width	 mm mm	 *Insert *Insert	
7.12	Informative dimensional sketch		To be enclosed with bid	
7.13	Maximum shipping dimensions of tank: 76. Outside height 77. Outside width 78. Outside length	 mm mm mm	 *Insert *Insert *Insert	
7.14	Transportation drawing		To be enclosed with bid	
8	**Dehydrating breather**			
8.1	Type of dehydrating breather		Insert	
8.2	Dehumidifying agent	kg	Insert	
9	**Conservator**			
9.1	Type		With dehydrating breather	
9.2	Number of compartments	pcs.	1	
9.3	Total volume of conservator	m^3	Insert	
9.8	Oil level indicators with alarm for minimum oil level	pcs.	1	
10	**Current transformer incorporated into the auxiliary power transformer**			
10.1	CT in all MV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	
10.2	CT in all LV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10	**Operating conditions**			
10.1	At the altitude (above sea level)	m	≤ 1000	
10.2	Maximum ambient temperature	°C	+ 40	
10.3	Average daily temperature	°C	+ 35	
10.4	Average annual temperature	°C	+ 25	
10.5	Minimum ambient temperature	°C	– 5	
11	**Overall compliance with the requirements & detail specification described in Vol-2**	**Yes/No**	**Yes**	

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

GTP & requirement Form: *Auxiliary Transformer*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.2	Type		Auxiliary Power transformer three-phase, oil immersed, two windings, without tertiary winding, 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	Insert (As per BoQ)	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage of windings: 79. MV winding 80. LV winding	 kV V	 33 415	
2.4	Tap changer: 81. Type of tap changing 82. Tapping range 83. Tapping step 84. Rating	 % %	 Off-load ±5 2.5 Insert (Rated power all taps as per BoQ) (Calculation is required for verifying capacity)	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		Dyn11	
2.7	Percentage Impedance	%	5 (±10%)	
3	**Special technical requirements**			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: 85. MV winding 86. LV winding	 kA kA	 31.5 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	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.3	Insulation level			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.1	Medium voltage (MV)		LI 170 AC 70	
3.3.2	Low voltage (LV)		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	≤ 50	
3.5.2	Winding	K	≤ 55	
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	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	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36	
5.1.3	Manufacturer		Insert	
5.1.4	Type		Insert	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 200	
5.1.7	Rated short circuit current (3 s)	kA rms	31.5	
5.1.8	Rated lightning impulse withstand voltage	kV peak	170	
5.1.9	Rated switching impulse withstand voltage	kV peak	N.A.	
5.1.10	Rated power frequency withstand voltage	kV rms	70	
5.1.11	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		Insert	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 800	
5.2.7	Rated short-circuit current (3 s)	kA rms	15	
5.2.8	Rated lightning impulse withstand voltage	kV peak	N.A.	
5.2.9	Rated switching impulse withstand voltage	kV peak	-	
5.2.10	Rated power frequency withstand voltage	kV rms	3	
5.2.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	**Design data**			
6.1	Maximum flux density, at rated voltage	TT	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.2	Maximum current density in windings at rated power and normal tap changer position: 87. MV winding 88. LV winding	 A/mm^2 A/mm^2	 < 4 < 4	
6.4	Winding resistance at 75°C and middle tap changer position: 89. MV winding 90. LV winding	 Ω Ω	 Insert Insert	
6.5	Zero sequence impedance	Ω	Insert	
6.6	Current density in the interconnected star winding at rated short time current	A	Insert	
6.7	Current density in the interconnected star winding: c) At CMR d) At 10s fault rating simultaneously	 A A	 Insert Insert	
6.8	Rated earth fault current for 10s duration	A	>500	
6.9	Rated short time (10s) current at neutral	A	Insert	
7	**Weights and dimensions**			
7.1	Total weight of transformer, equipped for service	kg	*Insert	
7.10	Height from foundation to highest point of HV bushing	mm	*Insert	
7.11	Outer dimensions: 91. Length 92. Width	 mm mm	 *Insert *Insert	
7.12	Informative dimensional sketch		To be enclosed with bid	
7.13	Maximum shipping dimensions of tank: 93. Outside height 94. Outside width 95. Outside length	 mm mm mm	 *Insert *Insert *Insert	
7.14	Transportation drawing		To be enclosed with bid	
8	**Dehydrating breather**			
8.1	Type of dehydrating breather		Insert	
8.2	Dehumidifying agent	kg	Insert	
9	**Conservator**			
9.1	Type		With dehydrating breather	
9.2	Number of compartments	pcs.	1	
9.3	Total volume of conservator	m^3	Insert	
9.8	Oil level indicators with alarm for minimum oil level	pcs.	1	
10	**Current transformer incorporated into the auxiliary power transformer**			
10.1	CT in all MV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	
10.2	CT in all LV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10	**Operating conditions**			
10.1	At the altitude (above sea level)	m	≤ 1000	
10.2	Maximum ambient temperature	°C	+ 40	
10.3	Average daily temperature	°C	+ 35	
10.4	Average annual temperature	°C	+ 25	
10.5	Minimum ambient temperature	°C	– 5	
11	**Overall compliance with the requirements & detail specification described in Vol-2**	**Yes/No**	**Yes**	

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

GTP & Requirement Form: *GIS Switchgear 230kV Indoor*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**GIS Switchgear 230 kV – General & Electrical**			
1.1.	Manufacturer		Insert	
1.2	Country of origin		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.3	Type: - GIS type - Type of busbars - Model designation	 - - -	 Indoor Double, passive Insert	
1.4	Enclosure: -Bus bar -Bay -Enclosure material		 Insert Insert Al	
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		**[As per BoQ, SLD]**	
	96. Busbars 97. Line bay 98. Transformer bay 99. Bus Coupler bay 100. Bus Section bay	A A A A A	≥ 4000 ≥ 3150 ≥ 3150 ≥ 4000 ≥ 4000 **[As per BoQ, SLD]**	
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	
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 - Bursting pressure - Routine test pressure	Bar Bar	Insert Insert	
3	**Insulation Medium**			
3.1	Insulation Medium		SF_6	
3.2	Max. Permissible moisture content	ppm	300	
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		Less than 0.1%	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.3	Min operating period to 1 recharge of SF_6 gas		10	
4.4	Material of filter employed for moisture absorption		Al_2O_3	
4.5	SF6 filling pressure at 20^0C ambient temp. Min. SF6 service pressure at 40^0C ambient temp. Min. SF6 service pressure at -25^0C ambient temp.	Bar Bar Bar	Insert Insert Insert	
4.6	Type of gas monitoring Signal: "Loss of SF6 Gas" at 20^0C ambient temp. Signal: "Min. SF6 Density" at 20^0C ambient temp.		Density Monitor Insert Insert	
4.7	Type of pressure relief device		Rupturing diaphragm	
4.8	Material of pressure relief device		Ni-Fe	
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 - which need not to be touched during operation - which are not accessible to the operator	 ^{0}C ^{0}C ^{0}C	 Max. 30 Max. 40 Max. 55	
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		Insert	
6.4	Enclosure Material		Al	
6.5	Material of Contacts		Silver plated copper	
6.6	Design		Single breaking	
6.7	Operating mechanism -for closing -for opening		Motor-wound spring Insert Insert	
6.8	Number of poles	pcs.	3	
6.9	No. of breaks per phase	pcs	Insert	
6.10	Number of operating mechanisms per circuit breaker			
6.11	101. Line bay 102. Transformer bay 103. Bus Coupler bay	pcs. pcs. pcs.	**3** **1 or 3** **1 or 3**	
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	
6.14	Rated short time breaking current	kA	Insert	
6.15	Rated short time making current	kA	Insert	
6.16	Rated peak withstand current	kA	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.17	Auto reclosing 104. Line bay 105. Transformer bay 106. Bus Coupler bay		1p+3p NA NA	
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	Insert	
6.22	Total closing time (max)	ms	Insert	
6.23	Restrike performance during capacitive current switching	Class	C2	
6.24	Number of operations without maintenance 107. CO at no-load 108. CO at rated current 109. CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
6.25	The frequency of mechanical operations	Class	M2	
6.26	Rated electrical endurance	Class	Min E1	
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	 Insert Insert Insert	
6.33	Rated breaking current, small inductive currents - Unloaded transformers - Transformer loaded with reactor - Shunt reactors	 A A A	 Insert Insert Insert	
6.34	Switching overvoltage	p.u.	Insert	
6.35	Rated motor voltage	V d.c.	110	
6.36	Rated motor power	W	Insert	
6.37	Pre insertion resistor - Closing resistor - Pre insertion time	 Ohm ms	 Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.38	Control switching device (CSD) Applicable standards		BS 402 IEC 60255 IEC 61850	
7.	**Disconnector**			
7.1	Type		GIS, Indoor	
7.2	Enclosure		Insert	
7.3	Enclosure Material		Al	
7.4	Material of Contacts		Silver plated copper	
7.5	Gas quantity (3-phase) for isolator	kg	Insert	
7.6	Type of disconnector			
	110. Three pole, three position (close/open/earthed), motor operated, insulated, with earthing switch 111. Three pole,make-proof, motor operated earthing switch 112. Three pole, disconnector link, hand operated		 Yes Yes Yes	
7.7	Number of poles	pcs.	3	
7.8	Number of operating mechanism	pcs.	**1**	
7.9	Type of operating mechanism			
	113. Three position 114. Make-proof 115. Disconnector Link		Motor driven Motor-wound spring Manual	
7.10	No. of breaks in series (per phase)	pcs.	1	
7.11	Rated breaking current (capacitive)	A	Insert	
7.12	Operating mechanism - for closing - for opening		 Motor Motor	
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	**Maintenance earthing switch**			
8.1	Design		GIS, Indoor, three phase gang operation	
8.2	Enclosure		Insert	
8.3	Enclosure Material		Al	
8.4	Gas quantity (3-phase) for isolator	kg	Insert	
8.5	Operating mechanism - for closing - for opening		 Motor Motor	
8.6	Max. operating time - for closing - for opening	 sec sec	 Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.7	Auxiliary contacts - number (NC / NO)	 pcs.	 6 / 6	
8.8	Rated motor voltage	V d.c.	110	
8.9	Rated motor power	W	Insert	
8.10	Hand operating facilities		Yes	
9	**High speed earthing switch**			
9.1	Design		GIS, Indoor, three phase gang operation	
9.2	Enclosure		Insert	
9.3	Enclosure Material		Al	
9.4	Gas quantity (3-phase) for isolator	kg	Insert	
9.5	Rated current Rated capacitive breaking current (at 6 kV eff.) Rated inductive breaking current (at 10 kV eff.)	kA A A	Insert Insert Insert	
9.6	Operating mechanism - for closing - for opening		 SpringMotor charged SpringMotor charged	
9.7	Max. charging time	sec	5	
9.8	Max. operating time - for closing - for opening	 ms ms	 Insert Insert	
9.9	Auxiliary contacts - number (NC / NO / wiping)	 pcs.	 6 / 6 / 2	
9.10	Rated motor voltage	V d.c.	110	
9.11	Rated motor power	W	Insert	
9.12	Hand operating facilities		Yes	
10.	**Current Transformer**			
10.1	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	
10.2	Rated continuous thermal current (40°C): 116. I core 117. II core 118. III core 119. IV core 120. V core 121. V I core	 % In % In % In % In % In % In	 For protection core: 120 For metering core: 200 	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Current Transformer Rating: Line bays: 122. I core 123. II core 124. III core 125. IV core 126. V core 127. V I core Transformer bays: 128. I core 129. II core 130. III core 131. IV core 132. V core 133. V I core Bus Coupler Bays: 134. I core 135. II core 136. III core 137. IV core Bus Section Bays: 138. I core 139. II core 140. III core 141. IV core	 A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA	Rated transformer ratio, class & burden **(Number, ratio & rating of CT cores shall be as per BoQ & SLD. All CT parameters shall be finalized by calculation during execution)**	
10.3	Security factor metering core		Fs=5	
10.4	Winding Resistance (R_{CT})	Ω	Insert	
11.	**Voltage Transformer**			
11.1	Type		GIS, Indoor	
11.2	Rated primary voltage	kV	230/√3	
11.3	Voltage Transformer Rating: (Line Bay, Bus PT) 142. I winding 143. II winding 144. III winding Voltage Transformer Rating: (Transformer Bay) 145. I winding 146. II winding	V, VA V, VA V, VA V, VA V, VA	Rated secondary voltage ratio, class, burden 110/√3, 0.2, 30 110/√3, 1/3P, 30 110/√3, 1/3P, 30 110/√3, 0.2, 30 110/√3, 1/3P, 30 **(All PT parameters shall be finalized by calculation during execution)**	
11.4	Winding Resistance (R_{VT})	Ω	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
11.5	Load		Simultaneously	
12.	**Surge Arresters**			
12.1	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	
12.2	Rated voltage of surge arrester U_r	kV_{rms}	198 (Calculation for verification of this data is required during detail design stage)	
12.3	Max. continuous operating voltage U_c	kV_{rms}	158 (Calculation for verification of this data is required during detail design stage)	
12.4	Nominal discharge current In (8/20 µs)	kA_{peak}	10	
12.5	High current impulse of an arrester (4/10 µs)	kA_{peak}	100	
12.6	Line discharge class	Class	Heavy duty class 3	
12.7	Energy dissipation capacity (per kV of rated voltage)	kJ/ kV	≥ 6.5	
12.8	Long duration current impulse (2000 µs)	A	≥ 850	
12.9	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	
13	**Site Condition**			
13.1	Max. altitude abovesealevel	m	not more than 1000	
13.2	Max. ambienttemperature, outdoor	°C	+45	
13.3	Min. ambienttemperature, indoor	°C	+4	
13.4	Max. ambient relative humidity	%	100	
13.5	Max. seismicaccelertionatfloorlevel - horizontal - vertical	 g g	 0.2 0.2	
14	**Secondary circuits**			
14.1	Auxiliary voltages: - for controlling and signalling - for remote control - for heating - tolerance	 V d.c. V d.c. V a.c. %	 110 110 415 /240, 50Hz -15 / +10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15	**Connection (Connection type shall be GIB or Cable connection. Detail will be finalized during execution as per design requirement)**			
15.1	Type: GIB - Gas Insulated Busbars, Indoor		Yes	
15.2	Type: Single phase or Three phase, according to the design		Yes	
15.3	Insulator, Single phase, SF6 / Air		Yes	
15.3.1	Manufacturer of SF6 to Air Bushing		Insert	
15.3.2	Enclosure		Insert	
15.3.3	Enclosure material		Al	
15.3.4	Insulating material		Composite/Silicon	
15.3.5	Minimum creepage distance	mm/ kV	≥ 25 mm/ kV	
15.3.6	Flashover distance	mm	Insert	
16	**Circuit Breaker Control Cubicle**			
16.1	Material			
16.2	Material thickness	mm	Insert	
16.3	Dimensions	mm	Insert	
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height			
17	**Separate Local Control Cubicle**			
17.1	Material (Steel)		Yes	
17.2	Material thickness		Yes	
17.3	Dimensions			
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height	mm	Insert	
17.4	Total weight	kg	Insert	
18	**Maintenance requirement**			
18.1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays	Yes/No	Yes	
18.2	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & Requirement Form: *GIS Switchgear 132kV Indoor*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**GIS Switchgear 132 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		 Insert Insert Al	
1.5	Nominal system voltage	kV_{rms}	132	
1.6	Highest voltage for equipment U_n	kV_{rms}	145	
1.7	Rated lightning impulse withstand voltage - phase to earth - phase to phase - across open isolator - across open gap c.b.	kV_{peak}	650 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}	275 Insert Insert Insert Insert	
1.9	Rated frequency f_r	Hz	50	
1.10	Rated current I_r		**[As per BoQ, SLD]**	
	147. Busbars 148. Line bay 149. Transformer bay 150. Bus Coupler bay 151. Bus Section bay	A A A A A	≥ 3150 ≥ 3150 ≥ 2000 ≥ 3150 ≥ 3150 **[As per BoQ, SLD]**	
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_p	≥ 100	
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 - Bursting pressure - Routine test pressure	 Bar Bar	 Insert Insert	
3	**Insulation Medium**			
3.1	Insulation Medium		SF_6	
3.2	Max. Permissible moisture content	ppm	300	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		Less than 0.1%	
4.3	Min operating period to 1 recharge of SF_6 gas		10	
4.4	Material of filter employed for moisture absorption		Al_2O_3	
4.5	SF6 filling pressure at 20^0C ambient temp. Min. SF6 service pressure at 40^0C ambient temp. Min. SF6 service pressure at -25^0C ambient temp.	Bar Bar Bar	Insert Insert Insert	
4.6	Type of gas monitoring Signal: “Loss of SF6 Gas” at 20^0C ambient temp. Signal: “Min. SF6 Density” at 20^0C ambient temp.		Density Monitor Insert Insert	
4.7	Type of pressure relief device		Rupturing diaphragm	
4.8	Material of pressure relief device		Ni-Fe	
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 - which need not to be touched during operation - which are not accessible to the operator	 ^{0}C ^{0}C ^{0}C	 Max. 30 Max. 40 Max. 55	
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		Insert	
6.4	Enclosure Material		Al	
6.5	Material of Contacts		Silver plated copper	
6.6	Design		Single breaking	
6.7	Operating mechanism -for closing -for opening		Motor-wound spring Insert Insert	
6.8	Number of poles	pcs.	3	
6.9	No. of breaks per phase	pcs	Insert	
6.10	Number of operating mechanisms per circuit breaker			
6.11	152. Line bay 153. Transformer bay 154. Bus Coupler bay	pcs. pcs. pcs.	**3** **1 or 3** **1 or 3**	
6.12	D.C. component of the rated short-circuit breaking current	%	> 30	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
6.14	Rated short time breaking current	kA	Insert	
6.15	Rated short time making current	kA	Insert	
6.16	Rated peak withstand current	kA	Insert	
6.17	Auto reclosing 155. Line bay 156. Transformer bay 157. Bus Coupler bay		 1p+3p NA NA	
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	Insert	
6.22	Total closing time (max)	ms	Insert	
6.23	Restrike performance during capacitive current switching	Class	C2	
6.24	Number of operations without maintenance 158. CO at no-load 159. CO at rated current 160. CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
6.25	The frequency of mechanical operations	Class	M2	
6.26	Rated electrical endurance	Class	Min E1	
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	 Insert Insert Insert	
6.33	Rated breaking current, small inductive currents - Unloaded transformers - Transformer loaded with reactor - Shunt reactors	 A A A	 Insert Insert Insert	
6.34	Switching overvoltage	p.u.	Insert	
6.35	Rated motor voltage	V d.c.	110	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.36	Rated motor power	W	Insert	
6.37	Pre insertion resistor - Closing resistor - Pre insertion time	 Ohm ms	 Insert Insert	
6.38	Control switching device (CSD) Applicable standards		BS 402 IEC 60255 IEC 61850	
7.	**Disconnector**			
7.1	Type		GIS, Indoor	
7.2	Enclosure		Insert	
7.3	Enclosure Material		Al	
7.4	Material of Contacts		Silver plated copper	
7.5	Gas quantity (3-phase) for isolator	kg	Insert	
7.6	Type of disconnector			
	161. Three pole, three position (close/open/earthed), motor operated, insulated, with earthing switch 162. Three pole,make-proof, motor operated earthing switch 163. Three pole, disconnector link, hand operated		 Yes Yes Yes	
7.7	Number of poles	pcs.	3	
7.8	Number of operating mechanism	pcs.	**1**	
7.9	Type of operating mechanism			
	164. Three position 165. Make-proof 166. Disconnector Link		Motor driven Motor-wound spring Manual	
7.10	No. of breaks in series (per phase)	pcs.	1	
7.11	Rated breaking current (capacitive)	A	Insert	
7.12	Operating mechanism - for closing - for opening		 Motor Motor	
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	**Maintenance earthing switch**			
8.1	Design		GIS, Indoor, three phase gang operation	
8.2	Enclosure		Insert	
8.3	Enclosure Material		Al	
8.4	Gas quantity (3-phase) for isolator	kg	Insert	
8.5	Operating mechanism - for closing - for opening		 Motor Motor	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.6	Max. operating time - for closing - for opening	 sec sec	 Insert Insert	
8.7	Auxiliary contacts - number (NC / NO)	 pcs.	 6 / 6	
8.8	Rated motor voltage	V d.c.	110	
8.9	Rated motor power	W	Insert	
8.10	Hand operating facilities		Yes	
9	**High speed earthing switch**			
9.1	Design		GIS, Indoor, three phase gang operation	
9.2	Enclosure		Insert	
9.3	Enclosure Material		Al	
9.4	Gas quantity (3-phase) for isolator	kg	Insert	
9.5	Rated current Rated capacitive breaking current (at 6 kV eff.) Rated inductive breaking current (at 10 kV eff.)	kA A A	Insert Insert Insert	
9.6	Operating mechanism - for closing - for opening	 	 SpringMotor charged SpringMotor charged	
9.7	Max. charging time	sec	6	
9.8	Max. operating time - for closing - for opening	 ms ms	 Insert Insert	
9.9	Auxiliary contacts - number (NC / NO / wiping)	 pcs.	 6 / 6 / 2	
9.10	Rated motor voltage	V d.c.	110	
9.11	Rated motor power	W	Insert	
9.12	Hand operating facilities		Yes	
10.	**Current Transformer**			
10.1	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	
10.2	Rated continuous thermal current (40°C): 167. I core 168. II core 169. III core 170. IV core 171. V core 172. V I core	 % In % In % In % In % In % In	 120 For metering core 200 	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Current Transformer Rating: Line bays: 173. I core 174. II core 175. III core 176. IV core 177. V core 178. V I core Transformer bays: 179. I core 180. II core 181. III core 182. IV core 183. V core 184. V I core Bus Coupler Bays: 185. I core 186. II core 187. III core 188. IV core Bus Section Bays: 189. I core 190. II core 191. III core 192. IV core	 A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA A/A, VA	Rated transformer ratio, class & burden **(Number, ratio & rating of CT cores shall be as per BoQ & SLD. All CT parameters shall be finalized by calculation during execution)**	
10.3	Security factor metering core		Fs=10	
11.	**Voltage Transformer**			
11.1	Type		GIS, Indoor	
11.2	Rated primary voltage	kV	132/√3	
11.3	 Voltage Transformer Rating: (Line Bay, Bus PT) 193. I winding 194. II winding 195. III winding Voltage Transformer Rating: (Transformer Bay) 196. I winding 197. II winding	 V, VA V, VA V, VA V, VA V, VA	Rated secondary voltage ratio, class, burden 110/√3, 0.2, 30 110/√3, 1/3P, 30 110/√3, 1/3P, 30 110/√3, 0.2, 30 110/√3, 1/3P, 30 **(All PT parameters shall be finalized by calculation during execution)**	
11.4	Load		Simultaneously	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
12.	**Surge Arresters**			
12.1	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	
12.2	Rated voltage of surge arrester U_r	kV_{rms}	120 (Calculation for verification of this data is required during detail design stage)	
12.3	Max. continuous operating voltage U_c	kV_{rms}	96 (Calculation for verification of this data is required during detail design stage)	
12.4	Nominal discharge current In (8/20 µs)	kA_{peak}	10	
12.5	High current impulse of an arrester (4/10 µs)	kA_{peak}	100	
12.6	Line discharge class	Class	Heavy duty class 3	
12.7	Energy dissipation capacity (per kV of rated voltage)	kJ/ kV	≥ 6.5	
12.8	Long duration current impulse (2000 µs)	A	Insert	
12.9	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	
13	**Site Condition**			
13.1	Max. altitude abovesealevel	m	not more than 1000	
13.2	Max. ambienttemperature, outdoor	°C	+45	
13.3	Min. ambienttemperature, indoor	°C	+4	
13.4	Max. ambient relative humidity	%	100	
13.5	Max. seismicaccelertionatfloorlevel - horizontal - vertical	 g g	 0.2 0.2	
14	**Secondary circuits**			
14.1	Auxiliary voltages: - for controlling and signalling - for remote control - for heating - tolerance	 V d.c. V d.c. V a.c. %	 110 110 415 /240, 50Hz -15 / +10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15	**Connection (Connection type shall be GIB or Cable connection. Detail will be finalized during execution as per design requirement)**			
15.1	Type: GIB - Gas Insulated Busbars, Indoor		Yes	
15.2	Type: Single phase or Three phase, according to the design		Yes	
15.3	Insulator, Single phase, SF6 / Air		Yes	
15.3.1	Manufacturer of SF6 to Air Bushing		Insert	
15.3.2	Enclosure		Insert	
15.3.3	Enclosure material		Al	
15.3.4	Insulating material		Composite/Silicon	
15.3.5	Minimum creepage distance	mm/ kV	≥ 25 mm/ kV	
15.3.6	Flashover distance	mm	Insert	
16	**Circuit Breaker Control Cubicle**			
16.1	Material			
16.2	Material thickness	mm	Insert	
16.3	Dimensions	mm	Insert	
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height			
17	**Separate Local Control Cubicle**			
17.1	Material (Steel)		Yes	
17.2	Material thickness		Yes	
17.3	Dimensions			
	- Depth	mm	Insert	
	- Width	mm	Insert	
	- Height	mm	Insert	
17.4	Total weight	kg	Insert	
18	**Maintenance requirement**			
18.1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays	Yes/No	Yes	
18.2	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

230kV AIS Switchgear:

Circuit Breaker:

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.1	General			
1.1.1	Manufacturer		[Insert]	
1.1.2	Country of Make		[Insert]	
1.1.3	Model		[Insert]	
1.1.4	Type of circuit breaker		AIS, Outdoor	
1.1.5	Isolating and Quenching Medium		SF6	
1.1.6	Rated Current, Ir	A	3000A	
1.1.7	Rated Short Circuit Current, I_{ssc}	kA	50	
1.2	Design & Construction			
1.2.1	Clearance & Insulation			
	Minimum clearance			
	Across Interrupting chamber	mm	[Insert]	
	To ground	mm	[Insert]	
	Between poles [Gang pole CB]	mm	[Insert]	
	Insulator Material		Silicon Rubber/ porcelain	
	Color		[Insert]	
	Vulcanizing technique	RTV/HTV/others	[Insert]	
	Minimum creepage distance	mm/kV	Insert	
	Total creepage distance	mm	[Insert]	
1.2.2	HV Terminal	pcs.	02	
	Shape		Flat	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	Dimensions	mm x mm	Min 100 x 100	
	Number of holes		Min 4	
	Dimensions of holes	mm	[Insert]	
	Distance between holes	mm	[Insert]	
	Material suitable for		Al terminal	
	Support Structure to be provided by Vendor	Yes/No	Yes	
	Fixing Terminals	Yes/No	Yes	
	Earthing Terminal	Yes/No	Yes	
	Support Structure to be provided by Vendor	Yes/No	Yes	
1.2.3	Dimensions & Weight			
	Dimensions			
	Support insulator height	mm	[Insert]	
	Total height	mm	[Insert]	
1.2.19	Weight			
	Pole weight	kg	[Insert]	
	Weight of operating mechanism	kg	[Insert]	
	Weight of metal structure	kg	[Insert]	
	Total weight	kg	[Insert]	
	Shipping Weight	kg	[Insert]	
1.2.21	Degree of Protection for			
(a)	auxiliary circuits		[Insert]	
(b)	moving parts		[Insert]	
1.2.3x	Rated operating sequence		O-0.3 s-CO-3 min-CO	
1.2.4	Number of operating mechanisms per circuit breaker			

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	Line bay	pcs.	3	
	Transformer bay	pcs.	1	
	Bus Coupler bay	pcs.	1	
	Bus section Bay	pcs.	1	
1.2.5	Auto reclosing			
	Line bay		1p+3p	
	Transformer bay		3p	
1.2.6	Number of successive auto-Reclosing operations without derating		[Insert]	
1.2.7	Rated supply pressure of gas for interruption			
	Maximum	MPa (g)	[Insert]	
	Normal	MPa (g)	[Insert]	
	Minimum	MPa (g)	[Insert]	
	Low Pressure Alarm	MPa (g)	[Insert]	
	Lockout Alarm	MPa (g)	[Insert]	
1.2.7.1	Total mass of SF6 gas in a circuit breaker	kg	[Insert]	
1.2.7.2	Gas Leakage Per Year	%	[Insert]	
1.2.8	Limits for correct operation			
	Max	MPa (g)	Insert	
	Normal	MPa (g)	[Insert]	
	min	MPa (g)	[Insert]	
1.2.8.1	Maximum pressure rise in circuit breakers due to the making or breaking of rated current	MPa (g)	[Insert]	
1.2.9	Is lockout facility fitted?	Yes/No	Yes	
1.2.9.1	Whether Lockout will trip CB	Yes/No	No	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.10	Trip free/or fixed trip		Trip Free	
1.2.11	Is circuit-breaker re-strike free	Yes/No	Yes	
1.2.12	Restrike performance during capacitive current switching	Class	C2	
1.2.13	Number of operations without maintenance			
	CO at no-load	No.	≥ 10000	
	CO at rated current	No.	≥ 2500	
	CO at rated breaking current Isc	No.	≥ 8	
	Curve for above attached to CB		Yes	
1.2.14	The frequency of mechanical operations	Class	M2	
1.2.15	Rated electrical endurance	Class	Min E1	
1.2.16	Interrupter Chamber			
1.2.16.1	Design		Single breaking	
1.2.16.2	No. of Interrupter		01	
1.2.16.3	Type	Self-Blast/Puffer	Insert	
		Other	Insert	
1.2.16.4	Model Designation		Insert	
1.2.16.5	Material of Male-Female part		Insert	
1.2.16.6	Length of each break	mm	Insert	
1.2.16.7	Length of stroke	mm	Insert	
1.2.17	Operating Mechanism			
1.2.17.1	Type		Motor-wound spring	
1.2.17.2	Make		Insert	
1.2.17.3	Country of Manufacturer		Insert	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.17.4	Model Designation		Insert	
1.2.17.5	Motor - auxiliary supply voltage	V. AC, 50Hz	230	
1.2.17.6	Rated power of motor	W	Insert	
1.2.17.7	Current required at rated supply voltage to open circuit-breaker	A	Insert	
1.2.17.8	Number of making coils	pcs.	01	
1.2.17.8.1	Rated Operating Voltage	V.DC	110	
1.2.17.8.2	Power	W	Insert	
1.2.17.9	Number of breaking coils	pcs.	02	
1.2.17.9.1	Rated Operating Voltage	V.DC	110	
1.2.17.9.2	Power	W	Insert	
1.2.17.10	Minimum number of available contacts (NO/NC)		26NO+26NC	
1.2.17.11	Hearer & No.	Yes- Min 1	Insert	
1.2.17.11.1	Rated Voltage	V.AC/50 HZ	230	
1.2.17.11.2	Power	W	Insert	
1.2.17.12	Operating mechanism material		Insert	
1.2.17.13	Water-tight corrosion-resistant housing Material		AL	
1.2.17.14	Whether there is provision for manual spring charging. (in case of hydraulic manual operation, to build oil pressure)	Yes/No	Yes	
1.2.17.15	Spring Charging Time			
	Motor	ms		
	Crank	s		

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.17.16	Whether facility to close / open the CB manually in the Absence of DC control supply to the operating mechanism	Yes/No	Yes	
1.2.17.17	Whether suitable facility is available for bleeding the hydraulic Circuit in order to remove the trapped gas if any in the Hydraulic mechanism	Yes/No	Yes	
1.2.17.18	Whether anti pumping facility is provided in the Circuit breaker mechanism	Yes/No	Yes	
1.2.17.19	Type of transmission of mechanical energy from the operating mechanism to the interrupter unit i.e. whether single mechanism coupled to three phases or three independent mechanisms		Insert	
1.2.17.20	Number of close-open operations possible without recharging		O-CO	
1.2.17.21	Emergency Trip Switch	Yes/No	Yes	
1.2.17.22	MTBF of CB		Insert	
1.2.17.23	MTTR of CB		Insert	
2.				
2.3	Characteristics & Performance			
2.3.1	Voltage			
2.3.1.1	Rated lightning impulse withstand voltage	kVpeak		
	Phase to ground		Insert	
	Across interrupting chamber		Insert	
	Between phases [Gang pole CB]		Insert	
2.3.1.2	Rated Power frequency withstand voltage (dry), 1 minute	kVrms		

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	Phase to ground		Insert	
	Across interrupting chamber		Insert	
	Between phases [Gang pole CB]		Insert	
2.3.1.3	Maximum TRV (transient recovery voltage) withstand capability of the CB			
a.1	During Opening of Fault , T100	kV	[Insert]	
a.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
b.1	During Opening of Cable	kV	[Insert]	
b.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
c.1	During Opening of capacitor bank	kV	[Insert]	
c.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
d.1	During Opening of line	kV	[Insert]	
d.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
e.1	During Opening of Transformer	kV	[Insert]	
e.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
f.1	During Opening of Reactor	kV	[Insert]	
f.2	Rate of rise of recovery voltage	kV/µs	[Insert]	
g.1	Maximum switching surge withstand capacity	p.u	[Insert]	
2.3.1.4	Corona extinction voltage with CB open or close	kV rms	[Insert]	
2.3.1.5	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/√3)	µV	[Insert]	
2.3.1.6	First-pole-to-clear factor			
	Terminal fault		1.3	
	Short-line fault		1.0	
	Out-of-phase		2.0	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
2.3.2	Shor Circuit Rating			
2.3.2.1	Rated short-circuit breaking currents, Isc (equal to short circuit withstand/making current):	kA rms	50	
	Three phase Symmetrical breaking currents	kA rms	[Insert]	
	Three phase Asymmetrical breaking currents	kA rms	[Insert]	
	Single phase Symmetrical breaking current for line to ground	kA rms	[Insert]	
	Single phase Asymmetrical breaking current for line to ground	kA rms	[Insert]	
2.3.2.2	D.C. component of the rated short-circuit breaking current	%	>50	
2.3.2.3	Rated short line fault breaking current capability			
a)	Percentage of rated breaking current	%	[Insert]	
b)	Surge Impedance	Ohms	[Insert]	
c)	Amplitude factor		[Insert]	
d)	Critical percentage of rated breaking current	%	[Insert]	
e)	Maximum arc duration	ms	[Insert]	
2.3.2.4	Rated capacitive switching capability (breaking currents):			
	Line charging	A rms	[Insert]	
	Cable charging	A rms	[Insert]	
	Capacitor Bank breaking current	A rms	[Insert]	
2.3.2.5	Rated inductive switching/ breaking capability:	A	[Insert]	
2.3.3	Timing Performance			

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
2.3.3.1	Maximum total break time (trip initiation to final arc extinction) (3.7.135 acc. to IEC 62271-100)	ms	60	
2.3.3.2	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	
2.3.3.3	Opening time (trip initiation to contact separation)		[Insert]	
	Without current	ms	[Insert]	
	With 100 % rated current	ms	[Insert]	
	With 100 % rated breaking current	ms	[Insert]	
2.3.3.4	Closing time	ms	80	
	Without current	ms	[Insert]	
	With 100 % rated current	ms	[Insert]	
	With 100 % rated breaking current	ms	[Insert]	
2.3.3.5	Maximum time interval between opening interrupters between first & last phases	ms	[Insert]	
2.3.3.6	Maximum time interval between opening of interrupters in same phases		NA	
2.3.3.7	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	[Insert]	
2.3.3.8	Mechanical time staggering in Gang Pole CB			
	First-to-Second phase	ms	[Insert]	
	Second-to-Third Phase	ms	[Insert]	
2.3.3.9	Minimum time for auto reclosing (dead time)			
	Single phase	ms	[Insert]	
	Three Phase	ms	[Insert]	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
2.3.3.10	Pole discrepancy for the closing operation of CB i.e, Maximum difference in closing Time between first contact touch and Last phase to close.	ms	[Insert]	
2.3.3.11	Rated Mechanical Terminal Loads			
	Static horizontal force, longitudinal FthA	N	[Insert]	
	Static horizontal force, transversal FthB	N	[Insert]	
	Static vertical force Ftv	N	[Insert]	
	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	
2.4	Accessories in central control panel/ LCC			
2.4.1	Anti-pumping relay	Yes/No	Yes	
2.4.2	Local/remote control selector switch	Yes/No	Yes	
2.4.3	Single Pole/Gang operation switch	Yes/No	Yes	
2.4.4	Local operation push buttons	Yes/No	Yes	
2.4.5	Bulb Indication for Open/Close/Spring Charged	Yes/No	Yes	
2.4.6	Anti-Condensation Heater	Yes/No	Yes	
2.4.6.1	Supply Voltage	V.AC, 50Hz	230	
2.4.6.2	Power	W	[Insert]	
2.4.7	Humidity Controller	Yes/No	Yes	
2.4.8	Minimum pressure lock-out and alarm relays	Yes/No	Yes	
2.4.9	Operation counter	Yes/No	Yes	
2.4.10	DC MCB for Control Circuit	Yes/No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
2.4.10.1	NO/NC Contact in MCB for signaling	Min 02	[Insert]	
2.4.11	AC MCB	Yes/No	Yes	
2.4.11.1	NO/NC Contact in MCB for signaling	Yes/No	Yes	
2.4.12	Service outlet socket	Min 01, 10A	[Insert]	
2.4.13	Cu -earthing rails inside control cabinet	Yes/No	Yes	
2.4.14	Detachable plates, the bottom of control cabinet	Yes/No	Yes	
2.4.15	Set of cables for connection of operating mechanism and central control panel of circuit breaker	Yes/No	Yes	
2.4.16	Time phase discrepancy relay	Yes/No	Yes	
2.4.17	Weatherproof, corrosion resistance enclosure		IP55W	
2.4.18	Enclosure Material		Al or stainless steel	
2.5	Installation, Testing & Commissioning Supervision by Vendor Engineer	Yes/No	Yes	
2.6	Special Rating 400kV CB			
2.6.1	PIR			
	Applicable Breaker			
	Type	Series/Parallel	NA	
	PIR value	Ω	NA	
	EIT		NA	
	MIT		NA	
	Energy	kJ	NA	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
2.6.2	CSD		NA	
2.6.2.1	Applicable Breaker		NA	
2.6.2.2	Control Voltage	V.DC	NA	
2.6.2.3	Analog Input		NA	
	Current Input	No.	NA	
	Voltage input	No.	NA	
2.6.2.4	Binary Digital I/O		NA	
	Binary Input		NA	
	Group		NA	
	Number in each group		NA	
	Binary Output		NA	
	Group		NA	
	Number in each group		NA	
2.6.2.5	Mounting Arrangement		NA	
2.6.2.6	Dimension (LxWxH)	mm	NA	
2.6.2.7	Temperature Compensation	Yes/No	NA	
2.6.2.8	CB operating time adaption	Yes/No	NA	
2.6.2.9	Flux Management	Yes/No	NA	
2.6.2.10	Anti-pumping inside CSD	Yes/No	NA	
2.6.2.11	EMC Compatibility test Reference		NA	
2.6.2.12	Communication Port	Yes/No	NA	
2.6.2.13	Supported Protocol		NA	
2.6.2.14	Supported load type by CSD for Middle CB of 1&half CB scheme		NA	
2.7	Drawings attached			

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Circuit Beaker	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	GA Drawing with All dimension & clearance clearly marked, Fixing Detail	Yes/No	Yes	
	Sectional Drawing of Interrupter to show internal components	Yes/No	Yes	
	HV terminal Drawing	Yes/No	Yes	
	Nameplate of CB & Operating Mechanism Box Drawing	Yes/No	Yes	
	LCC & Operating Mechanism Box Equipment Layout Drawing	Yes/No	Yes	
	Earthing Terminal Drawing	Yes/No	Yes	
	CB NO/NC Contact Drawing	Yes/No	Yes	
	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/No	Yes	
	Quality & FAT/Routine Test Plan Attached	Yes/No	Yes	
	Overall Compliance with Requirement	Yes/No		

Disconnector without Earthing Switch

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.1	General			
1.1.1	Manufacturer		[Insert]	
1.1.2	Country of Make		[Insert]	
1.1.3	Model Designation		[Insert]	
1.1.4	Type			
1.2.1	Rated Current, Ir	A	3000A	
1.2.2	Rated Short Circuit Current, I_{ssc}	kA	50	
1.2.3	Design & Construction			
1.2.1	Type of Disconnector		Double side Break	
	Integrated Earth Switch	Yes/No.	No.	
1.2.2	Clearance & Insulation			
	Minimum clearance			
	Across Isolating Gap	mm	[Insert]	
	To ground	mm	[Insert]	
	Between poles	mm	[Insert]	
	Insulator Material		Porcelain	
	Color		Brown	
	Cantilever Force	kN	Min 8	
	Quality of Insulator		Min C130	
	Vulcanizing technique	RTV/HTV/ others	NA	
	Minimum creepage distance	mm/kV	Insert	
	Total creepage distance	mm	[Insert]	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.3	HV terminal	pcs.	06	
	Shape		Flat	
	Dimensions	mm x mm	Min 100 x 100	
	Number of holes		Min 4	
	Dimensions of holes	mm	[Insert]	
	Distance between holes	mm	[Insert]	
	Material suitable for		Al terminal	
	Support Structure to be provided by Vendor	Yes/No	[Insert]	
	Fixing & Earthing Terminals	Yes/No	Yes	
1.2.3	Dimensions & Weight			
	Dimensions			
	Support insulator height	mm	[Insert]	
	Total height	mm	[Insert]	
	Weight			
	Pole weight	kg	[Insert]	
	Weight of operating mechanism	kg	[Insert]	
	Weight of metal structure	kg	[Insert]	
	Total weight	kg	[Insert]	
	Shipping Weight	kg	[Insert]	
1.2.4	Number of breaks per pole	pcs		
1.2.5	Material of contact surfaces		[Insert]	
1.2.6	Operating Mechanism & Drive Box			
1.2.6.1	Number of operating mechanism	pcs.	03/01	
1.2.6.2	Type of operating mechanism		Motor driven	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230V	
1.2.6.4	Rated power of motor	W		
1.2.7	Accessories in LCC			
1.2.7.1	Voltage presence Contactor	Yes/No	Yes	
1.2.7.2	Other Contactors	Yes/No	Yes	
1.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01, A	[Insert]	
1.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01,A	[Insert]	
1.2.7.5	Control Circuit DC MCB	Min 01,A	[Insert]	
1.2.7.6	Selection switch (local/neutral/remote)	Yes/No	Yes	
1.2.7.7	Manual closing button	Yes/No	Yes	
1.2.7.8	Manual opening button	Yes/No	Yes	
1.2.7.9	GFCI service outlet socket	A	[Insert]	
1.2.7.10	Socket MCB	A	[Insert]	
1.2.7.11	Anti-condensation heater inside the operating mechanism cabinet	Yes/No	Yes	
1.2.17.12	Total heater power	W	[Insert]	
1.2.17.13	Heater- supply voltage	AC,50Hz	230 V	
1.2.17.14	Control Voltage	V.DC	110V	
1.2.17.15	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
1.2.17.16	LED Bulb with switch	W		
1.2.17.17	Water-tight corrosion-resistant housing		IP55W	
1.2.17.18	Drive housing Material	AL or Stainless Steel	[Insert]	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.2.17.19	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	
1.2.17.20	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment	Yes/No	Yes	
1.2.17.21	Whether loss of motor power also drop Control DC power	Yes/No	Yes	
1.2.8	MTBF of DS			
1.3	Rating & Characteristics			
1.3.1	Rated lightning impulse withstand voltage of DS	kVpeak		
	Phase to ground			
	Across Isolating Gap			
	Between phases			
1.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS	kVrms		
	Phase to ground			
	Across Isolating Gap			
	Between phases			
1.3.3	Corona extinction voltage	kV rms		
1.3.4	Load Switching capability			
	Capacitive Current			
	Cable charging current			
	Small inductive current			
1.3.5	Rated Current	Same as CB		
	Rated Short Time withstand Current		50	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	Duration		1s	
	Rated Short Time Peak Withstand Current		130	
1.3.6	Rated bus-transfer voltage and current			
	Rated Bus-transfer voltage for DS	V		
	Rated bus-transfer current	A		
1.3.7	Rated induced current and voltage for grounding switches	NA		
1.3.9	DS operation Timings			
	Closing	s		
	Opening	s		
1.3.10	Mechanical Terminal Load			
	Static horizontal force, longitudinal FthA	N	[Insert]	
	Static horizontal force, transversal FthB	N	[Insert]	
	Static vertical force Ftv	N	[Insert]	
	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	
1.3.11	Drawings attached			
	GA Drawing with All dimension & clearance clearly marked, Fixing Detail,	Yes/No	Yes	
	Sectional Drawing of all sides	Yes/No	Yes	
	Nameplate of DS & ES	Yes/No	Yes	
	LCC & Operating Mechanism Box Equipment Layout Drawing, DS-ES NO/NC Contact Drawing	Yes/No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
	HV terminal Drawing ,Earthing Terminal Drawing	Yes/No	Yes	
	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/No	Yes	
1.3.12	Quality & FAT/Routine Test Plan Attached	Yes/No	Yes	
	Overall Compliance with Requirement	Yes/No		

Disconnector with Earthing Switch:

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Disconnector without Earthing Switch	N/A	AIS Type	AIS Type
	System Rated Voltage, U_r	kV	230	230
	System Maximum Voltage, U_m	kV	245	245
1.1.1	Country of Make		[Insert]	
1.1.2	Model Designation		[Insert]	
1.1.3	Type			
1.2	**Design & Construction**			
1.2.1	Type of Disconnector		Double side Break	
	Integrated Earth Switch	Yes/No.	No.	
1.2.2	Clearance & Insulation			
a)	Minimum clearance			
	Across Isolating Gap	mm	[Insert]	
	To ground	mm	[Insert]	
	Between poles	mm	[Insert]	
b)	Insulator Material		Porcelain	
	Color		Brown	
	Cantilever Force	kN	Min 8	
	Quality of Insulator		Min C130	
	Vulcanizing technique	RTV/HTV /others	NA	
	Minimum creepage distance	mm/kV	Min > 25	
	Total creepage distance	mm	[Insert]	
1.2.3	HV terminal	pcs.	06	
	Shape		Flat	
	Dimensions	mm x mm	Min 100 x 100	
	Number of holes		Min 4	
	Dimensions of holes	mm	[Insert]	
	Distance between holes	mm	[Insert]	
	Material suitable for		Al terminal	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
	Support Structure to be provided by Vendor	Yes/No	[Insert]	
	Fixing & Earthing Terminals	Yes/No	Yes	
1.2.3	Dimensions & Weight			
a)	Dimensions			
	Support insulator height	mm	[Insert]	
	Total height	mm	[Insert]	
b)	Weight			
	Pole weight	kg	[Insert]	
	Weight of operating mechanism	kg	[Insert]	
	Weight of metal structure	kg	[Insert]	
	Total weight	kg	[Insert]	
	Shipping Weight	kg	[Insert]	
1.2.4	Number of breaks per pole	pcs		
1.2.5	Material of contact surfaces		[Insert]	
1.2.6	**Operating Mechanism & Drive Box**			
1.2.6.1	Number of DS operating mechanism	pcs.	03/01	
1.2.6.2	Type of operating mechanism		Motor driven	
1.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230V	
1.2.6.4	Rated power of motor	W		
1.2.6.1	Number of ES operating mechanism	pcs.	03	
1.2.6.2	Type of operating mechanism		Motor	
1.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230	
1.2.6.4	Rated power of motor	W		
1.2.6.5	Mechanical & Electrical Interlock between DS & ES	Yes/No.	Yes	
1.2.7	**Accessories in LCC**			
1.2.7.1	Voltage presence Contactor	Yes/No	Yes	
1.2.7.2	Other Contactors	Yes/No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
1.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01, A	[Insert]	
1.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01,A	[Insert]	
1.2.7.5	Control Circuit DC MCB	Min 01,A	[Insert]	
1.2.7.6	Selection switch (local/neutral/remote)	Yes/No	Yes	
1.2.7.7	Manual closing button	Yes/No	Yes	
1.2.7.8	Manual opening button	Yes/No	Yes	
1.2.7.9	GFCI service outlet socket	A	[Insert]	
1.2.7.10	Socket MCB	A	[Insert]	
1.2.7.11	Anti-condensation heater inside the operating mechanism cabinet	Yes/No	Yes	
1.2.17.12	Total heater power	W	[Insert]	
1.2.17.13	Heater- supply voltage	AC,50Hz	230 V	
1.2.17.14	Control Voltage	V.DC	110V	
1.2.17.15	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
1.2.17.16	LED Bulb with switch	W		
1.2.17.17	Water-tight corrosion-resistant housing		IP55W	
1.2.17.18	Drive housing Material	AL or Stainless Steel	[Insert]	
1.2.17.19	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	
1.2.17.20	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment	Yes/No	Yes	
1.2.17.21	Whether loss of motor power also drop Control DC power	Yes/No	Yes	
1.2.8	MTBF of DS			
1.3	**Rating & Characteristics**			
1.3.1	Rated lightning impulse withstand voltage of DS-ES	kVpeak		

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
a)	Phase to ground			
b)	Across Isolating Gap			
c)	Between phases			
1.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS-ES	kVrms		
a)	Phase to ground			
b)	Across Isolating Gap			
c)	Between phases			
1.3.3	Corona extinction voltage	kV rms		
1.3.4	Load Switching capability			
a)	Capacitive Current			
b)	Cable charging current			
c)	Small inductive current			
1.3.5	Rated Current	Same as CB		
	Rated Short Time withstand Current		50	
	Duration		1s	
	Rated Short Time Peak Withstand Current		130	
1.3.6	Rated bus-transfer voltage and current			
a)	Rated Bus-transfer voltage for DS	V	20	
b)	Rated bus-transfer current	A		
1.3.7	Rated induced current and voltage for grounding switches			
a)	Electromagnetic coupling			
i.	Induced Voltage	kV (rms)		
ii.	Induced Current	A (rms)		

No.	Description	Unit	Minimum Requirements	Guaranteed by Bidder
			Data	Data
b)	Electrostatic coupling			
i.	Induced Voltage	kV (rms)		
ii.	Induced Current	A (rms)		
1.3.9	DS operation Timings			
a)	Closing	s		
b)	Opening	s		
c)	Earthing	s		
1.3.10	**Mechanical Terminal Load**			
a)	Static horizontal force, longitudinal Fth_A	N	[Insert]	
b)	Static horizontal force, transversal Fth_B	N	[Insert]	
c)	Static vertical force Ftv	N	[Insert]	
d)	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	
1.3.11	**Drawings attached**			
i.	GA Drawing with All dimension & clearance clearly marked, Fixing Detail,	Yes/No	Yes	
ii.	Sectional Drawing of all sides	Yes/No	Yes	
iii.	Nameplate of DS & ES	Yes/No	Yes	
iv.	LCC & Operating Mechanism Box Equipment Layout Drawing, DS-ES NO/NC Contact Drawing	Yes/No	Yes	
v.	HV terminal Drawing ,Earthing Terminal Drawing	Yes/No	Yes	
vi.	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/No	Yes	
1.3.12	Quality & FAT/Routine Test Plan Attached	Yes/No	Yes	
	Overall Compliance with Requirement	**Yes/No**		

Current Transformers (CT):

No.	Description	Minimum Requirements	Guaranteed

		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape / design		Head type	
1.9	Sealing		Hermetically closed	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	230	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	245	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	50	
2.7	Rated dynamic current I_{dyn}	kV peak	125	
2.8	Rated continuous thermal current (40°C): I core II core III core IV core V core	 % In % In % In % In % In	 200 200 120 120 120	
2.9	Rated transformer ratio: I core II core III core IV core V core	 A/A A/A A/A A/A A/A	**Rated transformer ratio, class & burden** **(Number, ratio & rating of CT cores shall be as per BoQ & SLD. All CT parameters shall be finalized by sizing calculation during execution)**	
2.10	Accuracy class: I core II core III core IV core V core			
2.11	Rated power: I core II core III core IV core V core	 VA VA VA VA VA		
2.12	Factor of Security (FS):		FS= 5	
2.13	Rated mechanical terminal loads	Class	Min. Class II	
3.	**Current Transformers - Design and Construction**			
3.0	Min. Height of the Insulator Pole (excluding conducting metallic body)	mm	2100	
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.1	Total creepage distance	mm	6125	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: Test voltage $1.2*U_M/\sqrt{3}$ Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	tgδ test terminal		Yes	
3.11	Oil drain cock and sampling device		Yes	
3.13	Secondary reconnection		Yes	
3.14	Outdoor metal part made of aluminium or stainless steel		Yes	
3.15	Mass and dimensions			
3.15.1	Total mass	kg	Insert	
3.15.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

Capacitive Voltage Transformers (CVT):

No.	Description	Minimum Requirements Unit	Minimum Requirements Data	Guaranteed
1.	**Voltage Transformers - General**			
1.1	Manufacturer		Insert	
1.2	Type		Capacitive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-2 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape		Insert	
1.9	Sealing		Hermetically closed	
2.	**Voltage Transformers - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1s	kA	50	
2.7	Open Circuit Intermediate Voltage	kV	Insert	
2.8	Rated primary voltage	kV	230/√3	
2.9	Rated secondary voltage I winding II winding	 V V	Rated transformer ratio, class & burden	
2.10	Accuracy class: I winding II winding		(Number, ratio & rating of CT cores shall be as per BoQ & SLD. All CT parameters shall be finalized by sizing calculation during execution)	
2.11	Rated power: I winding II winding	 VA VA		
2.12	Load		Simultaneously	
2.13	Voltage factor	p.u./s	1.5/30	
2.14	Rated mechanical strength	Class	Min. Class II	
2.15	Power frequency withstand tests on secondary windings, 1 min	kV rms	Insert	
2.16	Capacitor Value	pF	Insert	
3.	**Voltage Transformers - Design and Construction**			
3.0	Min. Height of the Insulator Pole (excluding conducting metallic body)	mm	2100	
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper - Mixed dielectric	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.3.1	Total creepage distance	mm	6125	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. to IEC 60694)	µV	Max. 2500	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Permissible level of partial discharges: Test voltage1.2*$U_M/\sqrt{3}$ Test voltageU_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Vertical or horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Oil drain cock and sampling device		Yes	
3.11	Enable sealing after accuracy class checks (sealing possibilities)		Yes	
3.13	Outdoor metal part made of aluminium or stainless steel		Yes	
3.14	Mass and dimensions			
3.14.1	Total mass	kg	Insert	
3.14.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

GTP & requirement Form: *Surge Arresters 245kV:*

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}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.4	Rated voltage of surge arrester U_r	kV_{rms}	210 (Calculation for verification of this data is required during detail design stage)	
2.5	Max. continuous operating voltage U_c	kV_{rms}	168 (Calculation for verification of this data is required during detail design stage)	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current In (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	Heavy Duty 3 Calculation is required during design	
3.2	Pressure Relief Class	Class	insert	
3.2	Duty Class	Class	insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 8	
3.4	Long duration current impulse (2000 µs)	A	≥ 850	
3.5	Maximum residual voltage U_{res}			
3.5.1	For switching impulse current 30/60 µs at 0,5 kA	kV_{peak}	Insert	
3.5.2	For switching impulse current 30/60 µs at 1 kA	kV_{peak}	Insert	
3.5.3	For switching impulse current 30/60 µs at 2 kA	kV_{peak}	Insert	
3.5.4	For lightning impulse current 8/20 µs at 5 kA	kV_{peak}	Insert	
3.5.5	For lightning impulse current 8/20 µs at 10 kA	kV_{peak}	Insert	
3.5.6	For lightning impulse current 8/20 µs at 20 kA	kV_{peak}	Insert	
3.6	Steep Current residual voltage	kV_{peak}	Insert	
3.7	Dielectric endurance of arrester housing			
3.7.1	Lightning impulse withstand voltage of arrester housing (1.2/50 µs)	kV	≥ 925	
3.7.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 425	
3.8	Temporary Overvoltage (TOV)	kV_{rms}	Insert	
3.9	Mechanical requirements			
3.9.1	Specified short-term load SSL (F_{dyn})	N	≥ 2250	
3.9.2	Specified long-term load SSL (F_{stat})	N	≥ 1550	
3.9.3	Maximum Cantilever Strength	Nm	Insert	
3.9.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	
3.10	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.11	Overall creepage distance	mm	Insert	
3.12	Housing insulating material		Composite/Silicon	
3.13	Insulating basement	Yes	Insert	
3.14	Nominal Diameter of Resistor Blocks	Nos	Insert	
3.15	Number of resistor blocks connected electrically parallel	Nos	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.16	Number of separately housed units per phase	Nos	Insert	
3.17	Overall height of arrester (without supporting structure)	mm	Insert	
3.18	Overall height of arrester including grading ring if applicable	Mm	Insert	
3.19	Clearances: Phase to earth (from central line) Phase to phase (center line to center line)	 mm mm	 Insert Insert	
3.20	Overall weight of arrester (without supporting structure)	Kg	Insert	
3.21	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.22	Type and description of surge monitoring		Insert	
3.23	Surge Counter	Yes	Insert	
3.24	Leakage current detector	Yes	Insert	
3.25	HV terminal			
3.25.1	Shape		Flat	
3.25.2	Dimension	mm x mm	Min 100 x 100	
3.25.3	Number of holes		Min 4	
3.25.4	Distance between holes	mm x mm	50 x 50	
3.25.5	Material suitable for		Al terminal	
3.26	Type test certificate ref/date		Insert	
3.27	Number of the same type of surge arresters supplied to date		Insert	
3.28	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & requirement Form: *Surge Arresters 145kV:*

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}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.4	Rated voltage of surge arrester U_r	kV_{rms}	120 Calculation is required during detail design stage	
2.5	Max. continuous operating voltage U_c	kV_{rms}	96 Calculation is required during detail design stage	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current In (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	Heavy Duty 3 Calculation is required during design	
3.2	Pressure Relief Class	Class	insert	
3.2	Duty Class	Class	insert	
3.3	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 8	
3.4	Long duration current impulse (2000 µs)	A	≥ 850	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Maximum residual voltage U_{res}	kV_{peak}	Insert	
3.5.1	For switching impulse current 30/60 µs at 0,5 kA	kV_{peak}	Insert	
3.5.2	For switching impulse current 30/60 µs at 1 kA	kV_{peak}	Insert	
3.5.3	For switching impulse current 30/60 µs at 2 kA	kV_{peak}	Insert	
3.5.4	For lightning impulse current 8/20 µs at 5 kA	kV_{peak}	Insert	
3.5.5	For lightning impulse current 8/20 µs at 10 kA	kV_{peak}	Insert	
3.5.6	For lightning impulse current 8/20 µs at 20 kA	kV_{peak}	Insert	
3.6	Steep Current residual voltage	kV_{peak}	Insert	
3.7	Dielectric endurance of arrester housing			
3.7.1	Lightning impulse withstand voltage of arrester housing (1.2/50 µs)	kV	≥ 550	
3.7.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 250	
3.8	Temporary Overvoltage (TOV)	kV_{rms}	Insert	
3.9	Mechanical requirements			
3.9.1	Specified short-term load SSL (F_{dyn})	N	≥ 3750	
3.9.2	Specified long-term load SSL (F_{stat})	N	≥ 2500	
3.9.3	Maximum Cantilever Strength	Nm	Insert	
3.9.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	
3.10	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.11	Overall creepage distance	mm	Insert	
3.12	Housing insulating material		Composite/Silicon	
3.13	Insulating basement	Yes	Insert	
3.14	Nominal Diameter of Resistor Blocks	Nos	Insert	
3.15	Number of resistor blocks connected electrically parallel	Nos	Insert	
3.16	Number of separately housed units per phase	Nos	Insert	
3.17	Overall height of arrester (without supporting structure)	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.18	Overall height of arrester including grading ring if applicable	Mm	Insert	
3.19	Clearances: Phase to earth (from central line) Phase to phase (center line to center line)	 mm mm	 Insert Insert	
3.20	Overall weight of arrester (without supporting structure)	Kg	Insert	
3.21	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.22	Type and description of surge monitoring		Insert	
3.23	Surge Counter	Yes	Insert	
3.24	Leakage current detector	Yes	Insert	
3.25	HV terminal			
3.25.1	Shape		Flat	
3.25.2	Dimension	mm x mm	Min 100 x 100	
3.25.3	Number of holes	Nos.	Min 4	
3.25.4	Distance between holes	mm x mm	50 x 50	
3.25.5	Material suitable for		Al terminal	
3.26	Type test certificate ref/date		Insert	
3.27	Number of the same type of surge arresters supplied to date		Insert	
3.28	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & requirement Form: *Surge Arresters 36kV:*

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 Calculation is required during design stage	
2.5	Max. continuous operating voltage U_c	kV_{rms}	25 Calculation is required during design stage	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current In (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	Heavy Duty 3 Calculation is required during design	
3.2	Pressure Relief Class	Class	insert	
3.2	Duty Class	Class	insert	
3.3	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 8	
3.4	Long duration current impulse (2000 µs)	A	≥ 850	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Maximum residual voltage U_{res}			
3.5.1	For switching impulse current 30/60 µs at 0,5 kA	kV_{peak}	Insert	
3.5.2	For switching impulse current 30/60 µs at 1 kA	kV_{peak}	Insert	
3.5.3	For switching impulse current 30/60 µs at 2 kA	kV_{peak}	Insert	
3.5.4	For lightning impulse current 8/20 µs at 5 kA	kV_{peak}	Insert	
3.5.5	For lightning impulse current 8/20 µs at 10 kA	kV_{peak}	Insert	
3.5.6	For lightning impulse current 8/20 µs at 20 kA	kV_{peak}	Insert	
3.6	Steep Current residual voltage	kV_{peak}	Insert	
3.7	Dielectric endurance of arrester housing			
3.7.1	Lightning impulse withstand voltage of arrester housing (1.2/50 µs)	kV	≥ 235	
3.7.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 105	
3.8	Temporary Overvoltage (TOV)	kV_{rms}	Insert	
3.9	Mechanical requirements			
3.9.1	Specified short-term load SSL (F_{dyn})	N	≥ 7500	
3.9.2	Specified long-term load SSL (F_{stat})	N	≥ 5000	
3.9.3	Maximum Cantilever Strength	Nm	Insert	
3.9.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	
3.10	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.11	Overall creepage distance	mm	Insert	
3.12	Housing insulating material		Composite/Silicon	
3.13	Insulating basement	Yes	Insert	
3.14	Nominal Diameter of Resistor Blocks	Nos	Insert	
3.15	Number of resistor blocks connected electrically parallel	Nos	Insert	
3.16	Number of separately housed units per phase	Nos	Insert	
3.17	Overall height of arrester (without supporting structure)	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.18	Overall height of arrester including grading ring if applicable	Mm	Insert	
3.19	Clearances: Phase to earth (from central line) Phase to phase (center line to center line)	 mm mm	 Insert Insert	
3.20	Overall weight of arrester (without supporting structure)	Kg	Insert	
3.21	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.22	Type and description of surge monitoring		Insert	
3.23	Surge Counter	Yes	Insert	
3.24	Leakage current detector	Yes	Insert	
3.25	HV terminal			
3.25.1	Shape		Flat	
3.25.2	Dimension	mm x mm	Min 100 x 100	
3.25.3	Number of holes		Min 4	
3.25.4	Distance between holes	mm x mm	50 x 50	
3.25.5	Material suitable for		Al terminal	
3.26	Type test certificate ref/date		Insert	
3.27	Number of the same type of surge arresters supplied to date		Insert	
3.28	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP & requirement Form: *Circuit Breaker 33kV:*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF6 gas or Vacuum	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Double breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	1	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	33	
2.2	Highest voltage for equipment U_n	kV_{rms}	36	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	Insert	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 31.5	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 80	
2.9	D.C. component of the rated short-circuit breaking current	%	Insert	
2.10	First-pole-to-clear factor fff) Terminal fault ggg) Short-line fault hhh) Out-of-phase	p.u. p.u. p.u.	1.3 N.A. N.A.	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 3	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		NA	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 65	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) iii) Without current jjj) With 100 % rated breaking current	ms ms	Insert Insert	
2.20	Maximum time interval between opening interrupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) kkk) Without current lll) 100 % making current	ms ms	Insert Insert	
2.23	Minimum dead time	ms	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance mmm) CO at no-load nnn) CO at rated current ooo) CO at rated breaking current Isc	No.	≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	Min M2	
2.27	Rated electrical endurance	Class	Min E2	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	Insert	
2.30.2	Static horizontal force, transversal F_{thB}	N	Insert	
2.30.3	Static vertical force F_{tv}	N	Insert	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 50	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	1	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		6NO+6NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	Local/remote control selector switch		Yes	
3.3	Local operation push buttons			
3.3.1	Anti-pumping relay		Yes	
3.3.2	Operation counter		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.3	Motor MCB (miniature circuit breakers)		Yes	
3.3.4	Heater - 230 V, 50 HZ		Yes	
3.3.5	Cu earthing rails inside central control cabinet		Yes	
3.3.6	Detachable plates, the bottom of central control cabinet		Yes	
3.3.7	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements & detail specification described in Vol-2	**Yes/No**	**Yes**	

GTP form: 36kV Disconnector

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Vertical break, horizontal or wall mounting	
1.9	Number of poles	pcs.	3	
1.10	Type of operating mechanism		Motor & Hand operated	
1.11	Number of operating mechanisms	pcs.	1	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	33	
2.2	Highest voltage for equipment U_n	kV_{rms}	36	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**Insert**	
2.8	Rated short withstand current I_k	kA_{rms}	≥ 31.5	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 80	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Heaters	V a.c. / Hz	230 / 50	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	Min M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static F_b	N	Insert	
2.17.3	Vertical force F_c	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
2.18	Electrical endurance	Class	Min E2	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	HV terminals			
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 50	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.4	Weight and dimensions			
3.1.4.1	Pole height	mm	Insert	
3.1.4.2	Pole length	mm	Insert	
3.1.4.3	Distance between support axis of a pole	mm	Insert	
3.1.4.4	Shipping dimensions	mm	Insert	
3.1.4.5	Pole weight	kg	Insert	
3.1.4.6	Total weight	kg	Insert	
3.1.4.7	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.3	Minimum number of available contacts (NO/NC)	pcs.	6NO+6NC	
3.2.4	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.5	Heater, 230 V, 50 Hz		Yes	
3.2.6	Total heater power	W	Insert	
3.2.7	Water-tight corrosion-resistant housing		IP54	
3.2.8	Housing of Al or stainless steel		Yes	
3.2.9	Equipotential bonding rails		Yes	
	Overall compliance with the requirements (yes/no)			

GTP & requirement Form: *Charger*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Battery 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		Insert	
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; V DC, min	Insert	
1.25	Rated capacity	kVA	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	Insert (for 110 V DC) Insert (for 48 V DC) (Based on BoQ)	
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	%	±5	
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%	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3	**DC Output**			
3.1	Voltage	V	110±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 Output voltage Output current Battery current Load current Earth-fault voltage	
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

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			
	198. For 3h discharge time	Ah	Insert	
	199. For 5h discharge time	Ah	Insert (for 110 V DC) Insert (for 48 V DC) (Based on BoQ)	
	200. For 10h discharge time	Ah	Insert	
1.14	Discharge voltage per cell	V	1	
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±0.01	
1.20	Sp. gravity of electrolyte (Charged)	1	1.19 ± 1%	
1.21	Vent plug		Anti-corrosive & fire proof	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	201. T he battery stands steel frame		Yes	
1.28	202. T he 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: *LVAC Distribution*

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**AC Distribution Panel**			
1.1	Manufacturer		Insert	
1.2	Manufacturer's type designation		Insert	
1.3	Rating of Busbar	Amps	Insert	
1.4	Fault Rating for 1 sec	kA	Insert	
1.5	Incomer Breaker Rating	Amps	Insert	
1.6	Voltage	Volts	Insert	
1.7	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	

230kV XLPE Power Cable:

GTP & technical requirement form:

(Bidder/manufacturer may insert additional field of data if required as per detail specification described in volume-2)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
01	**General**			
	Manufacturer		Insert	
	Type		Insert	
	Model Designation		Insert	
	Country of Origin		Insert	
	Standards		EC 62067	
	Quality Control		ISO 9001 ISO 14001 ISO 18001	
	Type of conductor		Copper	
	Type of Insulation		XLPE	
	Ambient temperature for calculation Average daily temperature maximum daily temperature	 °C °C	 40 50	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
02	**Voltage**			
	Rated Voltage	kV	230kV	
	Maximum System Voltage	kV	245kV	
	Impulse withstand voltage	kV	1050	
	Power frequency withstand voltage	kV	460	
03	**Cores**			
	Number of cores		1 (one)	
04	**Conductor**			
	Standard		IEC 60228	
	Nominal Current	A	≥ 2000	
	Cross sectional area	mm2	Insert	
	Nominal Diameter	mm	Insert	
	Material		Annealed Copper	
	Design (standard of segmental)		Milliken (4/5 segment)	
05	**Conductor Screen**			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	
	Thickness (approx.)	mm	Insert	
	Nominal Diameter over semi-conducting layer	mm	Insert	
06	**Insulation**			
	Material		XLPE	
	Process		Triple simultaneous extrusion	
	Type of curing (dry)		Dry Curing (VCV)	
	Average Thickness		23-25 mm	
	Minimum Thickness		Insert	
	Nominal Diameter over insulation		Insert	
07	**Insulation screen**			
	Material		Extruded semi conducting compound, cross linked	
	Thickness approx.		Insert	
	Nominal Diameter over semi conducting		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	layer			
08	**Metallic Screen/Sheath**			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
09	**Longitudinal water tightness**			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.		Insert	
10	**Radial moister barrier**			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	
11	**Outer Covering**			
	Material		MDPE	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
12	**Completed Cable**		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
13	**Continuous Current carrying capacity based on the conditions special laid in the cable trench**		SPB * & Trefoil	
	One circuit		Insert	
	Two circuit		Insert	
	Three circuit		Insert	
	Drawn into ducts (One Cable in duct)		Insert	
	One circuit			
	Two circuit		Same as mentioned above provided the length of into the duct shall not exceed 5 % of route	
	Three Circuit		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	In Air		Insert	
14	**Max Conductor temperature**			
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
15	**Permissible overload in service condition**		2 hrs in a day 100 hrs in a month 500 hrs in total life	
16	Conductor short circuit current cable loaded as above prior to short circuit	KA/1sec	Insert	
	Carrying capacity for three second cable loaded	KA/3sec	Insert	
	Short circuit capacity of cable for 3sec	KA/3sec	Insert	
	Final conductor temperature	°C	Insert	
17	Sheath Earth Fault Current Carrying capacity for three second cable loaded as above prior to each fault	KA/1sec	50	
	Final Conductor temperature	°C	250°	
18	Max. Dielectric stress	kV/meter	Insert	
	on the conductor screen (assumed smooth)	kV/meter	Insert	
	on the insulation	kV/meter	Insert	
19	Minimum radius of bend around which cable can be laid		20 x overall diameter of cable in meters	
	Laid direct		Insert	
	In ducts		Insert	
	In air		Insert	
20	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One cable in duct)		Insert	
21	**Maximum DC resistance per km of cable at 20°C**	ohm/km		
	Of conductor	ohm/km	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Of metallic layer	ohm/km	Insert	
22	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
23	**Insulation Resistance per km of cable per core**			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
24	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	
25	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
26	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	
27	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
28	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
29	**Maximum dielectric Dissipation factor of charging of cable when laid direct in the ground at nominal voltage Uo, normal frequency at**			
	Conductor temperature of 20°C		Insert	
	Maximum conductor temperature of 90°C		Insert	
30	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
31	Cree page	Mm/kV	Insert	
	Total creepage distance of outdoor sealing approx. mm and porcelain.	mm	Insert	
32	Earth continuity copper Conductor (IF REQD)	mm2	Insert	
33	**Condition on which current carrying capacity are based**			
	Soil thermal resistivity	°C-cm/W	Insert	
	Ground temperature	°C	Insert	
	Air temperature	°C	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Burial depth	M	Insert	
	Axial spacing between phase cables	Mm	Insert	
	Axial spacing between circuits	Mm	Insert	
	Type of earth bonding.		Insert	
	Overall compliance with the requirements & detail specification described in volume-2	**(yes/no)**	**Yes**	

132kV XLPE Power Cable:

GTP & technical requirement form:

(Bidder/manufacturer may insert additional field of data if required as per detail specification described in volume-2)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
01	**General**			
	Manufacturer		Insert	
	Type		Insert	
	Model Designation		Insert	
	Country of Origin		Insert	
	Standards		EC 62067	
	Quality Control		ISO 9001 ISO 14001 ISO 18001	
	Type of conductor		Copper	
	Type of Insulation		XLPE	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Ambient temperature for calculation Average daily temperature maximum daily temperature	 °C °C	 40 50	
02	**Voltage**			
	Rated Voltage	kV	132kV	
	Maximum System Voltage	kV	145kV	
	Impulse withstand voltage	kV	650	
	Power frequency withstand voltage	kV	275	
03	**Cores**			
	Number of cores		1 (one)	
04	**Conductor**			
	Standard		IEC 60228	
	Nominal Current	A	≥ 2000	
	Cross sectional area	mm2	Insert	
	Nominal Diameter	mm	Insert	
	Material		Annealed Copper	
	Design (standard of segmental)		Milliken (4/5 segment)	
05	**Conductor Screen**			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	
	Thickness (approx.)	mm	Insert	
	Nominal Diameter over semi-conducting layer	mm	Insert	
06	**Insulation**			
	Material		XLPE	
	Process		Triple simultaneous extrusion	
	Type of curing (dry)		Dry Curing (VCV)	
	Average Thickness		23-25 mm	
	Minimum Thickness		Insert	
	Nominal Diameter over insulation		Insert	
07	**Insulation screen**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Material		Extruded semi conducting compound, cross linked	
	Thickness approx.		Insert	
	Nominal Diameter over semi conducting layer		Insert	
08	**Metallic Screen/Sheath**			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
09	**Longitudinal water tightness**			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.		Insert	
10	**Radial moister barrier**			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	
11	**Outer Covering**			
	Material		MDPE	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
12	**Completed Cable**		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
13	**Continuous Current carrying capacity based on the conditions special laid in the cable trench**		SPB * & Trefoil	
	One circuit		Insert	
	Two circuit		Insert	
	Three circuit		Insert	
	Drawn into ducts (One Cable in duct)		Insert	
	One circuit			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Two circuit		Same as mentioned above provided the length of into the duct shall not exceed 5 % of route	
	Three Circuit		Insert	
	In Air		Insert	
14	**Max Conductor temperature**			
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
15	**Permissible overload in service condition**		2 hrs in a day 100 hrs in a month 500 hrs in total life	
16	Conductor short circuit current cable loaded as above prior to short circuit	KA/1sec	Insert	
	Carrying capacity for three second cable loaded	KA/3sec	Insert	
	Short circuit capacity of cable for 3sec	KA/3sec	Insert	
	Final conductor temperature	°C	Insert	
17	Sheath Earth Fault Current Carrying capacity for three second cable loaded as above prior to each fault	KA/1sec	40	
	Final Conductor temperature	°C	250°	
18	Max. Dielectric stress	kV/meter	Insert	
	on the conductor screen (assumed smooth)	kV/meter	Insert	
	on the insulation	kV/meter	Insert	
19	Minimum radius of bend around which cable can be laid		20 x overall diameter of cable in meters	
	Laid direct		Insert	
	In ducts		Insert	
	In air		Insert	
20	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	cable in duct)			
21	**Maximum DC resistance per km of cable at 20°C**	ohm/km		
	Of conductor	ohm/km	Insert	
	Of metallic layer	ohm/km	Insert	
22	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
23	**Insulation Resistance per km of cable per core**			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
24	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	
25	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
26	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	
27	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
28	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
29	**Maximum dielectric Dissipation factor of charging of cable when laid direct in the ground at nominal voltage Uo, normal frequency at**			
	Conductor temperature of 20°C		Insert	
	Maximum conductor temperature of 90°C		Insert	
30	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
31	Cree page	Mm/kV	Insert	
	Total creepage distance of outdoor sealing approx. mm and porcelain.	mm	Insert	
32	Earth continuity copper Conductor (IF REQD)	mm2	Insert	
33	**Condition on which current carrying capacity are based**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Soil thermal resistivity	°C-cm/W	Insert	
	Ground temperature	°C	Insert	
	Air temperature	°C	Insert	
	Burial depth	M	Insert	
	Axial spacing between phase cables	Mm	Insert	
	Axial spacing between circuits	Mm	Insert	
	Type of earth bonding.		Insert	
	Overall compliance with the requirements & detail specification described in volume-2	**(yes/no)**	**Yes**	

AUXILIARY POWER AND MULTICORE CONTROL CABLES

Item		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of core																
Core section	mm^2															
Core diameter	mm															
Conductor insulation	mm															
Type of filler																
Type of tape																
Sheath thickness	mm															
Sheath outer diameter	mm															
Armour wires	no.															
Armour wires diameter	mm															
Outer covering	type															
Outer covering thickness																
Completed cable:																
diameter	mm															
weight per metre	kg															
maximum drum length	m															
Minimum installed bending	mm															

radius Maximum conductor operating temperature Continuous current rating Short circuit current rating for 1s Short circuit temperature	°C A A °C															

Post Insulator 245 kV:

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Post Insulators - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60168 IEC 60273 IEC 60672 IEC 60694	
1.6	Quality control		ISO 9001	
1.7	Design		Solid core, porcelain, outdoor	
2	Post Insulators - Characteristics			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage (Wet and Dry)	kV_{peak}	1050	
2.4	Rated switching impulse withstand voltage	kV_{peak}	850	
2.5	One min. power freq. withstand voltage (Wet and Dry)	kVrms	460	
2.6	Rated frequency f_r	Hz	50	
2.7	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.8	Total creepage distance, pedestal	mm	Min. ≥ 6125 mm	
2.9	Failing load bending (p0) (C10)	N	**≥ 10000** Calculation is required during design	
2.10	Failing load torsion	Nm	≥ 4000 Calculation is required during design	
2.11	Total min. cantilever strength	kg	≥ 800	
2.12	Corona extinction voltage	kVrms	156	
3	Post Insulators - Design and Construction			
3.1	Insulation material		Porcelain, brown	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	Min. material density ρ_a	Mgm^{-3}	≥ 2.5	
3.4	Min. stretch strength of material σ_{fg}	MPa	≥ 140	
3.5	Insulator height	mm	Insert	
3.5.1	Total min. height of insulator	(mm)	≥2500	
3.6	Max. diameter of insulating part	mm	Insert	
3.7	Diameter of upper base	mm	Insert	
3.8	Number of holes on upper base		Insert	
3.9	Diameter distance between holes on upper base	mm	Insert	
3.10	Hole type on upper base		Insert	
3.11	Diameter on lower base	mm	Insert	
3.12	Number of holes on lower base		Insert	
3.13	Diameter distance between holes on lower base	mm	Insert	
3.14	Hole type on lower base		Insert	
3.15	Insulator weight	kg	Insert	
Overall compliance with the requirements & detail specification described in Vol-2		**Yes**		

Post Insulator 145 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Post Insulators - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60168 IEC 60273 IEC 60672 IEC 60694	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.6	Quality control		ISO 9001	
1.7	Design		Solid core, porcelain, outdoor	
2	Post Insulators - Characteristics			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated switching impulse withstand voltage (Wet and Dry)	kV_{peak}	-	
2.5	One min. power freq. withstand voltage (Wet and Dry)	kVrms	275	
2.6	Rated frequency f_r	Hz	50	
2.7	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
2.8	Total creepage distance, pedestal	mm	Min. ≥ 3625 mm	
2.9	Failing load bending (p0) (C10)	N	**≥ 10000** Calculation is required during design	
2.10	Failing load torsion	Nm	≥ 4000 Calculation is required during design	
2.11	Total min. cantilever strength	kg	≥ 800	
2.12	Corona extinction voltage	kVrms	Insert	
3	Post Insulators - Design and Construction			
3.1	Insulation material		Porcelain, brown	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	Min. material density ρ_a	Mgm^{-3}	≥ 2.5	
3.4	Min. stretch strength of material σ_{fg}	MPa	≥ 140	
3.5	Insulator height	mm	Insert	
3.5.1	Total min. height of insulator	mm	≥2500	
3.6	Max. diameter of insulating part	mm	Insert	
3.7	Diameter of upper base	mm	Insert	
3.8	Number of holes on upper base		Insert	
3.9	Diameter distance between holes on upper base	mm	Insert	
3.10	Hole type on upper base		Insert	
3.11	Diameter on lower base	mm	Insert	
3.12	Number of holes on lower base		Insert	
3.13	Diameter distance between holes on lower base	mm	Insert	
3.14	Hole type on lower base		Insert	
3.15	Insulator weight	kg	Insert	
Overall compliance with the requirements & detail specification described in Vol-2		**Yes**		

GTP Format: Disc Insulator

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	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 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.) - Tensile strength - Torsional strength - Compressional strength - Combined electrical and mechanical strength Impact strength	 N N-m N N	Insert	

		N-m		
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	

GTP of Transformer oil

SL	Item Description	unit	Test method	Data	
				Required	Offered
A)	**Type**			Inhibited	
B)	**Function**				
1.	Viscosity, 40°C	mm^2/s	ISO 3104	<9.5	
2.	Viscosity, -30°C	mm^2/s	ISO 3104	900	
3.	Pour point	^0C	ISO 3016		
4.	Water content (Bulk)	mg/kg	IEC 60814	<20	
5.	Breakdown voltage				
	- Before treatment	kV	IEC 60156	>60	
	- After treatment	kV	IEC 60296	>75	
6.	Density, 20°C	Kg/dm^3	ISO 12185	<0.870	
7.	DDF [Dielectric Dissipation factor] at 90°C		IEC 60247	<0.001	
C)	**Refining/stability**				
1.	Appearance		IEC 60296	Clear, free from sediment	
2.	Acidity	mg KOH/g	IEC 62021	<0.01	
3.	Interfacial tension			>45	
4.	Total sulphur content	%	ISO 14596		
	Corrosive sulphur		DIN 51353	non-corrosive	
	Potentially corrosive sulphur		IEC 62535	non-corrosive	
	Corrosive sulphur		ASTM D 1275	non-corrosive	
5.	DBDS (Dibenzyl Disulfide)	mg/kg	IEC 62697-1	not detectable	
6.	Antioxidant	wt %	IEC 60666	0.36-0.4	
7.	Metal passivator additives	mg/kg	IEC 60666	not detectable	
8.	2-Furfural and related compounds content	mg/kg	IEC 61198	<0.05	
9.	Aromatic content	%	IEC 60590	4-6	
D)	**Performance**				
1.	Oxidation stability at 120°C, 500 h		IEC 61125 C		
	Total acidity	mg KOH/g		0.05	
	Sludge	wt %		0.01	
2.	DDF at 90°C			<0.0010	
3.	Gassing tendency	mm^3/min	IEC 60628 A	Negative [<-2]	
4.	Heat transfer capacity	W/m^2*K		[Insert]	
a.	At 40°C,				

b.	At operating temperature (100 °C)				
E)	**Health, safety and environment (HSE)**				
1.	Flash point, PM	^{0}C	ISO 2719	>145	
2.	PCA		IP 346	<3	
3.	PCB		IEC 61619	not detectable	

Control, Protection, Substation Automation & Metering

Line Distance Protection

No.	Description	Unit	Minimum Requirements	Guaranteed
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider	
2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/Canada	
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	

No.	Description	Unit	Minimum Requirements	Guaranteed
			condition (temp, humidity, dust etc.)	
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, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	8 (4 for Double Busbar arrangement)	
8.2	Nominal current	A	1A or 5A, depending on substation's CT rartio	
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	150 220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	40 (programmable)	
10.2	Minimum operating range	V	110V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	48 (programmable)	
11.2	Minimum operating range	V	110V and 220V DC (±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	5 (2ms for high speed contact) 10ms	
12	Number of LEDs	Nos.	15 (programmable) (Should be increased as per the scheme	

No.	Description	Unit	Minimum Requirements	Guaranteed
			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.	At least 4 (3 forward and 1 reverse zone)	
17.5	Shape of impedance zone		Mho/Quadrilateral	
17.6	Reverse looking element		1 zone should be settable for reverse looking	
17.7	Can resistance and reactance reaches be set independent of each other	Yes/ No	Yes	

No.	Description	Unit	Minimum Requirements	Guaranteed
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	
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	Oh m	0.1/In to 600/In 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 and time dependent, directional and non-directional, over current and earth fault; Over-voltage & under-voltage protection	
19	Control functions		2 sets of Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement) VT selection should be performed internally for Synchrocheck function	
20	Monitoring functions			

No.	Description	Unit	Minimum Requirements	Guaranteed
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 20 Nos previous records and disturbance recorder should handle at least 8 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	

Line Differential Protection

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	
2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/Canada	
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		Insert	

	version			
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition (temp, humidity, dust etc.)	
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, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	8 (4 for Double Busbar arrangement)	
8.2	Nominal current	A	1A or 5A, depending on substation's CT rartio	
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.	40 (programmable)	
10.2	Minimum operating range	V	110V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	48 (programmable)	
11.2	Minimum operating range	V	110V and 220V DC (±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	5ms & 2ms for high speed contact 10ms	
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		Restrained biased characteristics with	

	characteristics		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 features1	
17.8	Display options		There must be provision of displaying restraining and differential current on the HMI	
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 and time dependent, directional and non-directional, over current and earth fault; Over-voltage & under-voltage protection	
19	Control functions		2 sets of Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement) VT selection should be performed internally for Synchrocheck function	
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 20 Nos previous records and disturbance recorder should handle at least 8 Nos analogue channels and at least 24 Nos	

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

			binary channels	
21	Tripping and indication logics		Programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

Transformer Differential Protection (3 Winding):

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	

2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/Canada	
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 (temp, humidity, dust etc.)	
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, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	12 (8 Nos for 2 winding Transformer) Should be increased for 1 and half CB arrangement, external CT conjugation will not be allowed	
8.2	Nominal current	A	1A or 5A, depending on substation's CT rartio	
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.	32 (programmable)	
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	32 (programmable)	
11.2	Minimum operating range	V	110V and 220V DC (±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	
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 and time dependent, directional and non-directional, over current and earth fault; Over-voltage & under-voltage protection	
19	Control functions		2 sets of Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement) VT selection should be performed internally for Synchrocheck function	
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 20 Nos previous records and disturbance recorder should handle at least 8 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	

Over current and Earth fault protection:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	
2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/ Canada	
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 (temp, humidity, dust etc.)	
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, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	4	
8.2	Nominal current	A	1A or 5A, depending on substation's CT rartio	
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	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable)	Should be

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
				increased as per the scheme design
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	10 (programmable)	Should be increased as per the scheme design
11.2	Minimum operating range	V	110V and 220V DC (±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 Substation Automation System)	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
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*In to at least 20*In (step size 0.01)	
17.7	Pick up setting range for High set Directional/Non-directional OC	A	0.5*In to at least 35*In (step size 0.1)	
17.8	Pick up setting range for Time delayed Directional/Non-directional EF	A	0.01*In to at least 20*In (step size 0.01)	
17.9	Pick up setting range for High set Directional/Non-directional EF	A	0.5*In to at least 35*In (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 Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement)	1 set for Double Busbar arrangement

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
			VT selection should be performed internally for Synchrocheck function	
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	
23	Type test certificate		Should be provided	

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

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	
2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/Canada	
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 (temp, humidity, dust etc.)	
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, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos	Min 4	
8.2	Nominal current	A	1A or 5A, depending on substation's CT rartio	
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	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos	75 (programmable)	
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos	35 (programmable)	
11.2	Minimum operating range	V	110V and 220V DC (±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	Minimum 15 (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 (optional)		Instantaneous/delayed, directional/non-directional, over current and earth fault protection with IEC and ANSI/IEEE characteristics curves	
17.1	Number of parameters 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*In to at least 20*In (step size 0.01)	
17.7	Pick up setting range for High set Directional/Non-directional OC	A	0.5*In to at least 35*In (step size 0.1)	
17.8	Pick up setting range for Time delayed Directional/Non-directional EF	A	0.01*In to at least 20*In (step size 0.01)	
17.9	Pick up setting range for High set Directional/Non-directional EF	A	0.5*In to at least 35*In (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 (optional)		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 (3 sets of Synchrocheck functions have to be provided for 1 and half CB 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 256 20 Nos previous records and disturbance recorder should handle at least 8 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	

Frequency Protection

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	
2	Country of Origin (Place of Manufacturing)		Switzerland/Sweden/Germany/UK/USA/ France/ Canada	
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 (temp, humidity, dust etc.)	
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, ±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 (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos	8 (programmable)	
11.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11.3	Minimum continuous current	A	5	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
	capacity			
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	
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	Hz/sec	0.1 to 10 or higher range (in step size	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
	of Frequency (ROCOF))		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	

Busbar and Breaker Failure Protection

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK/USA/ France)	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
2	Country of Origin (Place of Manufacturing)			Switzerland/Sweden/Germany/UK/USA/ France/Canada	
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 (temp, humidity, dust etc.)	
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				
	4.9.1	Minimum number of binary inputs	Nos.	12 (programmable)	
	4.9.2	Minimum operating range	V DC	Substation nominal DC voltage ±15%	
	4.9.3	Operating time	ms	<1	
4.10	Binary Outputs of Central Unit				
	4.10.1	Minimum number of outputs	Nos.	9	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	4.10.2	Operating time	ms	3	
	4.10.3	Operating voltage	V	Upto 250 V AC/DC	
	4.10.4	Continuous current capacity	A	8	
	4.10.5	Short time current capacity	A	30A for at least 0.5s	
	4.10.6	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				
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	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	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	1A or 5A, depending on substation's CT rartio	
	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, 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	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
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 IN 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	
	7.1.1	Typical tripping time		20 to 30ms at IDiff/IRest ≥5	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	0				
	7.1.11	Settable CT ratio per feeder		50 to 10,000/1A	
7.2	Check zone criterion			Should be available	
	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	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
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	
	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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
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	C	-10 to +55	
	12.1.2 Storage and Transport	C	-40 to +85	
12.2	Climate tests			
	12.2.1 Cold		-25 C/16h	
	12.2.2 Dry heat		+70 C/16h	
	12.2.3 Damp heat		-25 C to +70 C, 1 C, 2 cycles	
	12.2.4 Damp heat (long time)		+40 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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
			1kV AC or 1.4kV DC/1 min (across open contacts)	
12.5	Impulse test		1.2/50 µS/0.5 Joule, 5kV AC	

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

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer's name		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK /USA/ France)	
2	Country of Origin		Switzerland/Sweden/Germany/UK/ USA/ France/Canada	
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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
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	

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

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer's name		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK /USA/ France)	
2	Country of Origin		Switzerland/Sweden/Germany/UK/ USA/ France/Canada	
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	Nos	As required for standard scheme	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
	contacts			
12	Number of Normally Close contacts	Nos	As required for standard scheme	
13	Standards		Should conform IEC-60255 in all aspects	

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

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer's name		ABB/SIEMENS/GE/SEL/Schneider (Switzerland/Sweden/Germany/UK /USA/ France)	
2	Country of Origin		Switzerland/Sweden/Germany/UK/ USA/ France/Canada	
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	
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	Nos	As required for standard scheme	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
	contacts			
12	Standards		Should conform IEC-60255 in all aspects	

Test Socket

No.	Description	Unit	Minimum Requirements	Bidder's Dtaa
			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,		Yes	

	and performing whole tripping test with following AR			
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	

Energy Meter (3-phase, 4-wire, 3-element, Numerical Indoor Type Multi-function Programmable Tariff Meter):

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
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 mater. Display reading X CT ratio X PT ratio = Actual reading in KWh	
21	Visual indication of		Pulse indicator on the front of meter as	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
	operation		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	
23	Auxiliary supply range		Dual Power Supply: 80V to 240V AC/DC or higher range Self Power with VT voltage (80V to 130V AC)	
24	Operating frequency		50Hz (±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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
			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 angel); 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 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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
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.	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
			Number of power interruption with date & time (minimum 100 events). Latest power failure time & date Date & time of meter tempering. (Voltage & 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		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) 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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
			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 C to +60 C	
	43.3 Storage temperature		-40 C to +80 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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
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	

Digital Multifunction Panel Meter:

Sl. No.	Description	Unit	PGCB Requirements	Bidder's Guaranteed
1.1	Name of the Brand	:	To be mentioned by the bidder	
1.2	Model Name	:	To be mentioned by the bidder	
1.3.	Country of Origin & Made in	:	EU/UK/USA/Japan/Canada.	
1.4	Reference Standard	:	Measurement Standard IEC 62053 or ANSI C12.20	
1.6	Meter type		Programmable, multi-function meter	
1.7	Display language		English	
1.8	Connection type		CT/VT operated, 3-phase, 4 wires, solidly grounded neutral	
1.9	Installation		Indoor installation	
1.10	Number of elements		3 (three)	
1.11	Measuring mode		True 4 quadrant	
1.12	Auxiliary power		AC or DC Universal, AC Power: 100~265Vac @ 50Hz; DC power: 100~220Vdc (±10%), Maximum Burden 10VA	
1.13	Current Inputs	:	Nominal Current: 1A Metering Range: 0.01~2A ac,	

Sl. No.	Description	Unit	PGCB Requirements	Bidder's Guaranteed
			Withstand: 20 Arms continuous, 1% Pickup Current of nominal, Accuracy: 0.2% full scale.	
1.14	CT polarity configuration		Software based online polarity change should be possible for each phase without reversing external connection.	
1.15	Voltage Input	:	Nominal Full Scale: 110Vac L-N, (+20%), Metering Frequency: 45Hz~55Hz Pickup Voltage: 20Vac, Accuracy: 0.5% full scale	
1.16	Energy Accuracy (%)	:	Active (IEC62053-22 or ANSI C12.20): Class 0.2 Reactive (IEC 62053-23): Class 2.0	
1.17	Communication Protocol	:	RS 485 MODBUS RTU Protocol, 2-wire connection.1200~38400 baud rate,	
1.18	Built in Memory	:	Minimum 2MB or 20 nos of parameters at 15 minutes interval for 90 days	
1.19	Panel cut & front side dimension	:	Panel cut not exceeding (92mm x 92mm) square shape and 4 inches diameter round shape; display size including overall front side dimension not exceeding (96mm x 96mm)	
1.20	Panel mounting	:	Universal ANSI & DIN dual supported panel mounting	
1.21	Metering	Voltage:	Resolution 0.1V, Range 50V~500kV	
		Current:	Resolution 0.1A, Range 1A~9999A	
		Active Power:	Resolution 1W, Range -9999MW~9999MW	
		Reactive Power:	Resolution 1var, Range -9999Mvar~9999Mvar	
		Power factor:	Resolution 0.01 Range: -1.000~1.000	
		Frequency	Resolution 0.01Hz Range 45.00~55.00Hz	

Sl. No.	Description	Unit	PGCB Requirements	Bidder's Guaranteed
		:		
		Active Energy:	Primary: Resolution 0.1kWh Range 0-99999999.9 kWh	
			Secondary: Resolution 0.001kWh, Range 0-999999.999 kWh	
		Reactive Energy:	Primary: Resolution 0.1kvarh Range 0-99999999.9 kvarh	
			Secondary: Resolution 0.001kvarh Range 0-999999.999 kvarh	
		Metering capability:	V1, V2, V3, Vln, ,V12, V23, V31, I1, I2, I3, In, P1, P2, P3, Psum, Q1, Q2, Q3, Qsum, PF1, PF2, PF3, PF, F, real power(imp, exp), reactive power(imp, exp), apparent power(imp, exp), Energy (Ep_imp, Ep_exp, Ep_total, Ep_net), Reactive Energy (Eq_imp, Eq_exp, Eq_total, Eq_net)	
1.22	Data logging	capability:	Data logging facility shall be available for all electrical parameter for historical trending with real time clock.	
1.23	Display Options		Built-in HMI LCD/LED display, power quadrant display	
1.24	Accessories to be supplied with meter (Cost shall be included in product price.)	:	a. Communication and configuration and data logging Software b. Engineering Data for Communication Protocol, Modbus RTU Holding Register Addresses of all electrical parameters. c. Operating instruction manual in English d. Panel mounting accessories	

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 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	
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	

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	

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.

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.

SCADA Server

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14261	SCADA Server			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	GB	Insert	
2.6	Video display adapter type		Insert	
2.7	Video display adapter memory		Insert	
2.8	Hard disc type		Insert	
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 24"	pcs.	2	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

SCADA servers must be in hot-standby redundant configuration.

Substation Automation System

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	General			
1.1	Standards			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	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	0/55	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	- 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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
3	Gateway to National Load dispatch Center			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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 +55 -10 to +55	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 +55 -10 to +55	
12.20	Relative humidity: Operating max./min Transport and storage	 % %	 93 93	
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	

Operator Workstation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Operator Workstation			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	Insert	
2.6	Video display adapter type		Dual head capability	
2.7	Video display adapter memory	MB	Insert	
2.8	Hard disc type		Insert	
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	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 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

Printer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14263	Printer / Code number: 14263			
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)			

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		No	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.19	Monitor 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	
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)			

Time Synchronization Device

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14271	Time Synchronization Device / Code number: 14271			
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)			

Weather Station (Optional)

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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

Ethernet Switch Process LAN

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14273	Ethernet Switch-Process LAN / Code number: 14273			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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..55°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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

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).

Ethernet Switch Control Room

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14274	Ethernet Switch-Control Room / Code number: 14274			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..55°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			
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)			

Protection Monitoring Software

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14281	Protection Monitoring Software / Code number: 14281			
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)			

SCADA Software

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14282	SCADA Software / Code number: 14282			
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 with armour 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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.

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)			

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 origin		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		3xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Voltage control function			
2.4.1	Set voltage range	% Ur2	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4.2	Set voltage dead-band range	% Ur2	Insert	
2.4.3	Upper limit busbar voltage range	% Ur2	Insert	
2.4.4	Lower limit busbar voltage range	% Ur2	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	% Ur2	Insert	
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)			

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 (code 14007)		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)	

GTP & Technical Requirement Form: DFDR

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		QUALITROL-UK, SIEMENS-Germany, SEL-USA	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Power supply	V, DC/AC	110 - 220 VDC or 125 - 220 VAC	
1.6	Possible sampling rates			
1.6.1	Slow. 1Hz-500Hz	Samples / sec	Insert	
1.6.2	Fast: 0.5 kHz - 12kHz	Samples / sec	Insert	
1.6.3	Continuous (variable rate)	Samples / sec	Insert	
1.7	DC-coupled inputs	Yes/No	Yes	
1.8	Resolution	bit	12 or better	
1.9	Accuracy	%	0.1% on voltage and 0.2% on current	
2	**Analog inputs**			
2.1	Number of channels		• 4 CT inputs and 4 VT inputs for each feeder of Line and Transformer type • 4 CT inputs for each feeder of Bus Coupler and Bus Section type • 4 VT inputs for each Busbar • 2 Voltage inputs of 2 DC systems	
2.1.1	Expandability		As required for future feeders according to the same numbers as existing feeders	
2.2	Nominal current	Amp	1A / 5A	
2.3	Nominal voltage	Vac	5, 20, 140 and 300 Vrms	
2.4	Cut-off frequency	dB	insert	
2.4.1	Bandwidth	dB	insert	
2.4.2	Attenuation	dB	insert	
2.4.3	Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	Yes	
2.4.4	Simultaneously programmable sampling rate for all feeders/inputs		Min 2 for FAST and SLOW Recording	
2.4.4.1	Locally changeable		Yes	
2.4.4.2	Remotely changeable		Yes	
2.5	Burden			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5.1	Current circuit	VA	Insert	
2.5.2	Voltage circuit	VA	Insert	
2.6	Over load			
2.6.1	Current	% In	100% In continuously, min 600 % In for 1 sec.	
2.6.2	Voltage circuit	% Vn	2Vn and max. 350 Vn	
3	**Digital inputs**			
3.1	Number of channels		• 36 Nos for each 230kV Line feeder • 26 Nos for each 132kV Line feeder • 28 Nos for each Transformer feeder • 8 Nos for each feeder of Bus Coupler and Bus Section type • 8 Nos for each BBP system	
3.2	Expandability (Without and time skew)		As required for future feeders according to the same numbers as existing feeders	
4	**Memory**			
4.1	Size	MB	4 GB or higher	
4.2	Type		Solid state	
4.3	Pre-fault time (fast scanning rate)	sec	0.1-2 user-programmable	
4.4	Post-fault (fast scanning rate	sec	0.1-2 user-programmable	
4.5	Pre and post-fault time (slow scanning rate)	sec	min. 180 user-programmable	
4.6	In-built hard disk (auto-maintained)	TB	min. 1 TB	
5	**Sensors / Triggering criteria**			
	All sensors/triggers are preferable programmable and virtually recordable	Yes/No	Yes	
5.1.	Logical combination sensor	Yes/No	Yes	
5.2	Physical analog channels		Level, rate of change, swing, adaptive rate of change	
5.2.1	Over/under voltage level	Yes/No	Yes	
5.2.2	Over current level	Yes/No	Yes	
5.2.3	Imbalance of phases	Yes/No	Yes	
5.2.4	dU/dt	Yes/No	Yes	
5.2.5	Frequency variation or active transition of a logic input	Yes/No	Yes	
5.3	Virtual (derived) quantities		RMS, P, Q, F, angle, sequence components, unbalance	
5.3.1	Single-phase active power and tri-phase	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	active power			
5.3.2	Single-phase, reactive power and tri-phase reactive power	Yes/No	Yes	
5.3.3	Frequency	Yes/No	Yes	
5.3.4	Zero sequences, negative sequence, and positive sequence parameter	Yes/No	Yes	
5.3.5	Unbalance factor and phase angle	Yes/No	Yes	
5.4	Threshold resolution	%	0.10%	
5.5	DC Step	Yes/No	Yes	
5.6	Sensor trigger	Yes/No	Yes	
5.7	Event trigger	Yes/No	Yes	
5.8	Manual trigger	Yes/No	Yes	
5.9	Remote trigger	Yes/No	Yes	
5.10	Fault Location Calculation	Yes/No	Displaying fault location automatically by impedance-based calculation	
5.11	The interface of Fault Records	Yes/No	All Analog and Digital signals of a single feeder have to be displayed on a single page of the HMI and separate pages have to be configured for separate feeders	
6	**Clock System**			
6.1.	Internal clock	Yes/No	Yes	
6.2.	Accuracy		Insert	
6.3.	External synchronization	Yes/No	Yes (GPS)	
6.4.	GPS Receiver and Antenna	Yes/No	Yes	
6.5.	Time resolution between 2 synchronized pulses		Insert	
7	**Output Alarm Relay Contact &Human interface**			
7.1.	Relay	Potential or potential-free contact	Insert	
7.2.	Contact	NO/NC contact rating	250VRMS - 5A, 110V – 0.5A DC	
7.3.	Make and carry for 0.5 sec	A	Min 8A	
7.4.	Carry continuously	A	Min 5A	
7.5	Break (DC) - resistive	W	Insert	
7.6	Human Interface	LED	Front panel LEDs for feedback on status, synchronization, triggering	
8	**Interface for Data Communication**			
8.1.	Full definition compression	Yes/No	Yes	
8.2.	Maximum transmission rate	KB / sec	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.3.	Standard serial port (EIA-232-D)	Yes / No	Yes	
8.4.	Printer port	Yes/No	Yes	
8.5.	Dedicated serial port for modem	Yes/No	Yes	
9	**Standard Compliance**			
9.1	Immunity Compliance		IEC 61000-4-4, 4-5, 4-6, 4-12 compliant	
9.2	Environmental-Operating compliance		5 to 55 °C (41° to 131 °F)	
9.3	Storage		-10 to 65 °C (14° to 149°F)	
9.4	Humidity		10 to 90%	
9.5	Vibration		IEC 68-2-6, 4.9m/s2	
9.6	Radiated electromagnetic field		IEC 61000-4-2, class 4; IEC 61000-4-3, class 4	
10	**Communication and remote analysing unit**			
10.1.	Processor Intel Core-i7	MHz	Minimum 3.4 GHz	
10.2.	Co-processor Pentium	Yes/No	Yes	
10.3.	Main memory capacity, RAM DDR4	GB	Minimum 8GB	
10.4.	Colour graphics board S-VGA	Yes/No	Yes	
10.5	Screen S-VGA	Yes/No	Yes	
10.6	Hard disk unit	TB	Minimum 1 TB	
10.7	Printer	Yes/No	Yes	
10.8	Modem	Yes/No	Yes.	
11	**Printer Data**			
11.1.	Printer amplitude (scaling peak to peak)		Insert	
11.2.	Time scale	mm/s	Insert	
11.3.	Printer resolution	-	Insert	
11.4.	Auto printing	Yes/No	Yes	
11.5	Fault priority transmission	Yes/No	Yes	
11.6	Fault location (distance calculation)	Yes/No	Yes	
11.7	Power supply	V, Hz	AC 230 V, 50 Hz	
	Overall compliance with the requirements & detail specification described in volume-2	**(yes/no)**	**Yes**	

GTP for Energy Meter

SL	Item Description	unit	Data	
			Required	Guaranteed
1.	Manufacturer		CEWE/Elster/Landis+Gyr/EDMI/SEL	
2.	Country of origin		UK/USA/Switzerland/EU	
	Engraved in Meter body	Y/n	Yes	
3.	Model		Insert	
4.	Supported standard		Insert	
5.	Connection type		From Ins. Tranf.	
6.	No. of elements/ phase		3	
7.	Input /Secondary Current Rating			
a	Nominal Rating ,In	A	1/5/10A, user selectable	
b	Current that can be sensed	%In		
c	Continuous Thermal current rating		2*In	
d	Short time thermal rating	1s	10*In	
		3s	Insert	
		5s	Insert	
		10s	Insert	
8.	Analog Contacts			
a	Voltage	No.		
b	Current	No.		
9.	Digital I/O	No.		
10.	Digital contact to monitor Meter Life	Y/N	Yes	
11.	Operating Voltage	Vac		
a	Continuous Operating		1.3*Vn	
b	Variation Limits permitted	V	insert	
12.	Accuracy class		0.2s	
11.1	Voltage & Current			
i.	Unity Power Factor			
ii.	0.5 Power Factor:			
11.2	Energy Accuracy			
a)	KWh			
i.	Unity Power Factor			
ii.	0.5 Power Factor:			
b)	KVarh			

SL	Item Description	unit	Data	
			Required	Guaranteed
i.	Unity Power Factor			
ii.	0.5 Power Factor:			
13.	Frequency variation		1%	
i.	for PQ			
ii.	for metering			
14.	Meter constant			
15.	Multiplication factor			
16.	Visual indication of operation		Pulse to be indicated on the front of meter as per meter constant.	
17.	Burden on Ins. Trf.			
	CT	VA	<0.5	
	VT	VA	<0.5	
18.	Power consumption from Auxiliary supply	W	Insert	
19.	Auxiliary Power supply range	VDC		
20.	Dual Supply possible [Self & separate]	Y/N	Insert	
21.	Dos the meter can be power from VT	Y/N	Insert	
22.	Internal Memory	MB		
23.	Communications Protocol supported			
a.	IEC 61107	Y/N		
b.	DLMS	Y/N		
c.	IEC 61850	Y/N		
d.	Modbus	Y/N		
24.	Remote Communication to Control Centre	Y/N	Y	
a	Protocol Supported for Remote Communication		Insert	
25.	No. of Communications Ports	No.	Insert	
a	RS485	Y/N	Yes/ Insert speed	
b	RS232	Y/N	Yes/ Insert speed	
c	Ethernet-RJ	Y/N	Insert	
d	Ethernet-Fibrer optic	Y/N	Insert	
e	USB, type(2.0 or 3.0)	Y/N	Insert	
26.	Optical Port for Reading	Y/N	Insert	
27.	Data refresh Rate over RS-485 DLMS / MODBUS	s	Insert	
28.	DISPLAY			LCD
	Dimension	mmxmm	Insert	
	Technology		TFT/others	
	LCD/Color			
29.	Analysis Software requirement			
a	Name			
b	Features			

SL	Item Description	unit	Data	
			Required	Guaranteed
i	PC-based tool.			
ii	License supplied without any time-bound license		Yes	
iii	Method to control data duplication and installation (i.e. software keys or other)		Insert	
30.	Meter sealing condition		Sealed (Hermetically or Ultrasonic welded)	
31.	Time Sync Option			
a	In built clock	Y/N		
b	Provision of GPS synchronization	Y/N		
c	Converter timing	Y/N		
32.	Environment requirement			
a	IP rating		IP54 or better	
b	Operating temperature			
i	Device	^{0}C		
ii	Touchscreen operating Temp.	^{0}C		
c	Storage temperature	^{0}C		
d	Humidity range	%	0% to 95%, non-condensing	
33.	True Four Quadrant Metering	Y/N	Yes	
34.	Meter Designed service life	years	15	
35.	MTBF		Insert	
36.	MTTR		Insert	
37.	Year of manufacture		Engraved in meter	
38.	Synchrophasor Measurements	Y/N	Insert	
	PQ Functionalities			
39.	Max Harmonic Order in voltage & current circuit	No.		
40.	Waveform Capture Event Reports			
a	Samples Per Cycle	No.	128	
b	Duration	(cycles)	insert	
c	Number of Events	No.	Insert	
d	COMTRADE Reports	Y/N		
41.	Load Profile Recorder			
a	Recorders x channels		1x16	
b	Acquisition rates	mins	Insert	
c	Storage duration for 10 minute interval data			
i	16 channels	years		
ii	192 channels	years		
iii	512 channels	years		
42.	Voltage Sag, Swell, Interruption (VSSI)			

SL	Item Description	unit	Data	
			Required	Guaranteed
	Recorder			
a	Typical number of summary events	No.	Insert	
b	Number of detailed rows	No.	Insert	
c	Minimum disturbance duration	cycle	1/4	
d	Sampling rate		4 samples/cycle–1 sample/ day, adaptive	
43.	Sequential Events Recorder			
	Number of events	No.	> 80,000	
	Number of channels monitored	No.	>50	
44.	Compliance With IEC 61000-4-30 Power Quality Standard			
	150/180-cycle, 10-min. aggregation			
	2-hour aggregation			
	Real-time clock uncertainty			
	crest factor and K-factor metering			
45.	Power Quality Parameters			
a	Power frequency		A	
b	Magnitude of the supply voltage		A	
c	Flicker		Insert	
d	Supply voltage interruptions, dips, and swells		A	
e	Supply voltage unbalance		A	
f	Voltage harmonics		A	
g	Magnitude of current		A	
h	Harmonic currents		A	
i	Current unbalance		A	
46.	Anomaly Detection Features			
	Phase wise Missing Potential			Yes
	Phase wise Current Circuit Reversal			Yes
	Voltage Unbalance			Yes
	Current Unbalance			Yes
	CT Miss			Yes
	Power On/Off			Yes
	Auxiliary Supply Fail			Yes
47.	Alarm provision for Anomaly			
48.	Cyber Security Levels			

SL	Item Description	unit	Data	
			Required	Guaranteed
	Password levels	No.		
	During firmware upgrades	Y/N		
49.	Transformer/Line-Loss Compensation	Y/N	Y	
50.	Time Accuracy			
51.	Clock Drift With NoTime Input	min/year	<5 minutes per year	
52.	IRIG Accuracy:	uS	<4	
53.	SNTP Accuracy	ms	±5	
54.	Startup Time to Begin Energy Metering	s		
55.	Language Supported & Provided			
	English		Yes	
	others		Insert	
56.	Type test certificate			
	Testing Authority		Insert	
	Certificate Ref.		Insert	
	Testing Date		Insert	
57.	Construction			
	dimensions	mm	Insert	
	Weight	kg	Insert	
	Mounting provisions		Insert	
58.	Device Model Supply Information			
a	No. of devices supplied till date	No.	Insert	
b	No. of years this model is in service	No.	Insert	
c	No. of years this model is in satisfactory service performance	No.	Insert	
59.	Conformance to Safety standard		Yes,[CE,UL,FCC,RoHs]	
	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	**203.**

Telecommunication Equipment

GTP Format of Fibre Optic Multiplexer Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.0	**GENERAL:**			
1.1	Manufacturer		Insert	
1.2	Model No.		Insert	
1.3	Type		Insert	
1.4	Type of multiplexer		SDH: ADM & PDH Ethernet: MPLS	
1.5	Complying to ITU-T rec.		Yes	
1.6	Transmission Capacity	Mbit/s	STM-4 & STM-16 10G	
1.7	Access capacity on 64 kbit/s	channels	Minimum 200	
1.8	Access capacity on 2 Mbit/s	channels	Minimum 40	
1.9	Redundant central processor		Shall be available	
1.10	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	HDSL, 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1.2	Analogue, 4wire with E&M: Input level Output level	dBr	+7.5 .. –16 +7.0 .. –16.5	
4.1.3	Analogue, 2wire with E&M: Input level Output level	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	
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 Ethernit / OSI	
4.7	**Ambient Conditions:**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

GTP of Digital Multiplexer Interface

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Manufacturer			
2	Type			
3	Standards		ITU-T G.703, G.704, G.706 G.711, G.732, G.823, V.11, V.24 V.28	
4	Channel units		Ethernet 10/100 V24/28 V35 X24/V11 2-wires FXS	
5	Remote subscriber interface		ITU-T G.711	
6	ppp) Nominal impedance	Ω	600	
7	qqq) Subscriber line feed		Yes	
8	rrr) Dialling		Yes	
9	sss) Ringing detection		Yes	
10	PABX interface			
11	ttt) Nominal impedance	Ω	600	
12	uuu) Transmission speed	kbps	64	
13	Timing		Co- and contra-directional G.703	
14	64 kbps data interface			
15	vvv) Data transmission speed	kbps	64	
16	Timing		Co- and contra-directional G.703	
17	www) Nominal impedance		120	
18	xxx) Code		AMI	
19	Jitter		ITU-T G.823	
20	Data interface for transmission of asynchronous data channel with bit rate up to 9600 bps			
21	yyy) Bit rate	kbps	64	
22	zzz) Data transmission speed	bps	9600	
23	aaaa) Operating mode		Asynchronous	

No.	Description	Minimum Requirements Unit	Data	Guaranteed
24	bbbb) Electrical interface		ITU-T V.28	
25	cccc) Functional interface		ITU-T V.24	
26	Rated power supply voltage	V DC	48, plus pole earthed	
27	Mounting		Inside SDH rack	
28	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003, 9004		Yes	
29	Type test reports		To be included in bid	
	Overall compliance with the requirements (yes/no)			

GTP SDH Equipment

No.	Description	Minimum Requirements Unit	Data	Guaranteed
1	Manufacturer		Insert	
2	Type		Insert	
3	Optical interface(s)		STM-16	
4	dddd) Standard		ITU-T G.707 G.708, G.709 G.957, G.958	
5	eeee) Bit rate	Mbps	2,500	
6	ffff) Operating lengthwave	nm	1550	
7	gggg) Output optical transmit level	dBm	To guarantee 6 dB margin as a minimum	
8	hhhh) Receiver threshold	dBm	-28 dBm at 2500 Mbps	
9	iiii) Code binary		NRZ	
10	jjjj) Permissible attenuation at maximum dispersion	dB	0-30	
11	Four (4) Ethernet 10/100/1000 ports		Yes	
12	Electrical tributary interface 2 Mbps		Yes	
13	kkkk) Standard		ITU-T G.703G.823	
14	llll) Bit rate	kbps	2048	
15	mmmm) Code		HDB3	
16	nnnn) Nominal impedance	Ω	75 or 120	
17	Can be configured to operate as:		terminal multiplexer, add / drop multiplexer, cross-connect equipment	
18	Number of 2 Mbps tributary access (interfaces)		4*63	
19	Number of optical tributory interfaces (SCADA channel connection)		4	
20	Number of STM-4 optical interfaces		Minimum 2	
21	LCT interface			
22	oooo) F interface (QD2F)		RS 232 (V.24)	
23	pppp) Bit rate		9.6	
24	qqqq) Connector type at subrack		LC	
25	Network management interface			

No.	Description	Minimum Requirements Unit	Minimum Requirements Data	Guaranteed
26	rrrr) Q interface (QD2B3)		Ethernet G.773, G.784	
27	Rated power supply voltage	V DC	48, plus pole earthed	
28	Dimensions	mm		
29	Mass	kg		
30	Mounting		Rack 19''	
31	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003, 9004		Yes	
32	Type test reports		To be included in bid	
	Overall compliance with the requirements (yes/no)			

GTP ODF

No.	Description	Unit	Minimum Requirements Data	Data offered by Bidder
1	Manufacturer		Insert	
2	Type		Insert	
3	Standards		IP65	
4	ssss)for single mode fibres		ITU-T655 IEC 793-1 IEC 793-2	
5	tttt) for fibre optic cables		IEC 794-1 IEC 794-2	
6	Fibre optical cable gland		To accept metal-free optical cable, min 2*48 single mode fibres, with a loose tube Capability to accept 2*48 additional cores	
7	Patch cord connection		To accept 2*48 metal-free optical patch cords with 1 single mode fibre each. Connected pigtails Capability to accept 2*48 additional cores	
8	Maximum optical attenuation per slice	dB	0.1	
9	Type of optical connectors		LC	
10	Housing		Tamper-proof sealed rugged construction	
11	Installation		Mounted on wall	
12	Dimensions	mm		
13	Mass	kg		
14	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003, 9004		Yes	
15	Type test reports		To be included in bid	
	Overall compliance with the requirements (yes/no)			

GTP for SCADA Gateway

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1	Manufacturer		ABB/Siemens/SEL/GE/Schneider	
1.2	Country of origin		Switzerland/ Germany /USA/UK/France	
1.3	Type		Industrial Grade Server	
1.4	Standards		IEC-61850-3 Certified Power Automation Server	
1.5	Type of housing		Rack Mount	
2	Characteristics			
2.1	Power Supply			
2.1.1	Rated auxiliary supply voltage	V DC	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Processor		Intel Xeon	
2.3	Memory			
2.3.1	Type		DDR4	
2.3.2	Capacity	GB	8	
2.4	Storage			
2.4.1	Type		SATA SSD	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4.2	Rotating hard disc	Yes/No	No	
2.4.3	Capacity	GB	120	
2.4.4	Quantity	Nos.	02	
2.4.5	RAID controller type		RAID 1	
2.6	Display		VGA	
2.7	Communication Interface			
2.7.1	Serial interface RS232		Yes	
2.7.2	Number of serial interfaces	Nos.	2	
2.7.3	Ethernet interface		10/100/1000 Base-T RJ45 ports	
2.7.4	Number of Ethernet interfaces	Nos.	6	
2.7.5	Number of USB interfaces	Nos.	2	
2.8	Cooling		Dual Fan	
	Overall compliance with the requirements (yes/no)			

GTP for Firewall

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1	Manufacturer		ABB/Cisco/Fortinet/Juniper/Hirschmann/Ruggedcom	
1.2	Country of origin		Switzerland/Germany /USA/UK/France	
1.3	Type		Industrial Grade Firewall	
1.4	Standards		IEEE 1686	
1.5	Type of housing		Rack Mount	
2	Features			
2.1	Stateful Inspection		Firewall Rules (Incoming/Outgoing, Management), IP masquerading, Port Forwarding, DoS Protection, ACL	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	VPN		SSL and IPSec protected	
2.3	Protocols		Serial, HTTPS, SSH, SNMP	
2.4	Routing Functionality		L3 (Static & OSPF)	
2.5	VLAN Support		Yes	
2.6	Configuration		Command Line Interface (CLI), Web interface	
2.7	Power Supply			
2.7.1	Rated auxiliary supply voltage	V DC	110 ±15 %	
2.7.2	Dual power supply		Yes	
2.8	Communication Interface			
2.8.1	Ethernet interface		10/100/1000 Base-T RJ45 ports	
2.8.2	Number of Ethernet interfaces	Nos.	4	
2.8.3	Number of USB interfaces	Nos.	2	
	Overall compliance with the requirements (yes/no)			

GTP of capacitor bank and equipment 132kV

No.	Description	Unit	Requirement Data	Guaranteed
1.	**Capacitor Bank and Unit**			
1.1	Manufacturer		Insert	
1.2	Model		Insert	
1.3	Applicable Standard		IEC 60871	
1.4	Nominal system voltage	kV (rms)	132	
1.5	Rated voltage of capacitor bank	kV (rms)	145	
1.6	Nominal reactive power output at 132kV	MVar	50	
1.7	Rated reactive power output	MVar	204. 60.33	
1.8	Connection of capacitor bank		205. ouble Y ungrounded neutral	
1.9	Rated lightning impulse withstand voltage (Bank)	kV (peak)	≥650	
1.10	Rated power frequency short duration withstand voltage, 1 s (Bank)	kV (rms)	≥275	
1.11	Temperature category		-5 / B	
1.12	Rated frequency	Hz	50	
1.13	Creepage distance of bushings and support insulators based on pollution level	mm/kV	31	
1.14	Capacitance tolerance	%	0 to +5	
1.15.1	Discharge resistor, Built-in type	ohm		
1.15.1	Discharge requirement for unit	V/minutes	≤ 50/≤ 5	
1.16.1	Impregnant type		PCB free and	

			biodegradable	
1.16.2	Impregnant name		Insert	
1.17	Case		Stainless steel	
1.18	Paint		Insert	
1.19	Bushing no./per unit	Nos.	2	
1.20	Bushing type		Silicone polymer	
1.21	Dielectric system		Polypropylene film	
1.22	Type of capacitor unit		Single Phase	
1.23	Rating plate provided as per specification		Yes	
1.24.1	Rated kVAR of each capacitor unit, Q_N	kVAR	Insert [568.33]	
1.24.2	Rated voltage of each capacitor unit, U_N	V	Insert [10460]	
1.24.3	Rated capacitance of each capacitor unit, C_N	µF	Insert [1653]	
1.24.4	Rated lightning impulse withstand voltage (capacitor unit)	kV (peak)	Insert [**125]**	
1.24.5	Rated power frequency short duration withstand voltage, 1 s (capacitor unit)	kV (rms)	Insert [**50]**	
1.25.1	No. of capacitor unit in series per leg of single Y	Nos.	Insert	
1.25.2	No. of capacitor unit in parallel per leg of single Y	Nos.	Insert	
1.26	Fuse type		Internal	
1.27	Power loss (tanδ) including loss in fuse and internal resistor and series reactor* **(This item shall be used in evaluation)**	w/kVAR	<0.2	
1.28	Installation location		Outdoor	

1.20	Installation altitude	m	≤ 1000	
1.30	Average annual failure rate		Insert	
	Overall compliance with the requirements (yes/no)			

Manufacturers confirmation letter have to be submitted against guaranteed loss.

REACTOR

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Inrush current limiting reactors**			
1.1	Manufacturer	-	Insert	
1.2	Applicable Standard	-	IEC 60076-6	
1.3	Type	-	Air core, Dry	
1.4	Model	-	Insert	
1.5	Rated voltage	kV	145	
1.6	Current at rated voltage	A	165% of rated current (fundamental) of capacitor bank	
1.7	Insulation class	-	Class B	
1.8	Rated reactive power	kvar	Insert	
1.9	Conductor material	-	Cu	
1.10	Inductance per phase (0.2%)	mH	Insert	
1.11	Linear range	p.u	≥2.0	
1.12	Copper loss at 75 ^{o}C and rated current	kW	Insert	
1.13	Impedance at 75 ^{o}C and rated power	Ohms	Insert	
1.14	Rated lightning impulse withstand voltage	kV (peak)	206. ≥650	

1.15	Rated power frequency short duration withstand voltage, 1 s	kV (rms)	≥275	
1.16	Ambient temperature	°C	45	
1.17	Creepage distance	Mm/kV	31	
1.18	Rated inrush current	kA	Insert	
1.19	Dimensions length x width x height	mm	Insert	
1.20	Weight	kg	Insert	
1.21	Installation location		Outdoor	
1.22	Installation altitude	m	≤ 1000	
2.	**Detuning reactors**			
2.1	Manufacturer	-	Insert	
2.2	Applicable Standard	-	IEC 60076-6	
2.3	Type	-	Air core, Dry	
2.4	Model	-	Insert	
2.5	Rated voltage	kV		
2.6	Current at rated voltage	A	165% of rated current (fundamental) of capacitor bank	
2.7	Insulation class	-	Class B	
2.8	Rated reactive power	kvar	Insert	
2.9	Conductor material	-	Cu	
2.10	Inductance per phase (6%)	mH	Insert	
2.11	Linear range	p.u	≥2.0	
2.12	Copper loss at 75 ^{o}C and rated current	kW	Insert	
2.13	Impedance at 75 ^{o}C and rated power	Ohms	Insert	

2.14	Rated lightning impulse withstand voltage	kV (peak)	207.	
2.15	Rated power frequency short duration withstand voltage, 1 s	kV (rms)		
2.16	Ambient temperature	°C	45	
2.17	Creepage distance	Mm/kV	31	
2.18	Rated inrush current	kA	Insert	
2.19	Dimensions length x width x height	mm	Insert	
2.20	Weight	kg	Insert	
2.21	Installation location		Outdoor	
2.22	Installation altitude	m	≤ 1000	
Overall compliance with the requirements (yes/no)				

Neutral Current Transformer 132 kV, 10/1-1A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 61869-1,2	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor, post type	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	40	
2.7	Rated dynamic current I_{dyn}	kV peak	≥100	
2.8	Rated continuous thermal current (40°C): 208. I core 209. II core	 % In % In	 120 120	
2.9	Rated transformer ratio: 210. I core 211. II core	 A/A A/A	 **10/1** **10/1**	
2.10	Accuracy class: 212. I core 213. II core		 5P10 5P10	
2.11	Security factor: 214. I core		 NA	
2.12	Rated power: 215. I core 216. II core	 VA VA	 15 15	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Silicone polymer	
3.2	Insulating medium			
3.3	Minimum creepage distance	mm/ kV	Min. ≥ 31 mm/ kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: 217. Test voltage $1.2*U_M/\sqrt{3}$ 218. Test voltage U_M	 pC pC	 Max. ≤ 5(liquid)/20 (Solid) ≤ 10(liquid)//50(Solid)	
3.7	Min. LV enclosure protection		IP65	
3.8	HV terminals			
3.8.1	Shape		Flat	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 50	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Mass and dimensions			
3.11	Total mass	kg	Insert	
3.13	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			**219.**

GTP of capacitor bank and equipment 36kV

No.	Description	Unit	Requirement Data	Guaranteed
1.	**Capacitor Bank and Unit**			
1.1	Manufacturer		Insert	
1.2	Model		Insert	
1.3	Applicable Standard		IEC 60871	
1.4	Nominal system voltage	kV (rms)	33	
1.5	Rated voltage of capacitor bank	kV (rms)	36	
1.6	Nominal reactive power output at 33kV	MVar	15	
1.7	Rated reactive power output	MVar	220. 7.85	
1.8	Connection of capacitor bank		221. ouble Y ungrounded neutral	
1.9	Rated lightning impulse withstand voltage (Bank)	kV (peak)	≥170	
1.10	Rated power frequency short duration withstand voltage, 1 s (Bank)	kV (rms)	≥70	
1.11	Temperature category		-5 / B	
1.12	Rated frequency	Hz	50	
1.13	Creepage distance of bushings and support insulators based on pollution level	mm/kV	31	
1.14	Capacitance tolerance	%	0 to +5	

1.15.1	Discharge resistor		Built-in type	
1.15.1	Discharge requirement for unit	V/minutes	≤ 50/≤ 5	
1.16.1	Impregnant type		PCB free and biodegradable	
1.16.2	Impregnant name		Insert	
1.17	Case		Stainless steel	
1.18	Paint		Insert	
1.19	Bushing no./per unit	Nos.	2	
1.20	Bushing type		Silicone polymer	
1.21	Dielectric system		Polypropylene film	
1.22	Type of capacitor unit		Single Phase	
1.23	Rating plate provided as per specification		Yes	
1.24.1	Rated kVAR of each capacitor unit, Q_N	kVAR	Insert	
1.24.2	Rated voltage of each capacitor unit, U_N	kV	Insert	
1.24.3	Rated capacitance of each capacitor unit, C_N	µF	Insert	
1.24.4	Rated lightning impulse withstand voltage (capacitor unit)	kV (peak)	**≥38**	
1.24.5	Rated power frequency short duration withstand voltage, 1 s (capacitor unit)	kV (rms)	**≥95**	
1.25.1	No. of capacitor unit in series per leg of single Y	Nos.	Insert	
1.25.2	No. of capacitor unit in parallel per leg of single Y	Nos.	Insert	
1.26	Fusing type		Internal	
1.27	Power loss (Tandelta) including loss in fuse and internal resistor and series reactor*	w/kVAR	≤ 0.2	

	(This item shall be used in evaluation)			
1.28	Installation location		Outdoor	
1.20	Installation altitude	m	≤ 1000	
1.30	Average annual failure rate		Insert	
	Overall compliance with the requirements (yes/no)			

Manufacturers confirmation letter have to be submitted against guaranteed loss.

REACTOR

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Inrush current limiting reactors**			
1.1	Manufacturer	-	Insert	
1.2	Applicable Standard	-	IEC 60076-6	
1.3	Type	-	Air core, Dry	
1.4	Model	-	Insert	
1.5	Rated voltage	kV	36	
1.6	Current at rated voltage	A	165% of rated current (fundamental) of capacitor bank	
1.7	Insulation class	-	Class B	
1.8	Rated reactive power	kvar	Insert	
1.9	Conductor material	-	Cu	
1.10	Inductance per phase (0.2%)	mH	Insert	
1.11	Linear range	p.u	≥2.0	
1.12	Copper loss at 75 ^{o}C and rated current	kW	Insert	
1.13	Impedance at 75 ^{o}C and rated power	Ohms	Insert	

1.14	Rated lightning impulse withstand voltage	kV (peak)	222. ≥170	
1.15	Rated power frequency short duration withstand voltage, 1 s	kV (rms)	≥70	
1.16	Ambient temperature	°C	45	
1.17	Creepage distance	Mm/kV	31	
1.18	Rated inrush current	kA	Insert	
1.19	Dimensions length x width x height	mm	Insert	
1.20	Weight	kg	Insert	
1.21	Installation location		Outdoor	
1.22	Installation altitude	m	≤ 1000	
2.	**Detuning reactors**			
2.1	Manufacturer	-	Insert	
2.2	Applicable Standard	-	IEC 60076-6	
2.3	Type	-	Air core, Dry	
2.4	Model	-	Insert	
2.5	Rated voltage	kV	36	
2.6	Current at rated voltage	A	143% of rated current (fundamental) of capacitor bank	
2.7	Insulation class	-	Class B	
2.8	Rated reactive power	kvar	Insert	
2.9	Conductor material	-	Cu	
2.10	Inductance per phase (6%)	mH	Insert	
2.11	Linear range	p.u	≥2.0	
2.12	Copper loss at 75 °C and rated current	kW	Insert	

2.13	Impedance at 75 °C and rated power	Ohms	Insert	
2.14	Rated lightning impulse withstand voltage	kV (peak)	223. ≥170	
2.15	Rated power frequency short duration withstand voltage, 1 s	kV (rms)	≥70	
2.16	Ambient temperature	°C	45	
2.17	Creepage distance	Mm/kV	31	
2.18	Rated inrush current	kA	Insert	
2.19	Dimensions length x width x height	mm	Insert	
2.20	Weight	kg	Insert	
2.21	Installation location		Outdoor	
2.22	Installation altitude	m	≤ 1000	
Overall compliance with the requirements (yes/no)				

Neutral Current Transformer 33 kV, 2/1-1A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor, post type	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	33	
2.2	Highest voltage for equipment U_n	kV_{rms}	36	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3	Rated lightning impulse withstand voltage	kV peak	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	31.5	
2.7	Rated dynamic current I_{dyn}	kV peak	78.75	
2.8	Rated continuous thermal current (40°C): 224. I core 225. II core	 % In % In	 120 120	
2.9	Rated transformer ratio: 226. I core 227. II core	 A/A A/A	 2/1 2/1	
2.10	Accuracy class: 228. I core 229. II core		 5P10 5P10	
2.11	Security factor: 230. I core		 NA	
2.12	Rated power: 231. I core 232. II core	 VA VA	 15 15	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Silicone polymer	
3.2	Insulating medium			
3.3	Minimum creepage distance	mm/ kV	Min. ≥ 31 mm/ kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: 233. Test voltage $1.2*U_M/\sqrt{3}$ 234. Test voltage U_M	 pC pC	 Max. ≤ 5(liquid)/20 (Solid) ≤ 10(liquid)//50(Solid)	
3.7	Min. LV enclosure protection		IP56	
3.8	HV terminals			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 50	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Mass and dimensions			
3.11	Total mass	kg	Insert	
3.13	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			**235.**

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE F

PROPOSED SUBCONTRACTORS

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE F

PROPOSED SUBCONTRACTORS

The tenderer shall propose a list of the Sub-contractors in the following table as per sub-clause 2.5.2, Subcontractors, Section-3, Evaluation and Qualification Criteria, Volume 1 of 3 of the Tender Document.

Sl. No.	Name and Address of the Subcontractor

Signature ----------

Date ----------

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT

FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

POWER GRID COMPANY OF BANGLADESH LIMITED

TENDER DOCUMENT
FOR

Construction of 230/132/33kV GIS Substation at Anwara, 230/33kV GIS Substation at Bangabandhu Hi-Tech City (Kaliakoir), 132/33kV GIS Substation at Cox'sbazar & Teknaf and 230kV GIS bay extension at existing Kaliakoir Substation (Package-1)

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=0.20 c=0.22 d=0.25 e=0.15 f=0.03				