POWER GRID BANGLADESH PLC

Bidding Document
for

Design, Supply, Installation, Testing and Commissioning of 230/33 kV GIS Substation at Bhola and 132/33 kV GIS Substations at Domar, Hatibandha, Shibchar, Bhanga, Jhalokathi, Pirojpur on Turnkey Basis (Package-8)_Retender.

Volume 3 of 3

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Invitation for Bids No.:		**27.21.0000.101.07.321.24.3990**
OCB No.	:	**PGCB/AIIB/L8374/DWZTGEP/GIS/P8(Retender)**
Country	:	**Bangladesh**

Employer:

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Contents of the Tender Documents

VOLUME 1

Part 1: Bidding Procedures

Section 1: Instructions to Bidders (ITB)
Section 2: Bid Data Sheet (BDS)
Section 3: Evaluation and Qualification Criteria (EQC)
Section 4: Bidding Forms (BDF)
Section 5: Eligible Countries (ELC)

Part 2: Employer's Requirements

Section 6: Employer's Requirements (ERQ)

Part 3: Conditions of Contract and Contract Forms

Section 7: General Conditions of Contract (GCC)
Section 8: Special Conditions of Contract (SCC)
Section 9: Contract Forms (COF)

VOLUME 2

System Parameters
Technical Specifications & Requirements
Drawings forming Part of Specifications

VOLUME 3

Schedule A: Scope of Work
Schedule B: Bid Prices & Schedules
Schedule C: Bar Chart Program of Key Activities-Delivery & Completion Time Schedule
Schedule D: Manufacturers, Places of Manufacture and Testing
Schedule E: Technical Particulars and Guarantees
Schedule F: Proposed Subcontractors
Schedule G: Proposed Alternative Standards to Which Equipment Shall Be Provided
Schedule H: Drawings and Documents to be submitted with the Bid and after contract
Schedule I: Departures from the Specification

Contents

1. Schedule A: Scope of Work 1

1.1 Description of Overall Project 1
1.2 Description of this Package 2
1.3 Requirements 4
1.3.1 Technical Requirements for New 230/33KV Bhola GIS substation 4
1.3.2 Technical Requirements for New 132/33KV Hatibandha GIS substation 18
1.3.3 Technical Requirements for New 132/33KV Pirojpur GIS substation 31
1.3.4 Technical Requirements for New 132/33KV Bhanga GIS substation 46
1.3.5 Technical Requirements for New 132/33KV Jhalokati GIS substation 60
1.3.6 Technical Requirements for New 132/33KV Shibchar GIS substation 73
1.3.7 Technical Requirements for New 132/33KV Domar GIS substation 87
1.3.8 Technical Requirements for AIS extension of existing 132/33KV Patnitola Substation 100
1.3.9 Technical Requirements for GIS extension of existing 132/33KV Niyamatpur Substation 105
1.3.10 Technical Requirements for AIS extension of existing 400/230/132 **Kv Substation at Gopalganj(N) Substation** 111
1.3.11 Technical Requirements for GIS extension of existing 132/33 kV Substation at Purbasadipur Substation 117
1.3.12 Technical Requirements for GIS extension of existing 132/33 kV Substation at Bhandaria Substation 123
1.4 Detailed Description of the Scope of Supply for Tele-communication System 129
1.4.1 Recommendation of Communication system 129
1.4.2 Architecture of the Overall Telecommunication System 130
1.4.3 Scope of Work and Supply 131
1.4.4 Engineering Services 131
1.5 Detailed Description of the Scope of Supply for SCADA, Controll & Monitoring System 132
1.5.1 Overall Scope of Work and Supply 132
1.5.2 Adaptationand Configuration of the NLDC 133
1.5.3 General Principle and Description of SCMS 135
1.5.4 Scope of Work and Supply at New Substations 138
1.5.5 Scope of Work and Supply at Existing Substations 139
1.5.6 Engineering Services 140
1.6 Terminal Points 141
1.6.1 Transmission Line Circuit Connections 141
1.6.2 Communication and SCADA Equipment 141
1.7 Training and Inspection 142
1.7.1 Training Contents 144

2. Schedule B: Bid Prices & Schedules 145

Schedule No. B1: Plant and Equipment Suppplied from Abroad 146
Schedule No. B2: Plant and Equipment Supplied from Within the Employer's Country 146
Schedule No. B4: Installation and Other Services 146
Schedule No. B5: Grand Summary 146

Schedule No. B6: Recommended Spare Parts 146

3. Schedule C: Bar Chart Program of Key Activities - Delivery & Completion Time Schedule 147

3.1 Times for Delivery and Completion 147

4. Schedule D: Manufacturers, Places of Manufacture and Testing 150

5. Schedule E: Technical Particulars and Guarantees 161

5.1 General 161
5.2 Technical Data Schedule 161
5.2.1 Part-1: AIS Switchgear 161
5.2.2 Part 2: GIS Switchgear 200
5.2.3 Switchgear 33 kV 227
5.2.4 Transformers 241
5.2.5 Control, Protection, Substation Automation & Metering 277
5.2.6 Digital Fault and Disturbance Recorder (DFDR) 331
5.2.7 HV & LV Cable 334
5.2.8 Batteries, Chargers and DC Distribution: 342
5.2.9 LVDC/AC Distribution Panel 348
5.2.10 Telecommunication Equipment 349
5.2.11 Others 356
5.3 Technical information 360
5.4 Drawings and Other Technical Information to be provided 365

6. Schedule F: Proposed Subcontractors 368

7. Schedule G: Proposed Alternative Standards to Which Equipment Shall Be Provided 369

8. Schedule H: Drawings and Documents to Be Submitted with Bid and After Contract 370

8.1 Drawing and Documents to be Submitted with BID 370
8.2 Drawings and Documents to be Submitted after Contract 371

9. Schedule I: Departures from the Specification 375

1. Schedule A: Scope of Work

1.1 Description of Overall Project

The Government of the People's Republic of Bangladesh has prioritized the power sector development and has taken massive initiative to build a country-wide power network (transmission & distribution) targeting to reach electricity for all by 2021. As per Power System Master Plan (PSMP- 2016), a transmission system capable of supplying 40000 MW electricity throughout the country is essential by 2030. With the aim of realizing Government's vision, Power Grid Bangladesh PLC (PGB) has undertaken numerous projects to strengthen the National Grid in order to meet the proliferating demand of electricity throughout the country.

Bangladesh Power System is divided into nine (09) operation zones i.e. Dhaka, Mymensingh, Cumilla, Chattogram, Sylhet, Rajshahi, Rangpur, Khulna and Barishal. The proposed project aims to increase capacity of the transmission infrastructure for supplying uninterrupted and reliable power to northern area of Greater Dhaka region and Western region of the country, which will cover four operation zones (Dhaka, Rangpur, Khulna & Barishal).

Electricity demand in Dhaka City and its adjacent industrial areas are growing rapidly. Presently Dhaka city distributions system is operated by two authorities, named Dhaka Power Distribution Company (DPDC) and Dhaka Electric Supply Company (DESCO). DESCO conducted a master plan study appointing an independent consultant to prepare future demand of the area under DESCO authority. Under the study forecasted demand of DESCO area and required number of substation are identified. In the study forecasted demand under DESCO area in 2030 is approximately 4,000 MW.

In order to meet the growing demand for electricity in DESCO area, PGCB envisages to construct 2 nos. of 400 kV substations and 1 no. of 230 kV substation with associated 400 kV, 230 kV & 132 kV transmission lines.

Bangladesh government has taken an integrated development strategy for the West part of the country. In this regards PGCB has also taken plan to develop transmission infrastructure in Khulna and Barishal region through this proposed project.

Electricity demand of Khulna region is increasing rapidly. Khulna is mainly industrial area. Bangladesh Economic Zones Authority (BEZA) has already planned number of Economic Zones in this area. Adequate & reliable electricity supply is key input for industries. To fulfill electricity demand of the area PGCB has planned to establish a ring network around Khulna City and its adjacent area comprising 230 kV & 132 transmission lines.

After completion of Padma Multipurpose Bridge Project, it is expected that huge industrialization may happen in Barishal region. Massive development activities are planned in this region. In this regards Bangladesh Economic Zones Authority (BEZA) has already planned number of Economic Zones in the area. Such development activity will increases the power demand of this area.

To meet up Khulna and Barishal zone's upcoming demand PGCB has planned to construct 2 nos. 230 kv substations, 8 nos. 132 kV substations with associated 230 kV & 132 kV transmission lines in this area.

In Rangpur zone Hatibandha is an Upazila which is currently electrified through a 70 km long 33kV line from Lalmonirhat grid. Due to the long distance 33kV line, area facing persistent low voltage problem with inadequate electricity supply. There is no major industry in Hatibandha due to electricity problem. There is a bigpossibility of industrialization if electricity problem can overcome. Now a days small-scale industries are expanding. Grid substation will boost up the economic and living style of this area. In this regards PGCB has planned to construct 2 nos.132 kV substations in Hatibandha and Domar with associated 230 kV & 132 kV transmission lines. Here Domar 132 kV substation will use as a source of Hatibandha and it will also serve the growing local demand of Domar upazila and its adjacent areas.

After successful implementation of this projects power supply reliability of the DESCO & its adjacent area and Western region of Bangladesh will be highly enhanced through new substations and associated transmission lines.

To meet up the growing demand by ensuring reliable power supply to industrial, commercial and residential areas of Central Zone (DESCO area of Dhaka), Western Zone, Northern Zone and Southern Zone of Bangladesh by enhancing and strengthening existing grid network.

After completion of this project, the grid network capacity of western region of Bangladesh as well as DESCO area of Dhaka city will be enhanced. Growing demand of these areas will be fulfilled with reliable power supply to industrial, commercial and residential load points. This will improve the voltage stability of 400 kV, 230 kV & 132 kV level in transmission side along with 33 kV in distribution side. As a result, voltage regulation will improve and voltage fluctuation at consumer end will be at its minimum. There will be reduced load shedding and new consumers can be connected to the 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 of new 230/33 kV and 132/33 kV GIS substations and the extension of existing 132/33 kV AIS & GIS substations.

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.
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.

In case of extension and renovation works, not all required as-built drawings may be available for the existing plant and equipment, which required modification/renovation; the Contractor is also responsible to make drawings as required to complete the works.

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 bid price shall include all other miscellaneous works required.
The programme of works shall be as shown in Schedule C - 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, supply, delivery, installation, testing and commissioning for the complete work.

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 (Proposed) Price whether they be described in the specification or not.

The "Schedule of Requirements" for equipment, materials and services and the guaranteed technical particulars of equipment and materials will be stated in Schedule A of this bidding document shall be read in conjunction with the detailed technical specifications of equipment and materials described in Volume 2 of the bidding documents.

The "Price Schedule" for equipment, materials and services will be stated in Schedule B of this bidding document shall be read in conjunction with the detailed technical specifications of equipment and materials described in Volume 2 of the bidding documents

The works under this turnkey contract include the following:

- NEW 230/33 kV GIS Substation at Bhola
- NEW 132/33 kV GIS Substation at Hatibandha
- NEW 132/33 kV GIS Substation at Pirojpur
- NEW 132/33 kV GIS Substation at Bhanga
- NEW 132/33 kV GIS Substation at Jhalokathi
- NEW 132/33 kV GIS Substation at Shibchar
- NEW 132/33 kV GIS Substation at Domar
- 132kV AIS Bay Extension at Patnitala 132/33 kV AIS Substation

- 132kV GIS Bay Extension at Niyamatpur 132/33 kV AIS Substation
- 132kV AIS Bay Extension at Gopalganj 400/230/132 kV AIS Substation
- 132kV GIS Extension at Purabasadipur 132/33 kV GIS Substation
- 132kV GIS Bay Extension at Bhandaria 132/33 kV AIS Substation

1.3 Requirements

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

Denomination	Description
A	230 kV Switchgear
B	132 kV Switchgear
C	33 kV Switchgear
D	Transformers
E	SCADA System for Tele-control & Telemetering
F	Control, Protection, Substation Automation and Metering etc.
G	DFDR
H	Power Cable & GIL
I	Multicore Cables
J	Earthing and Lightning Protection
K	Batteries, Chargers and DC Distribution
L	LVAC Distribution
M	Civil works, Building and Foundations
N	Lighting, Small power and Air Conditioning
O	Fibre Optic Multiplexer Equipment for Communication and Protection

1.3.1 Technical Requirements for New 230/33KV Bhola GIS substation

Section I

New 230/33KV Bhola GIS substation

Description of Works:

The Bhola 230/33kV substation is a new substation at Daulat Khan upazilla in Bhola district under this project of PGCB which shall be connected to existing 230/132KV Bharishal grid substation and Bhola 225MW power plant Substation at Borhanuddin through LILO of Barishal-Bhola-Borhanuddin double circuit 230kV line at Bhola (using Twin mallard conductor with an approximate length of 1 km).

Under this project, the scope of work includes two 230KV transformer bays for two(02) 230/33KV, 120/140MVA transformer, two (02) 33KV incomer bays, six (06) line bays for Bhola ppline I & II, Bharishal(N) line I & II and furnished spare bay I & II. The busbar scheme for 230kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):

Deleted

230kV Gas Insulated Switchgear (GIS):

- Complete 230kV GIS consisting of Six (06) nos line bays, two (02) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 230kV lines (Bhola power plant-1&2), two (02) 230kV lines (Bharishal-1&2), two (02) furnished spare bays & two new 230/33kV transformers;
- Space provision shall be kept for future extension of Eight (08) 132kV bays, one (01) transformer bay and four (04) nos 230KV line bays.
- The position of Bus PT with high-speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 230kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

132kV Gas Insulated Switchgear (GIS):

Deleted

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Two(02) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of two new 230/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Two(2) sets of 120/140MVA(ONAN/ONAF), 230/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 300kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.

The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 230/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Supply, installation, testing & complete commissioning of DFDR at Bhola 230/33kV grid substation to accommodate the bays. The con-tractor shall provide with their Bid Detail BOQ for complete DFDR system as per Bid require-ment.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment forIndoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.
- Complete outdoor civil works, including 230 kV and 33 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing

- Complete civil works and facilities for **one** three storied control building including cable basement**,** including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

1A 245kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures

The 230 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule E to this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
1A.1	Six (6) sets 245kV GIS line circuit bays (3150A), 50kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	6 sets
I.	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	1 lot
II.	245kV, 50kA/3s, SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set

III.	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	245kV, 50kA/3s three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	245kV, 50kA/3s three phase line disconnector complete with motor operating mechanism	1 set
VI.	245kV, 50kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	245kV, 50kA/3s single phase,2-core, current transformer with cores as follows: 3200-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection 3200-1600-800/1A, Class 5P20, 30-60VA for Main 2 Protection, [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	245kV, 50kA/3s single phase, 3-core, current transformer with cores as follows: 3200-1600-800/1A, Class 0.2S,15VA for Metering 1 3200-1600-800/1A, Class 0.2S,15VA for Metering 2, BCU 3200-1600-800/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
IX.	245kV single phase voltage transformer 3 windings with manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
X.	245kV single-phase surge arresters, GIS type	3 nos
XI.	Local Control Cubicle	1 set
XII.	Partial Discharge Monitoring terminal for each compartment	1 lot
XIII.	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	1 lot
1A.2	Two (2) sets 230/33 kV GIS Transformer circuit bays(3150A), 50kA/3sec, 50Hz, 1050kVp BIL including main connections each comprising:	2 sets
I.	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	1 lot
II.	245kV, 50kA/3s, SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	245kV, 50kA/3s three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	245kV, 50kA/3s three phase line disconnector complete with motor operating mechanism	1 set
VI.	245kV, 50kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	245kV, 50kA/3s single phase, 3-core, current transformer with cores as follows: 2400-1200-600/1A, Class 5P20, 30-60VA for Main 1 Protection 2400-1200-600/1A, Class 5P20, 30-60VA for Main 2 Protection, 2400-1200-600/1A, Class 5P20, 30-60VA for DFDR [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos

VIII.	245kV, 50kA/3s single phase, 3-core, current transformer with cores as follows: 2400-1200-600/1A, Class 0.2S,15VA for Metering 1 2400-1200-600/1A, Class 0.2S,15VA for Metering, BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
IX.	245kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
X.	245kV single-phase surge arresters, GIS type	3 nos
XI.	Local Control Cubicle	1 set
XII.	Partial Discharge Monitoring terminal for each compartment	1 lot
XIII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements with cable, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
1A.3	One(1) set GIS Bus Coupler circuit bay(4000A), 50kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	1 set
I.	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	1 lot
II.	245kV, 50kA/3s, SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	245kV, 50kA/3s three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	245kV,50kA/3s, single phase, 3-core, current transformer with cores as follows: - 2000-4000/1A class 0.2S, 15VA for measuring - 2000-4000//1A class 0.2S, 15VA for measuring, BCU - 2000-4000//1A 5P20, 30-60VA for Busbar Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	245kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 2000-4000//1A, Class 5P20, 30-60VA for Protection - 2000-4000//1A 5P20, 30-60VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 set
IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
1A.4	One(1) set Bus section bays (4000A), 50kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising:	1 sets
I.	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	1 lot
II.	245kV, 50kA/3s, SF6, three phase, gang pole operation circuit breaker completes with Hydro-mechanical spring operating mechanism	1 set
III.	245kV, 50kA/3s, three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets

IV.	245kV, 50kA/3s three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	245kV,50kA/3s, single phase, 3-core, current transformer with cores as follows: - 2000-4000/1A class 0.2S, 15VA for measuring - 2000-4000//1A class 0.2S, 15VA for measuring, BCU - 2000-4000//1A 5P20, 30-60VA for Busbar Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	245kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 2000-4000//1A, Class 5P20, 30-60VA for Protection - 2000-4000//1A 5P20, 30-60VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
1A.5	Double Busbar (4000A), 50kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising:	3 sets
I.	245kV, 4000A, 50kA/3s, three phase enclosure double busbars	1 lot
II.	245kV single phase voltage transformer 3 windings with manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
1A.6	Double Busbar (4000A), 50kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising:	3sets
I.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbars	1 lot
II.	245kV, 50kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
III.	Partial Discharge Monitoring terminal for each compartment	1 lot

245kV Outdoor Type Air Insulated Switchgear (AIS)

The 230 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule E to this section and shall comprise the following:-

Item No.	Descriptions & Requirements
1A.7	Eighteen(18) nos. of 198kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
1A.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
1A.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 230kV interfacing.

1A.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 230kV interfacing.
1A.11	One(1) lot of 245KV post insulator

1B Deleted

1C 33kV Outdoor Type AIR Insulated Switchgear (AIS), equipment connection and steel structures

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule E to this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
1C1	Two (2) sets of 36kV, 3150A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum/SF6 Circuit Breakers(VCB) with spring-stored energy operating mechanism.
1C2	Four (4) sets of 36kV, 3150A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
1C3	One (1) sets of 36kV, 3150A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
1C4	Six(6) nos. of single-phase, 4-core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 3200-2400/1A, Class 0.2S, 10VA for Metering 1 - 3200-2400/1A, Class 0.2S, 10VA for Metering 2 - 3200-2400/1A class 5P20, 30VA for protection - 3200-2400/1A class 5P20, 30VA for protection
1C5	Six (6) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV: 110/√3V :110/√3V Class 0.2,15VA for 2 core Metering and Class 3P, 30VA for 1 Protection)
1C6	Six (6) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
1C7	One(1) lot of 36KV post insulator
1C8	One(1) lot of rigid/ flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
1C9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
1C10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
1C11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

1D Transformers

Item No.	Descriptions & Requirements
1D.1	Two (2) sets of 230/34.5kV, 120/140 MVA (ONAN/ONAF), vector group: Dyn1, three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.

1D.2	Two(2) sets 33/0.415kV, 300kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
1D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

1E	SCADA system for Tele-control and Telemetering
1E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One(01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

1F Control, Protection, Substation Automation & Metering

	230 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
1F.1	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for Six (06) sets of 230KV overhead line circuit bays. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel(Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
1F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two(2) sets of 230/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
1F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit.Each sets of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting,humidity controller, heater & other accessoriesas required.
1F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each sets of complete panel (Front opening, Swing Frame

	type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
1F.5	One(1) lot of 230kV Busbar protection systemincluding Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function& other accessoriesas required.
1F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
1F.7	Control, Protection, Metering & Substation Automation System including event recording function for two (2) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
1F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main & check tariff meter.
1F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 245kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55''or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables(Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc& other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

1G	**DFDR**
1G.1	One (01) lot of Digital Fault and Disturbance recorder (DFDR) to monitor complete 230kV & 33KV switchyard each comprising the following - i.One (01) set of DFDR processor ii.Card for each bay including A/D Converter, Digital & Analog data acquisition system etc.for 245kV Circuits: as per Protection SLD. iii.One(01) Lot of Ethernet Switch ivOne (01) set of GPS system v.One(01) Lot of Panel including wiring, lighting, heater, humidity sensor & other accessories vi.One (01) set of Engineering PC: core i7-9700K, 1/2 TB HDD, 16/32GB RAM, 17" display v. One(01) Lot of Other Accessories (if any)

1H	**Power Cable & cable termination& GIL**
1H.1	245 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design
1H.2	245KV XLPE cables with corresponding GIS connections and cable end terminals, with all required equipment; 245 kV, 1000 A, 50 kA / 1 sec, 50 Hz, for connection of one 230 kV bay.

1I	**Multicore Cables**
1I.1	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. The overall substation cable routing and core schedules shall also be provided.

1J	**Earthing and Lightning Protection**
1J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
1J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
1J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

1K	**Batteries, Chargers and DC Distribution**
1K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price.

	• One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
1K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. • The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

1L	**LVAC Distribution**
1L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

1M	**Civil Works, Building and Foundation**
1M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property line including slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 230 kV and 33 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, sentry post, security boundary wall 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 and gravel surfacing etc.
1M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 230 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, the 230 kV switchgear shall be installed, as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 40x 15 meters. The height of the GIS hall & building will be finalized during detail design stage.
1M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
1M.4	One (1) lot of complete Civil Works related to CAF system

1N	**Lighting, Small Power, Air Conditioning and Ventilation**
1N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS room &control building
1N.2	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 operations and inspections.
1N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
1N.4	One (01) Lot of Complete CCTV & with motion sensor.

1O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
1O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising:

	1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line-N/A v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required) ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required)- N/A iii. Required no.of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
1O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 230kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity

Serial No	Name	Quantity
1.	Socket Wrench Set	1 Set
2.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
3.	Ratchet Wrench Set	1 Set
4.	Open-endWrench Set	1 Set
5.	Ring/Ball Wrench Set	1 Set
6.	Pipe Wrench (12",18",24",	1 Set
7.	Allen Key Set	1 Set
8.	Hammer (1lb & 2lb)	1 Set
9.	Plier, 8 inch	1 No.
10.	Cutting Plier, 8 inch	1 No.
11.	Nose Plier, 8 inch	1 No.
12.	Screw Driver Set	1 Set
13.	Screw Driver (Star and Flat Big)	1 Set
14.	File (Flat)	1 No.
15.	File (Round)	1 No.
16.	Hakso Frame with blade	1 No.
17.	Safety Belt	4 Nos
18.	Ladder (Aluminium)	2 Nos.
19.	Helmet	6 Nos.
20.	Gas Cylinder Pipe Set	1 Set
21.	Multimeter (Fluke/Megger)	2 Nos
22.	Bucket	2 Nos.
23.	Shabol	2 Nos.
24.	Coppa	2 Nos
25.	Rope	200 m
26.	Duur Metal Box	1 No.
27.	Grinding Machine	1 No.
28.	Blower Machine	1 No.
29.	Mechanical Jug	1 No.
30.	Compressor Jug	1 No.
31.	Wire Cutter	1 No.
32.	Steel Cutter	1 No.
33.	Chain Pulley (2 Ton)	1 No.
34.	Vice Set	1 No.
35.	Drill Machine	1 No.
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.
45.	Vacuum Cleaner	1 No.

Serial No	Name	Quantity
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1”	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.2 Technical Requirements for New 132/33KV Hatibandha GIS substation

Section I

New 132/33KV Hatibandha GIS substation

Description of Works:
The Hatibandha 132/33kV substation is a new substation at Hatibandha upazilla at lalmonirhat district under this project of PGCB which shall be connected to 132/33KV Domar grid substation by Domar-Hatibandha double circuit 132kV line at Hatibandha (using single grosbeak equivalent ACCC conductor with an approximate length of 35 km with 850m testa river crossing).

Under this project, the scope of work includes two 132KV transformer bays for two(02) 132/33KV, 80/120MVA transformer, two (02) 33KV incomer bays, four (04) line bays for Domar bay I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):
Deleted

230kV Gas Insulated Switchgear (GIS):
Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of Four (04) nos line bays, two (02) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Domar-1&2), two (02) spare bays & two new 132/33kV transformers;
- Space provision shall be kept for future extension of Six (06) 132kV bays and one (01) transformer bays.
- The position of Bus PT with highSpeed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.

- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Two(02) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of two new 132/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Two(2) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two(2) sets 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.
The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprising with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

2A 230 kV Outdoor Type Gas Insulated Switchgear (GIS)

Deleted

2B 145kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
2B.1	Four(4) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	4 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800-1600- 2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800-1600- 2400/1A, Class 5P20, 30-60VA for Backup Protection, 800-1600- 2400/1A, Class 0.2S,15VA for Metering 1 800-1600- 2400/1A, Class 0.2S,15VA for Metering 2 , BCU	3 nos

	- 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	
VIII.	145kV single phase voltage transformer 3 windings with manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	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	1 set
2B.2	Two(2) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	2 sets
i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
ii.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
iii.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
iv.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
v.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
vi.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
vii.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800-1600- 2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800-1600- 2400/1A, Class 5P20, 30-60VA for Backup Protection, 800-1600- 2400/1A, Class 0.2S,15VA for Metering 1 800-1600- 2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
viii.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos-
ix.	145kV single-phase surge arresters, GIS type	3 nos
x.	Local Control Cubicle	1 set
xi.	Partial Discharge Monitoring terminal for each compartment	1 lot
xii.	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	1 set
2B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	1 set
i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
ii.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set

iii.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
iv.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
v.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring , BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
vi.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
vii.	Local Control Cubicle	1 set
viii.	Partial Discharge Monitoring terminal for each compartment	1 lot
ix.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
2B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising:	1 sets
i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
ii.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
iii.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
iv.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
v.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring , BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
vi.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
vii.	Local Control Cubicle(optional, may be incorporated in coupler LCC)	1 set
viii.	Partial Discharge Monitoring terminal for each compartment	1 lot
ix.	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	1 lot
x.	Partial Discharge Monitoring terminal for each compartment	1 lot
2B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising:	3 sets

i.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
ii.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
iii.	Partial Discharge Monitoring terminal for each compartment	1 lot
2B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising:	3sets
i.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
ii.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
iii.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Outdoor Type Air Insulated Switchgear (AIS)

The 132 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Item No.	Descriptions & Requirements
2B.7	Twelve(12) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
2B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
2B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
2B.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
2B.11	One(1) lot of 145KV post insulator

2C33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
2C.1	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum/SF6 Circuit Breakers(VCB) with spring-stored energy operating mechanism.
2C.2	Four (4) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
2C.3	One (1) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
2C.4	Six(6) nos. of single-phase, 4-core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2

	- 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
2C.5	Six (6) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering 2 core and Class 3P, 30VA for Protection 1 core)
2C.6	Six (6) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
2C.7	One(1) lot of 36KV post insulator
2C.8	One(1) lot of flexible conductors for busbar(3150A), jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
2C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
2C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
2C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

2D Transformers

Item No.	Descriptions & Requirements
2D.1	Two (2) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.
2D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
2D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

2E	SCADA system for Telecontrol and Telemetering
2E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power

	transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

2F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
2F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Four (04) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
2F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
2F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting,humidity controller, heater & other accessories as required.
2F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
2F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
2F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
2F.7	Control, Protection, Metering & Substation Automation System including event recording function for two (2) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup:

	67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
2F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
	Substation Automation System
2F.9	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

2G	**DFDR**
2G.1	**Deleted**

2H	**Power Cable& cable termination& GIL**
2H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder& transformer bay: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design

2I	**Multicore Cables**
2I.1	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. The overall substation cable routing and core schedules shall also be provided.

2J	**Earthing and Lightning Protection**
2J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
2J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.

2J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

2K	**Batteries, Chargers and DC Distribution**
2K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
2K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC.

	• The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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**
2L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

2M	**Civil Works, Building and Foundation**
2M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
2M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
2M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
2M.4	One (1) lot of complete Civil Works related to CAF system

2N	**Lighting, Small Power, Air Conditioning and Ventilation**
2N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS room &control building
2N.2	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 operations and inspections.
2N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
2N.4	One (01) Lot of Complete CCTV & with motion sensor.

2O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
2O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation –

	i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required) iii. Required no.of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
2O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity
i.	Socket Wrench Set	1 Set
i.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
i.	Ratchet Wrench Set	1 Set
v.	Open-endWrench Set	1 Set
v.	Ring/Ball Wrench Set	1 Set
i.	Pipe Wrench (12",18",24",	1 Set
i.	Allen Key Set	1 Set
i.	Hammer (1lb & 2lb)	1 Set
k.	Plier, 8 inch	1 No.
k.	Cutting Plier, 8 inch	1 No.
i.	Nose Plier, 8 inch	1 No.
i.	Screw Driver Set	1 Set
i.	Screw Driver (Star and Flat Big)	1 Set
v.	File (Flat)	1 No.
v.	File (Round)	1 No.
i.	Hakso Frame with blade	1 No.
i.	Safety Belt	4 Nos
i.	Ladder (Aluminium)	2 Nos.
k.	Helmet	6 Nos.
k.	Gas Cylinder Pipe Set	1 Set
i.	Multimeter (Fluke/Megger)	2 Nos
i.	Bucket	2 Nos.
i.	Shabol	2 Nos.

Serial No	Name	Quantity
v.	Coppa	2 Nos
v.	Rope	200 m
i.	Duur Metal Box	1 No.
i.	Grinding Machine	1 No.
i.	Blower Machine	1 No.
x.	Mechanical Jug	1 No.
x.	Compressor Jug	1 No.
i.	Wire Cutter	1 No.
i.	Steel Cutter	1 No.
i.	Chain Pulley (2 Ton)	1 No.
v.	Vice Set	1 No.
v.	Drill Machine	1 No.
i.	Crimping Tools	1 No.
i.	Lug Puncher	1 No.
i.	Steel Wire Brush	2 No.
x.	Blade type Knife	2 Nos.
l.	Wire Stripper	1 No.
i.	Grass Trimmer	1 No.
i.	Drill Bits	1 Set
i.	Tool Box	1 No.
v.	Hand Gloves (Leather)	1 No.
v.	Vacuum Cleaner	1 No.
i.	Chisel	1 No.
i.	Tester	1 No.
i.	Rivet Gun	1 No.
x.	PIB Tape, 1”	3 Nos.
l.	PVC Tape	4 Nos
i.	Steel Wire Brush	3 Nos.
i.	Chisel	2 Nos.
i.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.3 Technical Requirements for New 132/33KV Pirojpur GIS substation

Section I

New 132/33KV Pirojpur GIS substation

Description of Works:
The Pirojpur 132/33kV substation is a new substation at Pirojpur shadar in Pirojpur district under this project of PGCB shall be connected to 132/33KV Bhandaria grid substation and 132/33KV Bagerhat grid substation through Bhandaria-Pirojpur-Bagerhat double circuit 132kV line at Pirojpur (using single

grosbeak equivalent ACCC conductor with an approximate length of 49.5 km with 1m kacha river crossing & 300m Bhirab river crossing).

Under this project, the scope of work includes two 132KV transformer bays for two(02) 132/33KV, 80/120MVA transformer, two (02) 33KV incomer bays, six (06) line bays for Bagerhat bay I & II, Bhandaria I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):

Deleted

230kV Gas Insulated Switchgear (GIS):

Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of Six (06) nos line bays, two (02) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Bagerhat-1&2), two (02) 132kV lines (Bhandaria-1&2), two (02) spare bays & two new 132/33kV transformers;
- Space provision shall be kept for future extension of Six (06) 132kV bays and one (01) transformer bay.
- The position of Bus PT with high Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Two(02) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of two new 132/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Two(2) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.

The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning

protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

3A Deleted

3B132kV Indoor Type Gas Insulated Switchgear (GIS)

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
3B.1	Six(6) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	6 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800- 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800- 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800- 1600-2400/1A, Class 0.2S,15VA for Metering 1 800- 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	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	1 set
3B.2	Two(2) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	2 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets

V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s, three pole, high speed earth switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800-1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800-1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800-1600-2400/1A, Class 0.2S,15VA for Metering 1 800-1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	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	1 set
3B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising:	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
3B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising:	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot

II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	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	1 lot
X.	Partial Discharge Monitoring terminal for each compartment	1 lot
3B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections, protection and control requirements.	3 sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
3B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections, protection and control requirements.	3sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
III.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Outdoor Type Air Insulated Switchgear (AIS)

The 132 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Item No.	Descriptions & Requirements
3B.7	Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
3B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all

	necessary clamps & connectors required for completing AIS connection.
3B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
3B.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
3B.11	One(1) lot of 145KV post insulator

3C33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
3C.1	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum/SF6 Circuit Breakers with spring-stored energy operating mechanism.
3C.2	Four (4) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
3C.3	One (1) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
3C.4	Six(6) nos. of single-phase, -4core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2 - 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
3C.5	Six (6) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering 2 core and Class 3P, 30VA for Protection 1 core)
3C.6	Six (6) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
3C.7	One(1) lot of 36KV post insulator
3C.8	One(1) lot of flexible conductors for busbar(3150A), jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
3C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
3C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
3C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

3D Transformers

Item No.	Descriptions & Requirements
3D.1	Two (2) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.

3D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
3D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

3E	SCADA system for Telecontrol and Telemetering
3E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura &Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

3F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
3F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Six (06) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
3F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
3F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.

3F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
3F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
3F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
3F.7	Control, Protection, Metering & Substation Automation System including event recording function for two (2) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
3F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
3F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

3G	**DFDR**
3G.1	**Deleted**

3H	**Power Cable & cable termination& GIL**
3H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete

	with support structure, etc. for incoming line feeder& transformer bay: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design

3I	**Multicore Cables**
3I.1	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. The overall substation cable routing and core schedules shall also be provided.

3J	**Earthing and Lightning Protection**
3J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
3J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
3J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

3K	**Batteries, Chargers and DC Distribution**
3K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible

	countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
3K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

3L	**LVAC Distribution**
3L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

3M	**Civil Works, Building and Foundation**
3M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.

	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
3M.2	One (1) lot of complete design, supply and construction of all civil items items and facilitiesincluding all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
3M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
3M.4	One (1) lot of complete Civil Works related to CAF system

3N	**Lighting, Small Power, Air Conditioning and Ventilation**
3N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS room &control building
3N.2	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 operations and inspections.
3N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
3N.4	One (01) Lot of Complete CCTV & with motion sensor.

3O	**Fibre Optic Multiplexer Equipment for Communication and Protection**

3O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required) iii. Required no.of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v.One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
3O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

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

Serial No	Name	Quantity
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.
45.	Vacuum Cleaner	1 No.
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1”	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.4 Technical Requirements for New 132/33KV Bhanga GIS substation

Section I

New 132/33KV Bhanga GIS substation

Description of Works:
The Bhanga 132/33kV substation is a new substation at Bhanga upazilla in Faridpur district under this project of PGCB shall be connected to 132/33KV Madaripur grid substation and 132/33KV Faridpur grid substation through double circuit 132kV line at Bhanga (using hawk equivalent ACCC conductor with an approximate length of 0.5 km).

Under this project, the scope of work includes three 132KV transformer bays for three(03) 132/33KV, 80/120MVA transformer, three (03) 33KV incomer bays, six (06) line bays for Gopalganj(N) bay I & II, Faridpur I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):
Deleted

230kV Gas Insulated Switchgear (GIS):
Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of Six (06) nos line bays, three (03) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Madaripur-1&2), two (02) 132kV lines (Faridpur-1&2), two (02) spare bays & three new 132/33kV transformers;
- Space provision shall be kept for future extension of Six (06) 132kV bays and one (01) transformer bay.
- The position of Bus PT with High Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Three(03) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of three new 132/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Three(3) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.

The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

4A Deleted

4B **145kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures**

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements**single hawk ACCC**	Quantity
4B.1	Six(6) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	6 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase,single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800- 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800- 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800- 1600-2400/1A, Class 0.2S,15VA for Metering 1 800- 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
4B.2	Three(3) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot

II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s, three pole, high speed earth switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800- 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800- 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800- 1600-2400/1A, Class 0.2S,15VA for Metering 1 800- 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
4B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot

IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
4B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connection each comprising	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	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	1 lot
4B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
4B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising	3sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
III.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Air Insulated Switchgear(AIS) and Connection:

Item No.	Descriptions & Requirements
4B.7	Twenty one(21) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

4B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
4B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
4B.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
4B.11	1 lot of 145KV post insulator

4C33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
4C.1	Three (3) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum/SF6 Circuit Breakers with spring-stored energy operating mechanism.
4C.2	Six (6) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
4C.3	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
4C.4	Nine(9) nos. of single-phase, 4-core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2 - 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
4C.5	Nine(9) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering 2 core and Class 3P, 30VA for Protection 1 core)
4C.6	Nine (9) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
4C.7	1 lot of 36KV post insulator
4C.8	One(1) lot of flexible conductors for busbar(3150A), jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
4C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
4C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
4C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

4D Transformers

Item No.	Descriptions & Requirements

4D.1	Three (3) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.
4D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
4D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

4E	SCADA system for Telecontrol and Telemetering
4E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

4F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
4F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Six (06) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
4F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for three(3) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.

4F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
4F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
4F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
4F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
4F.7	Control, Protection, Metering & Substation Automation System including event recording function for three (3) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
4F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
4F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

4G	**DFDR**

4G.1	**Deleted**

4H	**Power Cable & cable termination& GIL**
4H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder& transformer bay: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design

4I	**Multicore Cables**
4I.1	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. The overall substation cable routing and core schedules shall also be provided.

4J	**Earthing and Lightning Protection**
4J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
4J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
4J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

4K	**Batteries, Chargers and DC Distribution**
4K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price.

	• One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
4K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

4L	**LVAC Distribution**
4L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

4M	**Civil Works, Building and Foundation**
4M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
4M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
4M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
4M.4	One (1) lot of complete Civil Works related to CAF system

4N	**Lighting, Small Power, Air Conditioning and Ventilation**
4N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS control building
4N.2	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 operations and inspections.
4N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
4N.4	One (01) Lot of Complete CCTV & with motion sensor.

4O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
4O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system

	- Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required) iii. Required no of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v.One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
4O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity
1.	Socket Wrench Set	1 Set
2.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
3.	Ratchet Wrench Set	1 Set
4.	Open-endWrench Set	1 Set
5.	Ring/Ball Wrench Set	1 Set
6.	Pipe Wrench (12",18",24",	1 Set
7.	Allen Key Set	1 Set
8.	Hammer (1lb & 2lb)	1 Set
9.	Plier, 8 inch	1 No.
10.	Cutting Plier, 8 inch	1 No.
11.	Nose Plier, 8 inch	1 No.
12.	Screw Driver Set	1 Set
13.	Screw Driver (Star and Flat Big)	1 Set
14.	File (Flat)	1 No.
15.	File (Round)	1 No.
16.	Hakso Frame with blade	1 No.
17.	Safety Belt	4 Nos
18.	Ladder (Aluminium)	2 Nos.
19.	Helmet	6 Nos.
20.	Gas Cylinder Pipe Set	1 Set
21.	Multimeter (Fluke/Megger)	2 Nos
22.	Bucket	2 Nos.
23.	Shabol	2 Nos.
24.	Coppa	2 Nos
25.	Rope	200 m
26.	Duur Metal Box	1 No.
27.	Grinding Machine	1 No.
28.	Blower Machine	1 No.
29.	Mechanical Jug	1 No.
30.	Compressor Jug	1 No.
31.	Wire Cutter	1 No.
32.	Steel Cutter	1 No.
33.	Chain Pulley (2 Ton)	1 No.
34.	Vice Set	1 No.
35.	Drill Machine	1 No.
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.

Serial No	Name	Quantity
45.	Vacuum Cleaner	1 No.
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1”	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.5 Technical Requirements for New 132/33KV Jhalokati GIS substation

Section I

New 132/33KV Jhalokati GIS substation

Description of Works:
The Jhalokati 132/33kV substation is a new substation at Jhalokati shadar in Jhalokati district under this project of PGCB shall be connected to 132/33KV Bhandaria grid substation and 132/33KV Barishal grid substation through LILO of Bhandaria-Barishal double circuit 132kV line at Jhalokati (using single ACSR grosbeak conductor with an approximate length of 1.5 km).

Under this project, the scope of work includes two 132KV transformer bays for two(02) 132/33KV, 80/120MVA transformer, two (02) 33KV incomer bays, six (06) line bays for Barishal(N) bay I & II, Bhandaria I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):
Deleted

230kV Gas Insulated Switchgear (GIS):
Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of Six (06) nos line bays, two (02) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Barishal-1&2), two (02) 132kV lines (Bhandaria -1&2), two (02) spare bays & two new 132/33kV transformers;
- Space provision shall be kept for future extension of Six (06) 132kV bays and one (01) transformer bay.
- The position of Bus PT with High Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Two(02) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of two new 132/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Two(2) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.

The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water

reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

5A Deleted

5B145kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
5B.1	Six(6) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising.	6 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800- 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800- 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800- 1600-2400/1A, Class 0.2S,15VA for Metering 1 800- 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	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	1 set
5B.2	Two(2) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	2 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot

II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800- 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800- 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800- 1600-2400/1A, Class 0.2S,15VA for Metering 1 800- 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for single-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 set
5B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections, protection and control requirements.	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot

IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
5B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising	1 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	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	1 lot
X.	Partial Discharge Monitoring terminal for each compartment	1 lot
5B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
5B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising:	3sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
III.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Outdoor Type Air Insulated Switchgear (AIS)

The 132 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Item No.	Descriptions & Requirements
5B.7	Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
5B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
5B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
5B.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
5B.11	1 lot of 145KV post insulator

5C33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
5C.1	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.
5C.2	Four (4) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
5C.3	One (1) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
5C.4	Six(6) nos. of single-phase, 4-core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2 - 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
5C.5	Six (6) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering 2 core and Class 3P, 30VA for Protection 1 core)
5C.6	Six (6) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
5C.7	1 lot of 36KV post insulator
5C.8	One(1) lot of flexible conductors for busbar(3150A), jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
5C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
5C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
5C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary

	transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

5D Transformers

Item No.	Descriptions & Requirements
5D.1	Two (2) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.
5D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
5D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

5E	SCADA system for Telecontrol and Telemetering
5E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

5F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
5F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Six (06) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as

	required.
5F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
5F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
5F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
5F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
5F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter.
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
5F.7	Control, Protection, Metering & Substation Automation System including event recording function for two (2) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
5F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
5F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories.

	The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

5G	**DFDR**
5G.1	**Deleted**

5H	**Power Cable & cable termination& GIL**
5H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder& transformer bay: The Length of GIL shall be different for different bay as per actual design.Actual payment shall be as per final design

5I	**Multicore Cables**
5I.1	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. The overall substation cable routing and core schedules shall also be provided.

5J	**Earthing and Lightning Protection**
5J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
5J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
5J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

5K	**Batteries, Chargers and DC Distribution**
5K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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.

	• Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
5K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

5L	**LVAC Distribution**
5L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

5M	**Civil Works, Building and Foundation**
5M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
5M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
5M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
5M.4	One (1) lot of complete Civil Works related to CAF system

5N	**Lighting, Small Power, Air Conditioning and Ventilation**
5N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS control building
5N.2	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 operations and inspections.
5N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
5N.4	One (01) Lot of Complete CCTV & with motion sensor.

5O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
5O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC)

	- 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required) iii. Required no.of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v.One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
5O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall

have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity
1.	Socket Wrench Set	1 Set
2.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
3.	Ratchet Wrench Set	1 Set
4.	Open-endWrench Set	1 Set
5.	Ring/Ball Wrench Set	1 Set
6.	Pipe Wrench (12",18",24",	1 Set
7.	Allen Key Set	1 Set
8.	Hammer (1lb & 2lb)	1 Set
9.	Plier, 8 inch	1 No.
10.	Cutting Plier, 8 inch	1 No.
11.	Nose Plier, 8 inch	1 No.
12.	Screw Driver Set	1 Set
13.	Screw Driver (Star and Flat Big)	1 Set
14.	File (Flat)	1 No.
15.	File (Round)	1 No.
16.	Hakso Frame with blade	1 No.
17.	Safety Belt	4 Nos
18.	Ladder (Aluminium)	2 Nos.
19.	Helmet	6 Nos.
20.	Gas Cylinder Pipe Set	1 Set
21.	Multimeter (Fluke/Megger)	2 Nos
22.	Bucket	2 Nos.
23.	Shabol	2 Nos.
24.	Coppa	2 Nos
25.	Rope	200 m
26.	Duur Metal Box	1 No.
27.	Grinding Machine	1 No.
28.	Blower Machine	1 No.
29.	Mechanical Jug	1 No.
30.	Compressor Jug	1 No.
31.	Wire Cutter	1 No.
32.	Steel Cutter	1 No.
33.	Chain Pulley (2 Ton)	1 No.
34.	Vice Set	1 No.
35.	Drill Machine	1 No.
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.

Serial No	Name	Quantity
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.
45.	Vacuum Cleaner	1 No.
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1"	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.6 Technical Requirements for New 132/33KV Shibchar GIS substation

Section I

New 132/33KV Shibchar GIS substation

Description of Works:
The Shibchar 132/33kV substation is a new substation at Shibchar upazilla at Madaripur district under this project of PGCB shall be connected to Gopalganj(N) grid substation through Shibchar-Gopalganj(N) double circuit 230kV line at Shibchar, initially charged at 132KV (using Twin Mallard equivalent ACCC conductor with an approximate length of 25 km with 0.4 river crossing).

Under this project, the scope of work includes three 132KV transformer bays for three(03) 132/33KV, 80/120MVA transformer, three (03) 33KV incomer bays, four (04) line bays for Gopalganj(N) bay I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):
Deleted

230kV Gas Insulated Switchgear (GIS):
Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of four (04) nos line bays, three (03) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Gopalganj(N) -1&2), two (02) spare bays & three new 132/33kV transformers; bus section bays
- new two (02) 132kV lines (Gopalganj(N) -1&2) is 230KV double circuit line initially charged at 132KV.

- Space provision shall be kept for future extension of Six (06) 132kV bays, one (01) transformer bay and ten (10) nos 230KV line bays.
- The position of Bus PT with High Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Three(03) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of three new 132/33kV transformers bays.
- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Three(3) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.

The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC

Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

6A Deleted

6B145 kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
6B.1	Four(4) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL equipped with each comprising	4 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 Lot
II.	145kV, 40kA/3s,SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set

VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800– 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800– 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800– 1600-2400/1A, Class 0.2S,15VA for Metering 1 800– 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 Nos.
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	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	1 Lot
6B.2	Three(3) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800 – 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800 – 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800 – 1600-2400/1A, Class 0.2S,15VA for Metering 1 800 – 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 Nos.
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot

XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for single-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 set
6B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	1 set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
6B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising	1 sets
I.	145kV,3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set

VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	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	1 lot
X.	Partial Discharge Monitoring terminal for each compartment	1 lot
6B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
6B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising	3sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set
III.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Outdoor Type Air Insulated Switchgear (AIS)

The 132 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Item No.	Descriptions & Requirements
6B.7	Fifteen(15) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
6B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
6B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
6B.10	One(1) lot of steel structures for 245KV gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
6B.11	1 lot of 145KV post insulator

6C 33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements

6C.1	Three (3) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum/ SF6 Circuit Breakerswith spring-stored energy operating mechanism.
6C.2	Six (6) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
6C.3	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
6C.3	Nine(9) nos. of single-phase, 4-core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2 - 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
6C.4	Nine(9) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering 2 core and Class 3P, 30VA for Protection 1 core)
6C.5	Nine (9) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
6C.6	1 lot of 36KV post insulator
6C.7	One(1) lot of flexible conductors for busbar(3150A), jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
6C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard
6C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
6C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

6D Transformers

Item No.	Descriptions & Requirements
6D.1	Three (3) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.
6D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
6D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

6E	SCADA system for Telecontrol and Telemetering
6E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at

	Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

6F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
6F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Four (04) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
6F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for three(3) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
6F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
6F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
6F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
6F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible

	countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
6F.7	Control, Protection, Metering & Substation Automation System including event recording function for three (3) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
6F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
6F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

6G	**DFDR**
6G.1	**Deleted**

6H	**Power Cable & cable termination& GIL**
6H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design
6H.2	145KV XLPE cables with corresponding GIS connections and cable end terminals, with all required equipment; 145 kV, 1600 A, 40 kA / 1 sec, 50 Hz, for connection of one 145 kV bay.

6I	**Multicore Cables**
6I.1	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. The overall substation cable routing and core schedules shall also be provided.

6J	**Earthing and Lightning Protection**
6J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.

6J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
6J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

6K	**Batteries, Chargers and DC Distribution**
6K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.

6K.2	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, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

6L	**LVAC Distribution**
6L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

6M	**Civil Works, Building and Foundation**
6M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
6M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting,

	water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
6M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
6M.4	One (1) lot of complete Civil Works related to CAF system

6N	**Lighting, Small Power, Air Conditioning and Ventilation**
6N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the GIS control building
6N.2	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 operations and inspections.
6N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
6N.4	One (01) Lot of Complete CCTV & with motion sensor.

6O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
6O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132 kV line at remote end (if required) iii. Required no of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v.One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
6O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room , pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity
1.	Socket Wrench Set	1 Set
2.	Adjustable Wrench Set wiith Grip (6”,8”,12”,15”)	1 Set
3.	Ratchet Wrench Set	1 Set
4.	Open-endWrench Set	1 Set
5.	Ring/Ball Wrench Set	1 Set
6.	Pipe Wrench (12”,18”,24”,	1 Set
7.	Allen Key Set	1 Set
8.	Hammer (1lb & 2lb)	1 Set
9.	Plier, 8 inch	1 No.

Serial No	Name	Quantity
10.	Cutting Plier, 8 inch	1 No.
11.	Nose Plier, 8 inch	1 No.
12.	Screw Driver Set	1 Set
13.	Screw Driver (Star and Flat Big)	1 Set
14.	File (Flat)	1 No.
15.	File (Round)	1 No.
16.	Hakso Frame with blade	1 No.
17.	Safety Belt	4 Nos
18.	Ladder (Aluminium)	2 Nos.
19.	Helmet	6 Nos.
20.	Gas Cylinder Pipe Set	1 Set
21.	Multimeter (Fluke/Megger)	2 Nos
22.	Bucket	2 Nos.
23.	Shabol	2 Nos.
24.	Coppa	2 Nos
25.	Rope	200 m
26.	Duur Metal Box	1 No.
27.	Grinding Machine	1 No.
28.	Blower Machine	1 No.
29.	Mechanical Jug	1 No.
30.	Compressor Jug	1 No.
31.	Wire Cutter	1 No.
32.	Steel Cutter	1 No.
33.	Chain Pulley (2 Ton)	1 No.
34.	Vice Set	1 No.
35.	Drill Machine	1 No.
36.	Crimping Tools	1 No.
37.	Lug Puncher	1 No.
38.	Steel Wire Brush	2 No.
39.	Blade type Knife	2 Nos.
40.	Wire Stripper	1 No.
41.	Grass Trimmer	1 No.
42.	Drill Bits	1 Set
43.	Tool Box	1 No.
44.	Hand Gloves (Leather)	1 No.
45.	Vacuum Cleaner	1 No.
46.	Chisel	1 No.
47.	Tester	1 No.
48.	Rivet Gun	1 No.
49.	PIB Tape, 1”	3 Nos.
50.	PVC Tape	4 Nos
51.	Steel Wire Brush	3 Nos.
52.	Chisel	2 Nos.
53.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.7 Technical Requirements for New 132/33KV Domar GIS substation

Section I

New 132/33KV Domar GIS substation

Description of Works:
The Domar 132/33kV substation is a new substation at Domar upazilla in Nilphamari district under this project of PGCB shall be connected to 132/33KV Hatibandha grid substation by Domar-Hatibandha double circuit 132kV line at Hatibandha (using single grosbeak equivalent ACCC conductor with an approximate length of 35 km with 850m testa river crossing) andPurbasadipur grid substation through Purbasadipur -Domar double circuit 230kV line at Domar, initially charged at 132KV (using Twin Mallard equivalent ACCC conductor with an approximate length of 46.5 km).

Under this project, the scope of work includes three 132KV transformer bays for two(02) 132/33KV, 80/120MVA transformer, two (02) 33KV incomer bays, six (06) line bays for Purbasadipur bay I & II, Hatibandha bay I & II and spare bay I & II. The busbar scheme for 132kV system is double busbar scheme.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of two new bays with extension of associated control, automation, protection, fibre optic multiplexer equipment for communication & protection, and civil works.

420kV Gas Insulated Switchgear (GIS):
Deleted

230kV Gas Insulated Switchgear (GIS):
Deleted

132kV Gas Insulated Switchgear (GIS):

- Complete 132kV GIS consisting of six (06) nos line bays, two (02) nos transformer bays and One (01) bus-coupler bays to connect new two (02) 132kV lines (Purbasadipur-1&2), two (02) 132kV lines (Hatibandha-1&2), two (02) spare bays & two new 132/33kV transformers; bus section bays
- new two (02) 132kV lines (Purbasadipur-1&2) is 230KV double circuit line initially charged at 132KV.
- Space provision shall be kept for future extension of Six (06) 132kV bays, one (01) transformer bay and ten (10) nos 230KV line bays.
- The position of Bus PT with High Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- The configuration of the 132kV busbar shall be double busbar scheme with section. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- 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.

33kV Air Insulated Switchgear (AIS) and Switch Yard:

- Two(02) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of two new 132/33kV transformers bays.

- Space provision shall be kept for one (1) Complete 33kV AIS bays with VCB, CT, LA, DS, VT consisting of one future 132/33kV transformers bays.
- Two (2) sets of 33kV Switchgear bays for station auxiliary transformers
- The configuration of the 33kV busbar for each transformer shall be single busbar scheme.

Transformer:

- Two(2) sets of 80/120MVA(ONAN/ONAF), 132/33kV, outdoor type three phase power transformers.
- Two 33/0.4 kV, 200kVA outdoor type auxiliary transformers connected to 33kV busbar to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for the new substation.
The SAS system shall be equipped with a common alarm unit to incorporate MCB's(DC/AC) status. The contractor shall provide with their Bid Detail BOQ of SAS system as per Bid requirement.

Earthing & Lighting Protection:

Complete design, supply, delivery, installation, testing & commissioning of earthing & Lightning protection for the present scope of work.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and Biddut Bhaban for integration of complete new 132/33kV 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhaban are to be carried out.

The contractor shall provide with their Bid Detail BOQ for complete SCADA system as per Bid requirement

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Complete equipment for Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB. The contractor shall provide with their Bid Detail BOQ for complete Fibre Optic Multiplexer Equipment system as per Bid requirement.

DC and LVAC System:

Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board. The system shall be comprises with a backup/standby set.

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Land Development, Civil Works, Building and Foundation:

- Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

- Complete outdoor civil works, 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main

gate and guard house, security boundary wall including retaining wall and internal fencing, access road, internal roads and parking, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing

- Complete civil works and facilities for **one** three storied control building including cable basement, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.
- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

7A Deleted

7B145kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures

The 132 kV indoor type GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Busbar configuration is double bus bar scheme.

Item No.	Descriptions & Requirements	Quantity
7B.1	Four(4) sets 132kV GIS line circuit bays (1600A), 40kA/3sec, 50Hz, 650kVp BIL equipped with each comprising	6 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, single pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800– 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800– 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800– 1600-2400/1A, Class 0.2S,15VA for Metering 1 800– 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set

XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
7B.2	Two(2) sets 132/33 kV GIS Transformer circuit bays(1600A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	2 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV, 40kA/3s, three phase line disconnector complete with motor operating mechanism	1 set
VI.	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set
VII.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: 800– 1600-2400/1A, Class 5P20, 30-60VA for Main 1 Protection 800– 1600-2400/1A, Class 5P20, 30-60VA for Backup Protection, 800– 1600-2400/1A, Class 0.2S,15VA for Metering 1 800– 1600-2400/1A,, Class 0.2S,15VA for Metering 2 , BCU - 3200/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VIII.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
IX.	145kV single-phase surge arresters, GIS type	3 nos
X.	Local Control Cubicle	1 set
XI.	Partial Discharge Monitoring terminal for each compartment	1 lot
XII.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
7B.3	One(1) set GIS Bus Coupler circuit bay(3150A), 40kA/3sec, 50Hz, 650kVp BIL including main connections each comprising	1set
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos

VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	1 lot
7B.4	One(1) set GIS Bus section bays (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT and ES including main connections each comprising	1 sets
I.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 lot
II.	145kV, 40kA/3s,SF6, three phase, gang pole operation circuit breaker complete with Hydro-mechanical spring operating mechanism	1 set
III.	145kV, 40kA/3s,three phase earth switch complete with motor operating mechanism at both sides of CB	2 sets
IV.	145kV, 40kA/3s,three phase busbar disconnector complete with motor operating mechanism	2 sets
V.	145kV,40kA/3s, single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A class 0.2S, 15VA for measuring BCU - 3200-1600/1A, Class 5P20, 30VA for Bus Differential Protection [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VI.	145kV, 50kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1A, Class 5P20, 30VA for Protection, - 3200-1600/1A, 5P20, 30VA for Busbar Differential Protection and Breaker Failure [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
VII.	Local Control Cubicle (optional, may be incorporated in coupler LCC)	1 set
VIII.	Partial Discharge Monitoring terminal for each compartment	1 lot
IX.	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	1 lot
7B.5	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with VT including main connections each comprising	3 sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 nos
III.	Partial Discharge Monitoring terminal for each compartment	1 lot
7B.6	GIS Double Busbar (3150A), 40kA/3sec, 50Hz, 650kVp BIL with HSES including main connections each comprising	3sets
I.	145kV, 3150A, 40kA/3s, three phase enclosure double busbars	1 lot
II.	145kV, 40kA/3s, three phase High Speed earth switch complete with spring operating Mechanism	1 set

III.	Partial Discharge Monitoring terminal for each compartment	1 lot

132kV Outdoor Type Air Insulated Switchgear (AIS)

The 132 kV outdoor type AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-

Item No.	Descriptions & Requirements
7B.7	Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
7B.8	One(1) lot of rigid tubular bus / flexible conductors for equipment connection [ACSR], including all necessary clamps & connectors required for completing AIS connection.
7B.9	One(1) lot of insulators & fittings including all necessary accessories required to complete 132kV interfacing..
7B.10	One(1) lot of steel structures for gantry and outdoor equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV interfacing.
7B.11	1 lot of 145KV post insulator

7C33kV Air Insulated Switchgear(AIS) and Connection:

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and bid drawings; shall comprise the following:-

Busbar configuration is single bus bar scheme.

Item No.	Descriptions & Requirements
7C.1	Two (2) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.
7C.2	Four (4) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors with E/S.
7C.3	One (1) sets of 36kV, 2500A, 31.5kA/1sec, 50Hz, 170kVp BIL, Horizontal break gantry mounted type disconnector.
7C.4	Six(6) nos. of single-phase, 4core, multi ratio, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, post type current transformer with winding as follows: - 2400-1600/1A, Class 0.2S, 10VA for Metering 1 - 2400-1600/1A, Class 0.2S, 10VA for Metering 2 - 2400/1, class 5P20, 30VA for protection - 2400/1, class 5P20, 30VA for protection
7C.5	Six (6) nos. of single-phase, 3-core, 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, voltage transformers. (33/√3kV : 110/√3V :110/√3V Class 0.2,15VA for Metering and Class 3P, 30VA for Protection)
7C6	Six (6) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.
7C.7	1 lot of 36KV post insulator
7C.8	One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.
7C.9	One(1) lot of insulators and fittings including all necessary accessories required to complete 33kV

	switchyard
7C.10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.
7C.11	Two (2) sets of 33kV, 200A rated outdoor fuse disconnecting switch for station auxiliary transformer feeder (three phase, 3pole gang manual operated, 10A power fuse, structure mounted) as shown on the relevant bid drawings

7D Transformers

Item No.	Descriptions & Requirements
7D.1	Two (2) sets of 132/33kV, 80/120 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.
7D.2	Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated support steel structures including all necessary connections, insulators & fittings..
7D.3	One (1) sets of Complete CAF (Compressed Air Foam) Type fire fighting system for power transformer

7E	SCADA system for Telecontrol and Telemetering
7E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of complete new substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include of 02 (two) sets of industrial gateways (Hot & standby) with redundant 02 (two) sets Ethernet switches, one/two hardware firewalls, cables, separate panel with wiring & all other accessories. One (01) Lot of panel for SCADA system shall be separate than SAS panels & shall be located in Main Control Room building. The Engineering PC & software of SAS shall be useable for engineering of SCADA system also. Therefore, necessary hardware & software shall be installed here. BCU for controlling 05 (five) No's of 33kV Load Shed Feeders shall be supplied. These 33kV BCU shall be considered in addition to required no. of BCUs for 33kV side of power transformers. (01 BCU solution is acceptable). Any other accessories shall be provided to complete the whole SCADA system as required.

7F Control, Protection, Substation Automation & Metering

	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
7F.1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for Six (06) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including

	monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
7F.2	Control, Monitoring, Protection (Main-1 & Main-2 relay) & Substation Automation Facility including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control. Main-1 & Main-2 relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & Main-2), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
7F.3	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus coupler circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
7F.4	Control, Protection, Metering & Substation Automation System including event recording function for one (1) set of bus section circuit. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relay, Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater & other accessories as required.
7F.5	One (1) lot of 132kV Busbar protection system including Bay unit with HMI & Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories as required.
7F.6	One (01) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) for each 132 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main and check tariff meter
	33 KV circuits The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
7F.7	Control, Protection, Metering & Substation Automation System including event recording function for two (2) sets of power transformer circuits shall include Control Mimic with all accessories including monitoring, Protection main relay (as Backup: 67,67N,50,50N,51,51N), Auxiliary relays (TCS, Lockout etc) including wiring, lighting,humidity controller, heater & other accessories as required.
7F.8	Tariff metering to accommodate programmable & recordable digital 3- phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). Different model/manufacturer shall be considered for main and check tariff meter
7F.9	**Substation Automation System**
	Complete SAS including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 145kV Circuits: as per Protection SLD and 33kV Circuits : as per Protection SLD, Two (02) sets of Industrial Server PC (not less than Intel XEON Silver- 4116 processor, ECC memory) cum Operator workstation (Main & Redundant) with SAS & Enginering Software, Firewall, 55'' or Large LCD Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (not leass than core i7-9800X series processor, 2TB HDD, 16/32GB RAM, 22" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for

	annunciation etc & other accessories. The SAS system shall be equipped with a common alarm unit to incorporate MCB's (DC/AC) status. Any other accessories shall be provided to complete the whole SCADA system as required.

7G	**DFDR**
7G.1	**Deleted**

7H	**Power Cable & cable termination& GIL**
7H.1	145 kV Gas Insulated Line (GIL) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder: The Length of GIL shall be different for different bay as per actual design . Actual payment shall be as per final design
7H.2	145KV XLPE cables with corresponding GIS connections and cable end terminals, with all required equipment; 145 kV, 1600 A, 40 kA / 1 sec, 50 Hz, for connection of one 145 kV bay. Approximate lengths are 15 to 30 meters

7I	**Multicore Cables**
7I.1	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. The overall substation cable routing and core schedules shall also be provided.

7J	**Earthing and Lightning Protection**
7J.1.i	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
7J.1.ii	One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room 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 (for switchyard & Building) shall be provided as per DSLP calculation during detail design stage.
7J.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (required voltage levels). Manufacturer shall be European, Japanese, Korean or American origin or other eligible countries with equivalent quality.

7K	**Batteries, Chargers and DC Distribution**
7K.1	110V substation Ni-Cd batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment including powering two (2) 240V, 50Hz, 3 kVA Inverter with AC bypass system & automatic change-rover facility being supplied. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 100% batteries complete, each capacity shall not be less than 600Ah at the 5-hour rate of discharge and total battery cell quantity not less than 92 nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 170A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. • Two (2) sets of Online 240V, 50Hz, 3kVA Inverter powered from 110V DC distribution board and AC distribution board as bypass circuit for substation automation system. All 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.
7K.2	48V DC system and distribution equipment to be supplied installed and commissioned in the main con2rol building for the new fiber optic multiplexer equipment for communication, protecttion. One set shall be used as standby supply. The system shall generally be as shown in bid drawing and shall include: • Two (2) sets of 48V 100% batteries complete, each capacity shall not be less than 150Ah at the 5-hour rate of discharge and total quantity not less than 42nos. 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 clause 8.4.3 of 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. • Two (2) sets of battery chargers complete, each charge shall not be less than 70A rating and input voltage three phase 50Hz, 415V AC. • The rating shall be based on battery boost charging rate & continuous DC load. The higher charging rated charger than minimum specified, if required after calculation, shall be supplied within the same price. • One (1) set of DC distribution board. The DC distribution board shall be with 50% spare MCBs for future use. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts. All 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.

7L	**LVAC Distribution**
7L.1	One (1) lot of LVAC switchboard for 400/230kV substation services to be supplied, installed

	and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey project. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. 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. The AC distribution board shall be with 50% overall spare switches for future use

7M	**Civil Works, Building and Foundation**
7M.1	One (01) lot of land development of complete Design, supply and construction of switchyard area by cutting, land filling, compacting up to a suitable level within the property lineincluding slope protection.
	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall 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 and gravel surfacing etc.
7M.2	One (1) lot of complete design, supply and construction of all civil items items and facilities including all necessary for one new three storied control building including cable basement including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc. The new 132 kV GIS building has to be with cable basement, but no full cable basement is required. Generally, the cable basement will be only for primary and secondary cables. The height of the cable basement should be 3 (three) meters. On the first floor, 132 kV switchgear shall be installed as well as all necessary facilities, including motorized crane and space for HV testing equipment and SF6 gas treatment plant. The building shall have a size of approximately 36x 12 meters. The height of the GIS hall & building will be finalized during detail design stage.
7M.3	One (01) Lot of testing of pile Foundation, Compression & uplift on random basis.
7M.4	One (1) lot of complete Civil Works related to CAF system

7N	**Lighting, Small Power, Air Conditioning and Ventilation**
7N.1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type) , LV power supply, air conditioning system, ventilation system and emergency DC lighting for the control building
7N.2	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 operations and inspections.
7N.3	One (1) lot of complete design, supply and construction of Fire fighting system GIS & control room.
7N.4	One (01) Lot of Complete CCTV & with motion sensor.

7O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
7O.1	The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot of complete set of design, supply, installation and commissioning of Fibre optic

	multiplexer equipment at local and remote end substation with necessary works to interface with connecting substations is to be provided with the following minimum services: - 21(or 87 with built-in 21) relay for each transmission line protection (through fibre cores or backup PLC) - 21 or 87 (built in 21) relay carrier signal (main and back-up) - SCADA data from switchgear and control system through SAS - Operator and Administrative telephone system - Substation LAN system The equipment to be supplied, installed and commissioned shall be as shown on bid drawing.Supply of Indoor Fibre Optic Multiplexer Equipment at local and remote end substations each comprising: 1) At Local End Substation a)Modification of ADM with TP unit without booster each comprising i. One (01) set Duplicate CPU ii. One (01) set Duplicate PSU iii. One (01) lot of Optical STM-16 ports for each direcion of 230 kV line-N/A iv. One (01) lot of Optical STM-4 ports for each direction of 132 kV line v. One (01) set of 16x2 Mbps (E1) card vi. One (01) set of card with minimum Eight ports 10/100 Base T LAN vii. One (01) set of card with minimum Eight ports 10/100 Base T Router viii. One (01) set of card with 20x2-w voice for FXS ix. 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 f) One (01) lot of Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories g) Other accessories 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) At remote end Substation – i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end(if required)-N/A ii. One (01) lot of Optical STM-16 ports for each 132kV line at remote end (if required) iii. Required no.of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v.One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
7O.2	Outdoor equipment:
	Outdoor terminal box at gantry, Armoured Underground optical fibre cables (48 cores) from gantry of 132kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room, pigtail cables with adequate length etc.

Section-II **Mandatory Spares, Maintenance tools & 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. Preferable country of origin of Testing Equipment shall be supplied from Germany, USA, UK and Japan. The materials shall have to be handed over to the designated store as per instruction of the Employer.

A sample tool list to be submitted for substation is as follows:

Serial No	Name	Quantity
54.	Socket Wrench Set	1 Set
55.	Adjustable Wrench Set wiith Grip (6",8",12",15")	1 Set
56.	Ratchet Wrench Set	1 Set
57.	Open-endWrench Set	1 Set
58.	Ring/Ball Wrench Set	1 Set
59.	Pipe Wrench (12",18",24",	1 Set
60.	Allen Key Set	1 Set
61.	Hammer (1lb & 2lb)	1 Set
62.	Plier, 8 inch	1 No.
63.	Cutting Plier, 8 inch	1 No.
64.	Nose Plier, 8 inch	1 No.
65.	Screw Driver Set	1 Set
66.	Screw Driver (Star and Flat Big)	1 Set
67.	File (Flat)	1 No.
68.	File (Round)	1 No.
69.	Hakso Frame with blade	1 No.
70.	Safety Belt	4 Nos
71.	Ladder (Aluminium)	2 Nos.
72.	Helmet	6 Nos.
73.	Gas Cylinder Pipe Set	1 Set
74.	Multimeter (Fluke/Megger)	2 Nos
75.	Bucket	2 Nos.
76.	Shabol	2 Nos.
77.	Coppa	2 Nos
78.	Rope	200 m
79.	Duur Metal Box	1 No.
80.	Grinding Machine	1 No.
81.	Blower Machine	1 No.
82.	Mechanical Jug	1 No.
83.	Compressor Jug	1 No.
84.	Wire Cutter	1 No.
85.	Steel Cutter	1 No.
86.	Chain Pulley (2 Ton)	1 No.
87.	Vice Set	1 No.
88.	Drill Machine	1 No.
89.	Crimping Tools	1 No.
90.	Lug Puncher	1 No.
91.	Steel Wire Brush	2 No.

Serial No	Name	Quantity
92.	Blade type Knife	2 Nos.
93.	Wire Stripper	1 No.
94.	Grass Trimmer	1 No.
95.	Drill Bits	1 Set
96.	Tool Box	1 No.
97.	Hand Gloves (Leather)	1 No.
98.	Vacuum Cleaner	1 No.
99.	Chisel	1 No.
100.	Tester	1 No.
101.	Rivet Gun	1 No.
102.	PIB Tape, 1"	3 Nos.
103.	PVC Tape	4 Nos
104.	Steel Wire Brush	3 Nos.
105.	Chisel	2 Nos.
106.	Measuring Tape	1 No.

Refer to the BOQ for detail of other spares, testing kit, tools etc.
For Tools set, STANLEY, USA is preferable.

1.3.8 Technical Requirements for AIS extension of existing 132/33KV Patnitola Substation

Description of Works:

An existing 132/33 kV AIS substation at Patnitola shall be connected to existing Niyamatpur 132/33KV substation through Niyamatpur-Patnitola 132 kV double circuit line (using single Grosbeak equivalent ACCC conductor with an approximate length of 32.5 km).

The control room has enough space. Auxiliary power supply is available.

The **scope of work** under this turnkey contract is design, supply, delivery, installation, testing & commissioning of:

230kV Gas Insulated Switchgear (GIS) and Switch Yard:

Deleted

230kV Air Insulated Switchgear (AIS):

Deleted

132kV AIR Insulated Switchgear (AIS):

- Two (2) nos of AIS line bay extension
- Extension of 132kV Bus (Bus shall be extended considering there shall be provision for entering two-line bays.)
- **The configuration of the existing 132kV busbar is Double** Main U-Bus scheme**.**

33kV Air Insulated Switchgear (AIS):

Deleted

Transformer:

Deleted

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme for the 132KV bay extension under this project.

Earthing & Lightning Protection:

Extension & modification of design, supply, delivery, installation, testing & commissioning of earthing & lightning protection for the present scope of work.

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of Indoor type Fibre Optic Multiplexer & communication Equipment (protection & communication) and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and Biddut Bhaban for integration for the 132KV bay extension under this project. 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhabanare to be carried out.

DC and LVAC System:

Extension of Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, cable trenches, earth filling, surfacing, drainage, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for the extension part including control room. etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

8A Deleted

8B 145 kV Air Insulated Switchgear (AIS)

Item No.	Descriptions & Requirements
8B1	Two (02) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operation, SF6 gas circuit breakers with spring-stored energy operating mechanism with support structure.

8B2	Two (02) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BILhorizontal double break, post type, motor operated disconnectors **with** motor-operated **earthing switch**
8B3	Four (04) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL,horizontal double break, post type, motor operated disconnectors **withoutearthing switch**.
8B4	Six (06) nos. of single-phase, 5-core, 145kV, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer
8B5	Six (06) nos. of single-phase, 3-core, 145kV, 50Hz, 650kVp BIL capacitive type voltage transformers.
8B6	Six (06) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters.
8B7	One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 145kV busbar (3150 Amp bus) and switchgear connection required under the scope of work.
8B8	One(1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard
8B9	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 145kV switchyard.
8B10	145KV post insulator

8C **Deleted**

8D **Deleted**

8E	SCADA system for Telecontrol and Telemetering
8E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of the 132KV bay extension in the existing substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work in Substation shall include Ethernet switch, cables, separate panel with wiring & all other accessories needed for the extension work. Therefore, necessary hardware & software shall be installed here (if required)

8F	**Control, Protection, Substation Automation & Metering**
	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
8F1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for two (02) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
8F2	1 lot of modification/extension busbar protection withBay unit with HMI. Central unit with HMI

	including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories If required.
8F3	One (01) lot of Tariff metering to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) 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, Canada, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
8F4	**Substation Automation system(SAS)**
	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 as required.

8G	**DFDR**
8G1	Deleted

8H	**GIL & Power Cable**
8H1	Deleted

8I	**Multicore Cables**
8I1	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. The overall substation cable routing and core schedules shall also be provided.

8J	**Earthing and Lightning Protection**
8J1	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
8J2	One (1) lot of design, 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.

8K	**Batteries, Chargers and DC Distribution**
8K1	One (01) lot of Extension of existing 110V DC distribution board to provide DC connections to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.
8K2	One (01) lot of Extension of existing 48V DC distribution board to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.

8L	**LVAC Distribution**
8L1	One (1) lot extension of LVAC switchboard for two (02) new bays at Patnitola substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project.
8L2	Deleted

8M	**Civil Works, Building and Foundation**
8M1	One (1) lot of Complete design, supply and construction of all civil items required for extension of bays at 132kV level. The outdoor works shall include necessary land development, filling/cutting of soil and leveling up to finished level and within the property line suitable for switchyard gantry & equipment foundations, Extension of internal roads, cable trenches including soak pit, septic tank, switchyard drainage system including outfall, fences, sentry post, PVC pipes etc., switchyard surface finishing and gravel surfacing etc. shall be included.
8M2	One (01) lot of Complete design, supply and construction of all civil items and facilities required for the extension/modification of 132kV control houses to incorporate the extension bays.
8M3	One (01) lot of Testing of pile Foundation, Compression & uplift on random basis.

8N	**Lighting, Small Power, Air Conditioning and Ventilation**
8N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation system and emergency DC lighting for extension work
8N2	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 .

8O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
8O1	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 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 1) At Local end substation 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. Optical STM-16 ports for each direction of 400 kV line– N/A iv. Optical STM-16 ports for each direction of 230 kV line – N/A v. One (01) lot of Optical STM-4 ports for each direction of 132 kV line 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) At remote end Substation – i. Optical STM-16 ports for 400 kV line at remote end-NA ii. Optical STM-16 ports for each 132 kV line at remote end iii. One(01) lot of Required no. of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
8O2	Outdoor equipment:
	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 ii. One (01) lot of Outdoor termination box

1.3.9 Technical Requirements for GIS extension of existing 132/33KV Niyamatpur Substation

Description of Works:

An existing 132/33 kV AIS substation at Niyamatpur shall be connected to existing Patnitola 132/33 kV substation through Niyamatpur-Patnitola 132 kV double circuit line (using single Grosbeak equivalent ACCC conductor with an approximate length of 32.5 km).

The control room has enough space. Auxiliary power supply is available.

The **scope of work** under this turnkey contract is design, supply, delivery, installation, testing & commissioning of:

230kV Gas Insulated Switchgear (GIS) and Switch Yard:

Deleted

230kV Air Insulated Switchgear (GIS):

Deleted

132kV Gas Insulated Switchgear (GIS):

- Two(2) nos of GIS line bay extension
- Extension of 132kV Bus (Bus shall be extended considering there shall be provision for entering two-line bays.)
- **The configuration of the 132kV GIS busbar shall be** Double Busbar scheme**. The existing busbar will be change into double busbar scheme from Main & transfer bus scheme soon.**
- Re-location of Bus VT (if required)

33kV Air Insulated Switchgear (AIS):

Deleted

Transformer:

Deleted

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme for the 132KV bay extension under this project.

Earthing & Lightning Protection:

Extension & modification of design, supply, delivery, installation, testing & commissioning of earthing & lightning protection for the present scope of work.

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of Indoor type Fibre Optic Multiplexer & communication Equipment (protection & communication) and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB.

SCADA system for Telecontrol and Telemetering:

One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of extension of 132kV Baghabari AIS substation. All required electrical signals shall be transmitted to the NLDC through the remote terminal unit (RTU). All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the RTU using IEC 60870-5-101/104 protocol. All necessary modification work in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out.

DC and LVAC System:

Extension of Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, outdoor lighting system, cable trenches, earth filling, surfacing, drainage, earthing & lightning protection, switchyard lighting, etc.
Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for the extension part including control room & GIS room. etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

9A Deleted

9B 145 kV Gas Insulated Switchgear (GIS)

Item No	Sub-item	Requirements	Quantity
9B	**145 kV Outdoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures**		
The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-			
9B1	**145kV 1600A, 40kA/3sec, GIS Line Feeder Bays, each comprising:**		**02 Sets**
	i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 Lot
	ii.	145kV, 40kA/3s, SF6, three phase, single operation circuit breaker complete with spring-stored energy operating mechanism	1 Set
	iv.	145kV, 40kA/3s, three phase three position disconnector integrated with earth switch complete with motor operating mechanism at both sides of CB	2 Sets
	v.	145kV, 40kA/3s three phase line disconnector complete with motor operating mechanism	1 Set
	vi	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set
	vii.	145kV, 40kA/3s single phase, 5core, current transformer with cores as follows: - 2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection - 2400-1600-800/1A, Class 5P20, 30-60VA for Backup Protection, - 2400-1600-800/1A, Class 0.2S,15VA for Metering 1 - 2400-1600-800/1A,, Class 0.2S,15VA for Metering 2 , BCU [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
	ix..	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 Nos.
	x.	145kV single-phase surge arresters, GIS type	3 nos
	xi	Local Control Cubicle	1 set
	xii	Partial Discharge Monitoring terminal for each compartment	1 lot
	xiii	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	1 Lot

145kV Air Insulated Switchgear (AIS)

9B7	Six (06) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters
9B8	One (1) lot of rigid tubular bus and/or stranded conductors including accessories for each connection as required for completing 132kV GIS Switchyard

9B9	One (1) lot of insulator and fittings including all necessary clamps and connectors as required for completing 132kV GIS Switchyard
9B10	One (1) lot of steel structures for gantry and equipment supports required for completing 145kV busbar and switchgear including all necessary accessories required for completing 132kV GIS Switchyard

9C Deleted

9D Deleted

9E	SCADA system for Telecontrol and Telemetering
9E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of extension of 132kV Baghabari AIS substation. All required electrical signals shall be transmitted to the NLDC through the remote terminal unit (RTU). All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the RTU using IEC 60870-5-101/104 protocol. All necessary modification work in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work shall include one (1) lot of complete design, supply, installation, testing & commissioning of RTU Subrack for incorporating two new line bays. This RTU Subrack shall be interconnected with the existing RTU (AREVA make) and integrated with the existing NLDC (National Load Despatch Center) system. Existing RTU database shall be upgraded. The following items shall be included with the RTU Subrack : -one (01) no. of BIU (Base Interface Unit) -one (01) no. of CPU (Central Processing Unit) -one (01) no. of SWU (Switch Unit) -two (02) nos. of DIU (Digital Input Unit) -one (01) no. of DOU (Digital Output Unit) Two (02) nos. of IED (RIDH Ducer M01 Programmable Multi-Transducer) shall also be supplied. *RTU is from AREVA make Scope of supply work in Substation shall include cables, separate panel with wiring & all other accessories needed for the extension work. Therefore, necessary hardware & software shall be installed here (if required)

9**F**	**Control, Protection, Substation Automation & Metering**
	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
9**F1**	Control, Monitoring, Protection (Main-1 & backup relay) including event recording function for two (02) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.

9**F2**	1 lot of modification/extension busbar protection withBay unit with HMI. Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories If required
9**F3**	One (01) lot of Tariff metering to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) 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, Canada, USA or Japan origin or other eligible countries with equivalent quality. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
9**F4**	**Substation Automation system(SAS)**
	Deleted

9**G**	**DFDR**
9G1	Deleted

9**H**	**GIL & Power Cable**
9**H1**	145 kV Gas Insulated Busbar (GIB) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design.
9**H2**	145kV, 40 kA / 1 sec, 1600A XLPE power cable, 145KV AIS cable sealing end with all necessary accesories for connecting & termination of new two line bays.

9I	**Multicore Cables**
9I1	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. The overall substation cable routing and core schedules shall also be provided.

9J	**Earthing and Lightning Protection**
9J1	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
9J2	One (1) lot of design, 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.

9K	**Batteries, Chargers and DC Distribution**
9K1	One (01) lot of Extension of existing 110V DC distribution board to provide DC connections to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.
9K2	One (01) lot of Extension of existing 48V DC distribution board to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with

	equivalent quality. MCB must have in built NO/NC contacts.

9L	**LVAC Distribution**
9L1	One (1) lot extension of LVAC switchboard for two (02) new bays at Niyamatpur substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project.
9L2	Deleted

9M	**Civil Works, Building and Foundation**
9M1	One (1) lot of Complete design, supply and construction of all civil items required for extension of bays at 132kV level. The outdoor works shall include necessary land development, filling/cutting of soil and leveling up to finished level and within the property line suitable for switchyard gantry & equipment foundations, Extension of internal roads, cable trenches including soak pit, septic tank, switchyard drainage system including outfall, fences, sentry post, PVC pipes etc., switchyard surface finishing and gravel surfacing etc. shall be included.
9M2	One (01) lot of Complete design, supply and construction of all civil items and facilities required for the extension/modification of 132kV control houses to incorporate the extension bays.
9M3	One (01) lot of Testing of pile Foundation, Compression & uplift on random basis.

9N	**Lighting, Small Power, Air Conditioning and Ventilation**
9N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation system and emergency DC lighting for extension work
9N2	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 .

9O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
9O1	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 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 1) At Local end substation 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. Optical STM-16 ports for each direction of 400 kV line– N/A

	iv. Optical STM-16 ports for each direction of 230 kV line – N/A v. One (01) lot of Optical STM-4 ports for each direction of 132 kV line 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) At remote end Substation – i. Optical STM-16 ports for 400 kV line at remote end-NA ii. Optical STM-16 ports for each 132 kV line at remote end iii. One(01) lot of Required no. of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
9O2	Outdoor equipment:
	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 ii. One (01) lot of Outdoor termination box

1.3.10 Technical Requirements for AIS extension of existing 400/230/132 Kv Substation at Gopalganj(N) Substation

Description of Works:

An existing 400/230/132 AIS substation is Gopalganj(N).Gopalganj(N) shall be connected to the Shibchar a new 132/33kV substation under this project of PGCB through Shibchar-Gopalganj(N) double circuit 230kV line at Shibchar, initially charged at 132KV (using Twin Mallard equivalent ACCC conductor with an approximate length of 25 km with 0.4 river crossing).

The control room has enough space. Auxiliary power supply is available.

The **scope of work** under this turnkey contract is design, supply, delivery, installation, testing &commissioning of:

230kV Gas Insulated Switchgear (GIS) and Switch Yard:

Deleted

230kV Air Insulated Switchgear (AIS):

Deleted

132kV AIR Insulated Switchgear (AIS):

- Two(2) nos of AIS line bay extension.
- Two(2) nos of AIS line bay extension shall be terminated at 230KV side gantry and hooked up at 132KV switchyard by HV cable.
- Extension of 132kV Bus (Bus shall be extended considering there shall be provision for entering two-line bays.)
- **The configuration of the 132kV busbar shall be Double** Main U-Bus scheme**.**

33kV Air Insulated Switchgear (AIS):

Deleted

Transformer:

Deleted

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme for the 132KV bay extension under this project.

Earthing & Lightning Protection:

Extension & modification of design, supply, delivery, installation, testing & commissioning of earthing & lightning protection for the present scope of work.

Digital Fault & Disturbance Recorder (DFDR):

Supply, installation, testing & complete commissioning of extension of DFDR at Goplaganj 400/230/132kV substation. The contractor shall provide with their Bid Detail BOQ for complete DFDR system as per Bid requirement.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of Indoor type Fibre Optic Multiplexer & communication Equipment (protection & communication) and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and Biddut Bhaban for integration for the 132KV bay extension under this project. 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhabanare to be carried out.

DC and LVAC System:

Extension of Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, cable trenches, earth filling, surfacing, drainage, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for the extension part including control room. etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

10A Deleted

10B 145KV Air Insulated Switchgear (AIS)

Item No.	Descriptions & Requirements
10B1	Two (02) sets of 145Kv, 1600A, 50Ka/1sec, 50Hz, 650kVp BIL, live tank type, single pole operation**,** SF6 gas circuit breakers with spring-stored energy operating mechanism with support structure.
10B2	Two (02) sets of 145Kv, 1600A, 50Ka/1sec, 50Hz, 650kVp BILhorizontal double break, post type, motor operated disconnectors **with** motor-operated **earthing switch**
10B3	Four (04) sets of 145Kv, 1600A, 50Ka/1sec, 50Hz, 650kVp BIL,horizontal double break, post type, motor operated disconnectors **withoutearthing switch**.
10B4	Six (06) nos. of single-phase, 5-core, 145Kv, 50Ka/1sec, 50Hz, 650kVp BIL, ,post type current transformer
10B5	Six (06) nos. of single-phase, 3-core, 145Kv, 50Hz, 650kVp BIL capacitor type voltage transformers.
10B6	Twelve (12) nos. of 120KV rated voltage, 102Kv(rms) continuous operating voltage at 50Oc, 10Ka nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters.
10B7	One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR], including all necessary clamps & connectors required for completing 145Kv busbar(3150A busbar) and switchgear connection required under the scope of work.
10B8	One(1) lot of insulators and fittings including all necessary accessories required to complete 145Kv switchyard
10B9	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 145KV switchyard& 230KV switchyard.
10B10	145KV post insulator

10C Deleted

10D Deleted

10E	SCADA system for Telecontrol and Telemetering
10E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of the 132KV bay extension in the existing substation. All

	required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work in Substation shall include Ethernet switch, cables, separate panel with wiring & all other accessories needed for the extension work. Therefore, necessary hardware & software shall be installed here (if required)

10F	**Control, Protection, Substation Automation & Metering**
	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
10F1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for two (02) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
10F2	1 lot of modification/extension busbar protection with Bay unit with HMI. Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories If required.
10F3	One (01) lot of Tariff metering to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) 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, Canada, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
10F4	**Substation Automation system(SAS)**
	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 as required.

10G	**DFDR**
10G1	Supply, installation, testing & complete commissioning of One (01) lot of extension of DFDR at grid substation. The contractor shall provide with their Bid Detail BOQ for complete DFDR system as per Bid requirement.

10H	**GIL & Power Cable**
10H1	Deleted
10H2	145kV, 40 kA / 1 sec, 1600A XLPE power cable, 145KV AIS cable sealing end with all necessary accesories for connecting 245KV & 145KV switchyard for the termination of new two line bays.

10I	**Multicore Cables**
10I1	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. The overall substation cable routing and core schedules shall also be provided.

10J	**Earthing and Lightning Protection**
10J1	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
10J2	One (1) lot of design, 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.

10K	**Batteries, Chargers and DC Distribution**
10K1	One (01) lot of Extension of existing 110V DC distribution board to provide DC connections to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.
10K2	One (01) lot of Extension of existing 48V DC distribution board to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.

10L	**LVAC Distribution**
10L1	One (1) lot extension of LVAC switchboard for two (02) new bays at substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project.
10L2	Deleted

10M	**Civil Works, Building and Foundation**
10M1	One (1) lot of Complete design, supply and construction of all civil items required for extension of bays as per scope. The outdoor works shall include necessary land development, filling/cutting of soil and leveling up to finished level and within the property line suitable for switchyard gantry & equipment foundations, Extension of internal roads, cable trenches including soak pit, septic tank, switchyard drainage system including outfall, fences, sentry post, PVC pipes etc., switchyard surface finishing and gravel surfacing etc. shall be included.
10M2	One (01) lot of Complete design, supply and construction of all civil items and facilities required for the modification/extension of 132kV panel and extension work of Main Operation building to incorporate the extension bays.
10M3	One (01) lot of Testing of pile Foundation, Compression & uplift on random basis.

10N	**Lighting, Small Power, Air Conditioning and Ventilation**
10N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation

	system and emergency DC lighting for extension work
10N2	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 .

10O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
10O1	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 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 1) At Local end substation 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. Optical STM-16 ports for each direction of 400 kV line– N/A iv. Optical STM-16 ports for each direction of 230 kV line – N/A v. One (01) lot of Optical STM-4 ports for each direction of 132 kV line 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) At remote end Substation – i. Optical STM-16 ports for 400 kV line at remote end-NA ii. Optical STM-16 ports for each 132 kV line at remote end iii. One(01) lot of Required no. of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables

	- BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
10O2	Outdoor equipment:
	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 ii. One (01) lot of Outdoor termination box

1.3.11 Technical Requirements for GIS extension of existing 132/33 kV Substation at Purbasadipur Substation

Description of Works:

An existing GIS substation at Purbasadipur shall be connected to new Domar substation through Purbasadipur -Domar double circuit 230kV line at Domar, initially charged at 132KV (using Twin Mallard equivalent ACCC conductor with an approximate length of 46.5 km).

The control room has enough space. Auxiliary power supply is available.

The **scope of work** under this turnkey contract is design, supply, delivery, installation, testing &commissioning of:

230kV Gas Insulated Switchgear (GIS) and Switch Yard:

Deleted

230kV Air Insulated Switchgear (GIS):

Deleted

132kV Gas Insulated Switchgear (GIS):

- Two(2) nos of GIS line bay extension.
- Two(2) nos of GIS line bay extension shall be terminated at 230KV side gantry and hooked up at 132KV GIS by HV cable.
- Extension of 132kV Bus (Bus shall be extended considering there shall be provision for entering two-line bays.)
- **The configuration of the 132kV busbar shall be** Double Main Bus scheme**.**

33kV Air Insulated Switchgear (AIS):

Deleted

Transformer:

Deleted

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme for the 132KV bay extension under this project.

Earthing & Lightning Protection:

Extension & modification of design, supply, delivery, installation, testing & commissioning of earthing & lightning protection for the present scope of work.

Digital Fault & Disturbance Recorder (DFDR):

Supply, installation, testing & complete commissioning of extension of DFDR at grid substation. The contractor shall provide with their Bid Detail BOQ for complete DFDR system as per Bid requirement.

Fibre Optic Multiplexer Equipment for Communication and Protection:
Extension of Indoor type Fibre Optic Multiplexer & communication Equipment (protection & communication) and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB.

SCADA system for Telecontrol and Telemetering:
Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and Biddut Bhaban for integration for the 132KV bay extension under this project. 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 form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station at NLDC and Biddut Bhabanare to be carried out.

DC and LVAC System:
Extension of Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation:
Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, outdoor lighting system, cable trenches, earth filling, surfacing, drainage, earthing & lightning protection, switchyard lighting, etc.
Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for the extension part including control room & GIS room. etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

11A Deleted

11B 145 kV Gas Insulated Switchgear (GIS)

Item No	Sub-item	Requirements	Quantity
11B	**145 kV Indoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures**		
The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule E to this section and shall comprise the following:-			
11B1	**145kV 1600A, 40Ka/3sec, GIS Line Feeder Bays, each comprising:**		**02 Sets**
	i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 Lot
	ii.	145kV, 40kA/3s, SF6, three phase, single operation circuit breaker complete with spring-stored energy operating mechanism	1 Set
	iii.	145kV, 40kA/3s, three phase three position disconnector integrated with earth switch complete with motor operating mechanism at both sides of CB	2 Sets
	v.	145kV, 40kA/3s three phase line disconnector complete with motor operating	1 Set

Item No	Sub-item	Requirements	Quantity
		mechanism	
	vi	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set
	vii.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: - 2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection - 2400-1600-800/1A, Class 5P20, 30-60VA for Backup Protection, - 2400-1600-800/1A, Class 0.2S,15VA for Metering 1 - 2400-1600-800/1A,, Class 0.2S,15VA for Metering 2 , BCU [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
	ix.	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 Nos.
	x.	145kV single-phase surge arresters, GIS type	3 nos
	xi	Local Control Cubicle	1 set
	xii	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	1 Lot

145kV Air Insulated Switchgear (AIS)

11B27	Six (06) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters
11B8	One (1) lot of rigid tubular bus and/or stranded conductors including accessories for each connection as required for completing 132kV GIS Switchyard
11B9	One (1) lot of insulator and fittings including all necessary clamps and connectors as required for completing 132kV GIS Switchyard
11B10	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 145Kv switchyard & 230KV switchyard.

11C Deleted

11D Deleted

11E	SCADA system for Telecontrol and Telemetering
11E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of the 132KV bay extension in the existing substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors,

	tap changer, etc. shall be controlled from NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out. Scope of supply work in Substation shall include Ethernet switch, cables, separate panel with wiring & all other accessories needed for the extension work. Therefore, necessary hardware & software shall be installed here (if required)

11F	**Control, Protection, Substation Automation & Metering**
	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
11F1	Control, Monitoring, Protection (Main-1 & backup relay) & Substation Automation Facility including event recording function for two (02) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
11F2	1 lot of modification/extension busbar protection with Bay unit with HMI. Central unit with HMI including software modification along with Complete Protection Panel (Front opening, Swing Frame Type) including contactors, wiring, lighting, humidity controller, heater ,MCBs, TTBs, Selector Switch for Enabling/Disabling BBP,BFP, all function & other accessories If required.
11F3	One (01) lot of Tariff metering to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) 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, Canada, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
11F4	**Substation Automation system(SAS)**
	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 as required. One (01) lot of extension of Digital Fault and Disturbance recorder (DFDR) to monitor complete substation including all bays for 420kV AIS and 245kV AIS swicthyard.

11G	**DFDR**
11G1	Supply, installation, testing & complete commissioning of One (01) lot of extension of DFDR at grid substation. The contractor shall provide with their Bid Detail BOQ for complete DFDR system as per Bid requirement.

11H	**GIL & Power Cable**
11H1	Deleted
11H2	145kV, 40 kA / 1 sec, 1600A, XLPE power cable, 145KV AIS cable sealing end with all necessary accesories for connecting 245KV & 145KV switchyard for the termination of new two line bays.

11I	**Multicore Cables**
11I1	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. The overall substation cable routing and core schedules shall also be provided.

11J	**Earthing and Lightning Protection**
11J1	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
11J2	One (1) lot of design, 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.

11K	**Batteries, Chargers and DC Distribution**
11K1	One (01) lot of Extension of existing 110V DC distribution board to provide DC connections to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.
11K2	One (01) lot of Extension of existing 48V DC distribution board to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.

11L	**LVAC Distribution**
11L1	One (1) lot extension of LVAC switchboard for two (02) new bays at substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project.
11L2	Deleted

11M	**Civil Works, Building and Foundation**
11M1	One (1) lot of Complete design, supply and construction of all civil items required for extension of bays at 132kV level. The outdoor works shall include necessary land development, filling/cutting of soil and leveling up to finished level and within the property line suitable for switchyard gantry & equipment foundations, Extension of internal roads, cable trenches including soak pit, septic tank, switchyard drainage system including outfall, fences, sentry post, PVC pipes etc., switchyard surface finishing and gravel surfacing etc. shall be included.
11M2	One (01) lot of Complete design, supply and construction of all civil items and facilities required for the extension/ modification of 132kV GIS and control room to incorporate the extension bays.
11M3	One (01) lot of Testing of pile Foundation, Compression & uplift on random basis.

11N	**Lighting, Small Power, Air Conditioning and Ventilation**
11N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation system and emergency DC lighting for extension work
11N2	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 .

11O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
11O1	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 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 1) At Local end substation 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. Optical STM-16 ports for each direction of 400 kV line– N/A iv. Optical STM-16 ports for each direction of 230 kV line – N/A v. One (01) lot of Optical STM-4 ports for each direction of 132 kV line 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) At remote end Substation – i. Optical STM-16 ports for 400 kV line at remote end-NA ii. Optical STM-16 ports for each 132 kV line at remote end iii. One(01) lot of Required no. of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables - BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.
11O2	Outdoor equipment:

	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 ii. One (01) lot of Outdoor termination box

1.3.12 Technical Requirements for GIS extension of existing 132/33 kV Substation at Bhandaria Substation

Description of Works:

The Bhandaria 132/33kV substation is an existing substation under this project of PGCB shall be connected to new 132/33KV Pirojpur grid substation through double circuit 132kV line at Bhandaria (using single grosbeak equivalent ACCC conductor with an approximate length of 49.5 km with 1m kacha river crossing & 300m Bhirab river crossing).

The control room has enough space. Auxiliary power supply is available.

The **scope of work** under this turnkey contract is design, supply, delivery, installation, testing & commissioning of:

230kV Gas Insulated Switchgear (GIS) and Switch Yard:

Deleted

230kV Air Insulated Switchgear (GIS):

Deleted

132kV Gas Insulated Switchgear (GIS):

- Two(2) nos of GIS line bay extension
- Extension of 132kV Bus (Bus shall be extended considering there shall be provision for entering two-line bays.)
- **The configuration of the 132kV busbar shall be Double bus bar scheme. The existing busbar is** Main & transfer Bus scheme**.**

33kV Air Insulated Switchgear (AIS):

Deleted

Transformer:

Deleted

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme for the 132KV bay extension under this project.

Earthing & Lightning Protection:

Extension & modification of design, supply, delivery, installation, testing & commissioning of earthing & lightning protection for the present scope of work.

Digital Fault & Disturbance Recorder (DFDR):

Deleted

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of Indoor type Fibre Optic Multiplexer & communication Equipment (protection & communication) and integration with existing communication network (i.e. NLDC Rampura and Biddut Bhaban) of PGCB.

SCADA system for Telecontrol and Telemetering:
One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of extension of 132kV Baghabari AIS substation. All required electrical signals shall be transmitted to the NLDC through the remote terminal unit (RTU). All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the RTU using IEC 60870-5-101/104 protocol. All necessary modification work in the software of master station of NLDC at Rampura & Biddyut Bhaban are to be carried out.

DC and LVAC System:
Extension of Complete set of DC and LVAC system with all necessary materials required for 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation:
Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, outdoor lighting system, cable trenches, earth filling, surfacing, drainage, earthing & lightning protection, switchyard lighting, etc.
Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for the extension part including control room & GIS room. etc.

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawing:

12A Deleted

12B 145 kV Gas Insulated Switchgear (GIS)

Item No	Sub-item	Requirements	Quantity
12B	**145 kV Outdoor Type Gas Insulated Switchgear (GIS), equipment connection and steel structures**		
The 145kV GIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Schedule Eto this section and shall comprise the following:-			
12B1	**145kV 1600A, 40kA/3sec, GIS Line Feeder Bays, each comprising:**		**02 Sets**
	i.	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	1 Lot
	ii.	145kV, 40kA/3s, SF6, three phase, single operation circuit breaker complete with spring-stored energy operating mechanism	1 Set
	iii.	145kV, 40kA/3s, three phase three position disconnector integrated with earth switch complete with motor operating mechanism at both sides of CB	2 Sets
	v.	145kV, 40kA/3s three phase line disconnector complete with motor operating mechanism	1 Set
	vi	145kV, 40kA/3s three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	1 Set

Item No	Sub-item	Requirements	Quantity
	vii.	145kV, 40kA/3s single phase, 5 core, current transformer with cores as follows: - 2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection - 2400-1600-800/1A, Class 5P20, 30-60VA for Backup Protection, - 2400-1600-800/1A, Class 0.2S,15VA for Metering 1 - 2400-1600-800/1A,, Class 0.2S,15VA for Metering 2 , BCU [Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]	3 nos
	ix..	145kV single phase voltage transformer 3 windingswith manual operated Disconnection lever & Earthing facility to disconnect VT from Primary Circuit.	3 Nos.
	x.	145kV single-phase surge arresters, GIS type	3 nos
	xi	Local Control Cubicle	1 set
	xii	Partial Discharge Monitoring terminal for each compartment	1 lot
	xiii	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	1 Lot

145kV Air Insulated Switchgear (AIS)

12B2	Six (06) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters
12B3	One (1) lot of rigid tubular bus and/or stranded conductors including accessories for each connection as required for completing 132kV GIS Switchyard
12B4	One (1) lot of insulator and fittings including all necessary clamps and connectors as required for completing 132kV GIS Switchyard
12B5	One (1) lot of steel structures for gantry and equipment supports required for completing 145kV busbar and switchgear including all necessary accessories required for completing 132kV GIS Switchyard

12C Deleted

12D Deleted

12E	SCADA system for Telecontrol and Telemetering
12E.1	One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura and backup station at Biddyut Bhaban for integration of extension of 132kV Baghabari AIS substation. All required electrical signals shall be transmitted to the NLDC through the remote terminal unit (RTU). All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled from NLDC through the RTU using IEC 60870-5-101/104 protocol. All necessary modification work in the software of master station of NLDC at Rampura &

	Biddyut Bhaban are to be carried out. Scope of supply work shall include one (1) lot of complete design, supply, installation, testing & commissioning of RTU Subrack for incorporating two new line bays. This RTU Subrack shall be interconnected with the existing RTU (AREVA make) and integrated with the existing NLDC (National Load Despatch Center) system. Existing RTU database shall be upgraded. The following items shall be included with the RTU Subrack : -one (01) no. of BIU (Base Interface Unit) -one (01) no. of CPU (Central Processing Unit) -one (01) no. of SWU (Switch Unit) -two (02) nos. of DIU (Digital Input Unit) -one (01) no. of DOU (Digital Output Unit) Two (02) nos. of IED (RIDH Ducer M01 Programmable Multi-Transducer) shall also be supplied. Scope of supply work in Substation shall include cables, separate panel with wiring & all other accessories needed for the extension work. Therefore, necessary hardware & software shall be installed here (if required)

12**F**	**Control, Protection, Substation Automation & Metering**
	132 KV circuits
	The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -
12**F1**	Control, Monitoring, Protection (Main-1 & backup relay) Facility including event recording function for two (02) sets of 132KV overhead line circuit bays. Main-1 & backup relay shall from different manufacturer. Each set of complete panel (Front opening, Swing Frame type) shall include control Mimic with all accessories including monitoring, Protection main relays (Main-1 & backup), Auxiliary relays (TCS, Lockout etc) with wiring, lighting, humidity controller, heater, MCBs, TTBs & other accessories as required.
12**F2**	Deleted
12**F3**	One (01) lot of Tariff metering to accommodate programmable & recordable digital 3-phase,4wire import and export MWh and MVArh meters (accuracy class 0.2) 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, Canada, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. Different model/manufacturer shall be considered for main & check tariff meter.
12**F4**	**Substation Automation system(SAS)**
	Deleted

12**G**	**DFDR**
12**G1**	Deleted

12**H**	**GIB& Power Cable**
12H1	145 kV Gas Insulated Busbar (GIB) with GIS-to-AIR Bushing, terminating chambers complete with support structure, etc. for incoming line feeder: The Length of GIL shall be different for different bay as per actual design. Actual payment shall be as per final design.
12H2	145kV, 40 kA / 1 sec, 1600A XLPE power cable, 145KV AIS cable sealing end with all necessary accesories for connecting 245KV & 145KV switchyard for the termination of new two line bays.

12I	**Multicore Cables**

12I1	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. The overall substation cable routing and core schedules shall also be provided.

12J	**Earthing and Lightning Protection**
12J1	One (1) lot of design, supply and installation of earthing system for outdoor switchyard equipment & Control Room 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 shown using software like CYMGRD.
12J2	One (1) lot of design, 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.

12K	**Batteries, Chargers and DC Distribution**
12K1	One (01) lot of Extension of existing 110V DC distribution board to provide DC connections to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.
12K2	One (01) lot of Extension of existing 48V DC distribution board to provide DC connection to fibre optic multiplexer equipment for communication, protection to all equipment required for bay extension work under this contract. The MCBs shall be from USA/Europe/Japan/Korean origin or other eligible countries with equivalent quality. MCB must have in built NO/NC contacts.

12L	**LVAC Distribution**
12L1	One (1) lot extension of LVAC switchboard for two (02) new bays at substation to be supplied, installed and commissioned to provide the 415/240V supplies to all equipment being supplied under this turnkey project.
12L2	Deleted

12M	**Civil Works, Building and Foundation**
12M1	One (1) lot of Complete design, supply and construction of all civil items required for extension of bays at 132kV level. The outdoor works shall include necessary land development, filling/cutting of soil and leveling up to finished level and within the property line suitable for switchyard gantry & equipment foundations, Extension of internal roads, cable trenches including soak pit, septic tank, switchyard drainage system including outfall, fences, sentry post, PVC pipes etc., switchyard surface finishing and gravel surfacing etc. shall be included.
12M2	One (01) lot of Complete design, supply and construction of all civil items and facilities required for the extension/ modification of 132kV control room to incorporate the extension bays.
12M3	One (01) lot of Testing of pile Foundation, Compression & uplift on random basis.

12N	**Lighting, Small Power, Air Conditioning and Ventilation**
12N1	One (1) lot of complete design, supply, installation and commissioning of equipment to provide indoor lighting (LED type), LV power supply, air conditioning system, ventilation system and emergency DC lighting for extension work
12N2	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 .

12O	**Fibre Optic Multiplexer Equipment for Communication and Protection**
12O1	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 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 1) At Local end substation 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. Optical STM-16 ports for each direction of 400 kV line– N/A iv. Optical STM-16 ports for each direction of 230 kV line – N/A v. One (01) lot of Optical STM-4 ports for each direction of 132 kV line 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) At remote end Substation – i. Optical STM-16 ports for 400 kV line at remote end-NA ii. Optical STM-16 ports for each 132 kV line at remote end iii. One(01) lot of Required no. of cards with 4 commands for distance protection after detail design iv. One (01) lot of Outdoor termination box v. One (01) lot of Cables BOQ shall be finalized at the time of execution with the consent of Communication Circle, PGCB.

12O2	Outdoor equipment:
	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 ii. One (01) lot of Outdoor termination box

1.4 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 this package of the Project:

1) NEW 230/33 kV GIS SS at Bhlola
2) NEW 132/33 kV GIS SS at Hatibandha
3) NEW 132/33 kV GIS SS at Pirojpur
4) NEW 132/33 kV GIS SS at Bhanga
5) NEW 132/33 kV GIS SS at Jhalokati
6) NEW 132/33 kV GIS SS at Shibchar
7) NEW 132/33 kV GIS SS at Domar
8) Extension at Patnitala 132/33 kV AIS SS
9) Extension at Niyamatpur 132/33 kV AIS SS
10) Extension at Gopalganj 400/230/132 kV AIS SS
11) Extension at Purabasadipur 132/33 kV GIS SS
12) Extension at Bhandaria 132/33 kV GIS SS

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.

characteristics shall be define during the Design stage and there will be subject of the Employer's approval.

1.4.1 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/Tributary Services (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

1.4.2 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).

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

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

- **SDH Telecommunication System**

1.4.3 Scope of Work and Supply

The scope of work and supply of the telecommunication system:

- One (1) optical fibre cable from the gantry of each of 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 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 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 230 kV transmission line
  - One optical STM-4 ports for each 132 kV 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 or GE MSE-5010 (OSN-1500B) type to ensure fully integration with existing multiplexers.

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

1.4.4 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.

1.5 Detailed Description of the Scope of Supply for SCADA, Controll & Monitoring System

1.5.1 Overall Scope of Work and Supply

The SCADA system will be based on:

- The communication with the NLDC shall be via the supplied gateway for Control and Monitoring System of the substation.
- Industrial gateway shall be implemented at each involved substation for remote monitoring & control from the National Despatch Centre. It shall provide all the necessary control and monitoring facilities for 400kV, 230kV, 132 kV level and auxiliaries.
- At existing substation, monitoring 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.
- Contractor shall supply, install 2 (two) numbers of Industrial gateway and will be configured as master - hot standby mode or one gateway will report to main station & another will report to backup station. Gateway shall be capable report to both Main master station at Rampura (through VLAN network) & Standby Master Station at Bidyut Bhaban (through routed network) simultaneously. It will be configured according to the signal list, communication parameter, IP address, station address 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.
- In case of windows operating system based gateway there should be USB port, VGA port, HDD/flash memory 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 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 & MOD Bus etc.

- One laptop for each vendor & same software version is required with Acronis True image or Ghost or similar software for system back up & restoration.
- All necessary adaptation work and configuration of the existing SCADA platform of the NLDC to integrate the Substations and the new bays shall be provided.
- Minimum of four (4) or five (5) numbers, respectively, of 33 kV shed feeders shall be controlled from the SCADA system at each substation. All necessary equipment, including required number of BCU and panels shall be provided under the scope of the project. A scheme of the substation automation system is attached.

1.5.2 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 230kv 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-terra control 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
  - MegaVAR 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.

1.5.3 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 5/6 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/Inverter,

- Aux.48 V DC,
- Fire protection,
- Security light,
- Alarm system,
- HVAC,
- Telecommunication alarms,
- GPS time synchronizing input (NTP Protocol)

1.5.4 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" colour monitors (complete with appropriate desk and chair).
- The second operator workstation shall have the capability to be used as Employer's Representative workstation,
- Two (2) numbers of independent SCADA Gateways
- Black & white A 4 laser printer,
- Colour A 3 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 synchronisation 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 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:

- 230 kV transmission line bays,
- 230/33 kV power transformer
- 230 kV busbars
- 132 kV transmission line bays,
- 132/33 kV power transformers,
- 132 kV busbars
- Five (5) numbers of 33 kV load shed feeders (BCU and panels, if required) 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.

1.5.5 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.

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 adaptation work shall be provided.

The signal list will follow the same rules as for new substations.

1.5.6 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,

1.6 Terminal Points

1.6.1 Transmission Line Circuit Connections

The slack spans including overhead earth wires between the 230 kV and 132 kV 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.

1.6.2 Communication and SCADA Equipment

The voice communication, tele-protection signalling 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 tele-communication 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.

1.7 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:** Deleted

(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 Engineer	Duration (Working Days)	No. of Trip/ Visit
1.	Transformers	02	10	4 visitfor 230/34.5kV tr & 132/34.5kV Transformer
2.	GIS	02	05	3 visitfor 230kV GIS &132kV GIS
3.	Circuit Breaker	NA		
4.	Shunt Reactor	NA		
5.	Disconnector	NA		
6.	Instrument Transformer	NA		
7.	Lightning Arrester	02	05	01
8.	Control, protection & SAS including SCADA Gateway, Switch & firewall	02	07	02 visit 230 kV & 0132kV
9.	Communication system	N/A		

SL	Description	No. of Engineer	Duration (Working Days)	No. of Trip/ Visit
10.	DC system	N/A		

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

i. All transformers shall be factory tested in front of Employer's Engineers & contractor's representative.
ii. For GIS, at-least one from Each type of bay, such as Bus Coupler bay, Bus section bay, Transformer bay, Line bay, Bus PT bay shall be tested in front of Employer's Engineers & contractor's representative.
iii. For Lightning Arrester, sample of each voltage level and 15% of the supplied quantity shall be tested in front of Employer's Engineers & contractor's representative.
iv. For Control & Relay Panel, at-least one from each type of panel, such as Busbar protection relay panel, transformer control & protection panel, transmission line control & protection panel, Bus coupler control & relay panel shall be tested & contractor's representative.
v. For Substation Automation System, point-to-point communication, Relay communication protocol (PRP, HSR, RSTP etc. as applicable) test, inter-operability test (if applicable) shall be performed in front of Employer's Engineers & contractor's representative.

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

SL	Description	No. of Engineer	Duration (days)
1.	HV GIS switchgears	15	06
2.	Transformers	15	06
3.	Protection & Substation automation system	15	06
4.	Fiber optic multiplexer & digital PABX	15	06
5.	SCADA system	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. The payment of daily allowance of **US$ 80** per day excluding travel time for each of the Employer's trainee for item (a). The air ticket class shall be Economy class. The Employer's engineer attending the Pre-shipment inspection (as mentioned in item (b)) shall be provided with the same facilities except the payment of daily allowance which is to be **US$100** per day excluding travel time**.** For on-site instruction training, (item no (c)), the contractor shall not be responsible for any costs for trainees and the aforementioned onsite trainings shall have to be arranged at any Substation's respective local Grid Circle or GMD area with the consultation of Superintending Engineer, Grid Circle, PGCB.

In "Schedule B4.2: Installation and Other Services" of the Price Schedule, cost of Employer's Factory Acceptance Tests Witness, International Training and Local O&M Training are given as provisional sum. These costs are fixed ceiling and will be included in total price. But the payment shall be at actual.

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.

1.7.1 Training Contents

The contractor shall provid a details of training contents with schedule and the final schedule with contents shall be finalized during execution stage.

For each Training, Trainers shall have minimum 5 years experience in the related fields. The trainers shall be from reputed International training Organization/manufacturer/contractor. For Transformer & HV substation training, the trainer shall be experience of at least 245kV Class, 300MVA Substation & transformer design experience for at least 5 years. The CV of proposed trainers shall be submitted to employer & taken approval during execution. If the proposed trainer does not meet the minimum requirementmentioned here, the Employer shall preserve the right to ask the contractor to change the trainer as per requirement.

2. Schedule B: Bid Prices & Schedules

General

1. The Price Schedules are divided as follows:

   Schedule No. B1: Plant & Equipment Supplied from Abroad
   Schedule No. B2: Plant & Equipment Supplied from within the Employer's Country
   Schedule No. B3: Design Services
   Schedule No. B4: Installation and Other Services
   Schedule No. B5: Grand Summary
   Schedule No. B6: Recommended Spare Parts

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. To have comprehensive understanding of the technical specification of each equipment the bidder shall read technical specification in relevant sections in volume 02; Employer's Requirements & other sections of the Bidding Document (Requirement in Schedule A of Volume 03, GTP requirement in Appendix of Schedule A or Schedule E) 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 previously mentioned, including overheads and profit.

3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

4. The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive. The Bidder shall initial any alterations necessary due to errors, etc.

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

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

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

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

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

7. When requested by the Employer for the purposes of making payments or part 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.

Notes

i. Items identified as lot in price schedule shall include all the materials required for proper completion of work against that item.
ii. Items identified as meters, such as Cable, GIL, GIB etc. shall be deemed to be tentative & based on preliminary design which shall be variable during detail design in execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.
iii. Items identified as Cubic feet or meters, such as land/earth filling etc. shall be deemed to be tentative & based on preliminary estimation which shall be variable during execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.
iv. For Items under steel gantry, column & beam has been added as number basis so that payment can be made on actual basis if no. of column changes during detail Engineering in Execution stage while unit price shall remain fixed.
v. Equipment support structure& foundation for Transformer, switchgear etc has been added on Number basis based on tentative & preliminary design so that payment can be made on actual basis if no. of structure changes during detail Engineering in Execution stage while unit price shall remain fixed.

Schedule B: Schedules of Rates and Prices

Schedule No. B1: Plant and Equipment Suppplied from Abroad
Schedule No. B2: Plant and Equipment Supplied from Within the Employer's Country
Schedule No. B3: Design Services
Schedule No. B4: Installation and Other Services
Schedule No. B5: Grand Summary
Schedule No. B6: Recommended Spare Parts
Please see the separate Excel file for the above.

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

Please use the attached excel file.

3. Schedule C: Bar Chart Program of Key Activities - Delivery & Completion Time Schedule

(To be filled by the Bidder to be attached to the bid

3.1 Times for Delivery and Completion

The individual dates are all contractually binding.
The times given include all necessary control, relay, metering, auxiliary power and 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. busbar, etc. as well ensure that subsequent shut-downs are unnecessary or at least only of a temporary or short time nature.

Completion time for the scope of work under this project is 900 days. Construction Schedule exceeding 900 days shall be rejected.

The following dates shall be from the commencement date of the Contract.
Key dates to be provided as follows.

E - Target completion dates planned by the Contractor
D - Construction (delivery, erection and commissioning) date guaranteed by the Contractor.
C - Shipping completion dates guaranteed by the Contractor.
B - Date of arrival of first shipment guaranteed by the Contractor.
A - Earliest date by which access is required by the Contractor.

Site/Descriptions	A Earliest Access Permitted Months	B Months	C Months	D Months	E Months
NEW 230/33KV GIS SUBSTATION AT Bhlola : (1) Civil works (2) 230kVGIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Hatibandha (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Pirojpur					

Site/Descriptions	A Earliest Access Permitted Months	B Months	C Months	D Months	E Months
(1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Bhanga (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Jhalkhathi (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Shibchar (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
NEW 132/33 KV GIS SUBSTATION AT Domar (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
132 KV AIS BAY EXTENSION AT Patnitola SUBSTATION (1) Civil works (2) 132kV AIS Equipment (3) SAS (4) Protection					

Site/Descriptions	A Earliest Access Permitted Months	B Months	C Months	D Months	E Months
(5) AC/DC (6) Tel/SCADA					
132 KV AIS BAY EXTENSION AT Niyamatpur SUBSTATION (1) Civil works (2) 132kV AIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
132 KV AIS BAY EXTENSION AT Gopalganj SUBSTATION (1) Civil works (2) 132kV AIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
132 KV GIS BAY EXTENSION AT Purbasadipur SUBSTATION (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					
132 KV GIS BAY EXTENSION AT Bhandaria SUBSTATION (1) Civil works (2) 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					

4. Schedule D: Manufacturers, Places of Manufacture and Testing

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

Quoted rates and prices shall be deemed to apply to whichever Manufacturer is appointed, and no adjustment of the rates and prices will be permitted. Their participation shall be confirmed with the Manufacturer's Authorization letter(s), as required.

In case that more than one Manufacturer has been proposed, the Employer have right to choose one or more of them, or can ask for replacement.Should a manufacturer be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable manufacturer without any change to the bid price.

Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers for each item concerned.

Manufacturers

The following Manufacturers are proposed for carrying out the facilities:

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
1. Power Transformer					
1.1	**Auto/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				
1.2	**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	**Auxiliary Power /Zigzag Transformer**				
i.	Auxiliary power transformer				
ii	Earthing power transformer				
2. Shunt/Bus Reactor (N/A)					
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 (N/A)					
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	Disconnectors 400 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 (Fill as scope)				
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	Disconnectors 132 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				
6.6	Insulator				
	Post Insulator				
	Disk Insulator				
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 (N/A)				

11.2	230kV				
11.3	132kV				
11.4	33kV				
Cable Sealing End/ Cable Termination Kit (AIS)					
11.5	400kV (N/A)				
11.6	230kV				
11.7	132kV				
11.8	33kV				
Cable Sealing End/ Cable Termination Kit (GIS)					
11.9	400kV (N/A)				
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				
16	GIL				
i.	230KV GIL				
ii.	132KV GIL				
Name of Bidder:					
Signature of Bidder:					

Schedule E: Technical Particulars and Guarantees

4.1 General

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

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

They should be fully completed and submitted with the bid.

4.2 Technical Data Schedule

Please find hereafter the technical data schedules.

4.2.1 Part-1: AIS Switchgear

Circuit Breaker

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.0	Circuit Beaker									
2.1	General									
2.1.1	Manufacturer		[Insert]	[Insert]	[Insert]	[Insert]				
2.1.2	Country of Make		[Insert]	[Insert]	[Insert]	[Insert]				
2.1.3	Model		[Insert]	[Insert]	[Insert]	[Insert]				
2.1.4	Type of circuit breaker		AIS, Outdoor	AIS, Outdoor	AIS, Outdoor	AIS, Outdoor				
2.1.5	Isolating and Quenching Medium		SF6	SF6	SF6	Vacuum /sf6				
2.1.6	Rated Current, Ir	A	4000A	3150A	1600	2500/ 3150A				
2.2	Design & Construction									
2.2.1	Clearance & Insulation									
	Minimum clearance									
	Across Interrupting chamber	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	To ground	mm	[Insert]	[Insert]	[Insert]	[Insert]				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Between poles [Gang pole CB]	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Insulator Material		Silicon Rubber/porcelian	Silicon Rubber/ porcelian	Silicon Rubber/ porcelian	Silicon Rubber/ porcelian				
	Color		[Insert]	[Insert]	[Insert]	[Insert]				
	Vulcanizing technique	RTV/ HTV/ others	[Insert]	[Insert]	[Insert]	[Insert]				
	Minimum creepage distance	mm/ kV	Min > 31	Min > 31	Min > 31	Min > 31				
	Total creepage distance	mm	[Insert]	[Insert]	[Insert]	[Insert]				
2.2.2	HV Terminal	pcs.	02	02	02	02				
	Shape		Flat	Flat	Flat	Flat				
	Dimensions	mm x mm	Min 200 x 100	Min 100 x 100	Min 100 x 100	Min 50 x 50				
	Number of holes		Min 8	Min 4	Min 4	Min 4				
	Dimensions of holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Distance between holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Material suitable for		Al terminal	Al terminal	Al terminal	Al terminal				
	Fixing Terminals	Yes/ No	Yes	Yes	Yes	Yes				
	Earthing Terminal	Yes/ No	Yes	Yes	Yes	Yes				
	Support Structure to be provided by Vendor	Yes/ No	Yes	Yes	Yes	Yes				
2.2.3	Dimensions & Weight									
	Dimensions									
	Support insulator height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Total height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
2.2.3.1	Degree of Protection for									

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
(a)	auxiliary circuits		[Insert]	[Insert]	[Insert]	[Insert]				
2.2.3.2	Rated operating sequence		O-0.3 s-CO-3 min-CO	O-0.3 s-CO-3 min-CO	O-0.3 s-CO-3 min-CO	O-0.3 s-CO-3 min-CO				
2.2.4	Number of operating mechanisms per circuit breaker									
	Line bay	pcs.	3	3	3	1				
	Transformer bay	pcs.	3	1	1	1				
	Bus Coupler bay	pcs.	3	1	1	1				
	Bus section Bay	pcs.	3	1	1	1				
2.2.5	Auto reclosing									
	Line bay		1p+3p	1p+3p	1p+3p	3p				
	Transformer bay		3p	3p	3p	3p				
2.2.6	Number of successive auto-Reclosing operations without derating		[Insert]	[Insert]	[Insert]	[Insert]				
2.2.7	Rated supply pressure of gas for interruption									
	Maximum	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
	Normal	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
	Minimum	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
	Low Pressure Alarm	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
	Lockout Alarm	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
2.2.7.1	Total mass of SF6 gas in a circuit breaker	kg	[Insert]	[Insert]	[Insert]	NA				
2.2.7.2	Gas Leakage Per Year	%	[Insert]	[Insert]	[Insert]	NA				
2.2.8	Limits for correct operation									
	Max	MPa (g)	Insert	Insert	Insert	NA				
	Normal	MPa (g)	[Insert]	[Insert]	[Insert]	NA				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	min	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
2.2.8.1	Maximum pressure rise in circuit breakers due to the making or breaking of rated current	MPa (g)	[Insert]	[Insert]	[Insert]	NA				
2.2.9	Is lockout facility fitted?	Yes/ No	Yes	Yes	Yes	Yes				
2.2.9.1	Whether Lockout will trip CB	Yes/ No	No	No	No	No				
2.2.10	Trip free/or fixed trip		Trip Free	Trip Free	Trip Free	Trip Free				
2.2.11	Is circuit-breaker re-strike free	Yes/ No	Yes	Yes	Yes	Yes				
2.2.12	Restrike performance during capacitive current switching	Class	C2	C2	C2	C2				
2.2.13	Number of operations without maintenance									
	CO at no-load	No.	≥ 10000	≥ 10000	≥ 10000	≥ 10000				
	CO at rated current	No.	≥ 2500	≥ 2500	≥ 2500	≥ 2500				
	CO at rated breaking current Isc	No.	≥ 8	≥ 8	≥ 8	≥ 8				
	Curve for above attached to CB		Yes	Yes	Yes	Yes				
2.2.14	The frequency of mechanical operations	Class	M2	M2	M2	M2				
2.2.15	Rated electrical endurance	Class	Min E1	Min E1	Min E1	Min E1				
2.2.16	Interrupter Chamber									
2.2.16.1	Design		Double Breaking	Single breaking	Single breaking	Single breaking				
2.2.16.2	No. of Interrupter		02	01	01	01				
2.2.16.3	Type	Self-Blast/Puffer	Auto-Puffer	Insert	Insert	Insert				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
		Other	Insert	Insert	Insert	Insert				
2.2.16.4	Model Designation		Insert	Insert	Insert	Insert				
2.2.16.5	Material of Male-Female part		Insert	Insert	Insert	Insert				
2.2.16.6	Length of each break	mm	Insert	Insert	Insert	Insert				
2.2.16.7	Length of stroke	mm	Insert	Insert	Insert	Insert				
2.2.17	Operating Mechanism									
2.2.17.1	Type		Spring-Spring/ Spring-Hydraulic	Motor-wound spring	Motor-wound spring	Motor-wound spring				
2.2.17.2	Make		Insert	Insert	Insert	Insert				
2.2.17.3	Country of Manufacturer		Insert	Insert	Insert	Insert				
2.2.17.4	Model Designation		Insert	Insert	Insert	Insert				
2.2.17.5	Motor - auxiliary supply voltage	V. AC, 50Hz	Insert	230	230	230				
2.2.17.6	Rated power of motor	W	Insert	Insert	Insert	Insert				
2.2.17.7	Current required at rated supply voltage to open circuit-breaker	A	Insert	Insert	Insert	Insert				
2.2.17.8	Number of making coils	pcs.	Insert	Insert	Insert	Insert				
2.2.17.8.1	Rated Operating Voltage	V.DC	110	110	110	110				
2.2.17.8.2	Power	W	Insert	Insert	Insert	Insert				
2.2.17.9	Number of breaking coils for each operating mechanism	pcs.	02	02	02	02				
2.2.17.9.1	Rated Operating Voltage	V.DC	110	110	110	110				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.2.17.9.2	Power	W	Insert	Insert	Insert	Insert				
2.2.17.10	Minimum number of available contacts (NO/NC) for each operating mechanism		26NO+26NC	26NO+26NC	12NO+12NC	12NO+12NC				
2.2.17.11	Hearer & No.	Yes-Min 1	Insert	Insert	Insert	Insert				
2.2.17.11.1	Rated Voltage	V.AC /50HZ	230	230	230	230				
2.2.17.11.2	Power	W	Insert	Insert	Insert	Insert				
2.2.17.12	Operating mechanism material		Insert	Insert	Insert	Insert				
2.2.17.13	Water-tight corrosion-resistant housing Material		Insert	Insert	Insert	Insert				
2.2.17.14	Spring Charging Time									
	Motor	ms								
	Crank	s								
2.2.17.15	Whether facility to close / open the CB manually in the Absence of DC control supply to the operating mechanism	Yes/ No	Yes	Yes	Yes	Yes				
2.2.17.16	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	Yes	Yes	Yes				
2.2.17.17	Whether anti pumping facility is provided in the Circuit breaker mechanism	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.2.17.18	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	Insert	Insert	Insert				
2.2.17.19	Number of close-open operations possible without recharging		O-CO	O-CO	O-CO	O-CO				
2.2.17.20	Emergency Trip Switch	Yes/No	Insert	Insert	Insert	Insert				
2.2.17.21	MTBF of CB		Insert	Insert	Insert	Insert				
2.2.17.22	MTTR of CB		Insert	Insert	Insert	Insert				
2.3	Characteristics & Performance									
2.3.1	Voltage									
2.3.1.1	Rated lightning impulse withstand voltage	kVpeak								
	Phase to ground		Insert	Insert	Insert	Insert				
	Across interrupting chamber		Insert	Insert	Insert	Insert				
	Between phases [Gang pole CB]		Insert	Insert	Insert	Insert				
2.3.1.2	Rated Power frequency withstand voltage (dry), 1 minute	kVrms								
	Phase to ground		Insert	Insert	Insert	Insert				
	Across interrupting chamber		Insert	Insert	Insert	Insert				
	Between phases [Gang pole CB]		Insert	Insert	Insert	Insert				
2.3.1.3	Maximum TRV (transient recovery voltage) withstand capability of the CB									

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
a.1	During Opening of Fault , T100	kV	[Insert]	[Insert]	[Insert]	[Insert]				
a.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
b.1	During Opening of Cable	kV	[Insert]	[Insert]	[Insert]	[Insert]				
b.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
c.1	During Opening of capacitor bank	kV	[Insert]	[Insert]	[Insert]	[Insert]				
c.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
d.1	During Opening of line	kV	[Insert]	[Insert]	[Insert]	[Insert]				
d.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
e.1	During Opening of Transformer	kV	[Insert]	[Insert]	[Insert]	[Insert]				
e.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
f.1	During Opening of Reactor	kV	[Insert]	[Insert]	[Insert]	[Insert]				
f.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]	[Insert]	[Insert]				
g.1	Maximum switching surge withstand capacity	p.u	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.1.4	Corona extinction voltage with CB open or close	kV rms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.1.5	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/√3)	μV	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.1.6	First-pole-to-clear factor									
	Terminal fault		1.3	1.3	1.3	1.3				
	Short-line fault		1.0	1.0	1.0	1.0				
	Out-of-phase		2.0	2.0	2.0	2.0				
2.3.2	Shor Circuit Rating									

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.3.2.1	Rated short-circuit breaking currents, Isc (equal to short circuit withstand/making current):	kA rms	63	50	40	31.5				
	Three phase Symmetrical breaking currents	kA rms	[Insert]	[Insert]	[Insert]	[Insert]				
	Three phase Asymmetrical breaking currents	kA rms	[Insert]	[Insert]	[Insert]	[Insert]				
	Single phase Symmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]	[Insert]	[Insert]				
	Single phase Asymmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.2.2	D.C. component of the rated short-circuit breaking current	%	>50	>50	> 45	>45				
2.3.2.3	Rated short line fault breaking current capability									
a)	Percentage of rated breaking current	%	[Insert]	[Insert]	[Insert]	[Insert]				
b)	Surge Impedance	Ohms	[Insert]	[Insert]	[Insert]	[Insert]				
c)	Amplitude factor		[Insert]	[Insert]	[Insert]	[Insert]				
d)	Critical percentage of rated breaking current	%	[Insert]	[Insert]	[Insert]	[Insert]				
e)	Maximum arc duration	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.2.4	Rated capacitive switching capability (breaking currents):									
	Line charging	A rms	[Insert]	[Insert]	[Insert]	[Insert]				
	Cable charging	A rms	[Insert]	[Insert]	[Insert]	[Insert]				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Capacitor Bank breaking current	A rms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.2.5	Rated inductive switching/ breaking capability:	A	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3	Timing Performance									
2.3.3.1	Maximum total break time (trip initiation to final arc extinction) (3.7.135 acc. to IEC 62271-100)	ms	40	60	60	80				
2.3.3.2	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 2	20 ± 5	20 ± 5	40 ± 5				
2.3.3.3	Opening time (trip initiation to contact separation)		[Insert]	[Insert]	[Insert]	[Insert]				
	Without current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	With 100 % rated current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	With 100 % rated breaking current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3.4	Closing time	ms	60	80	100	120				
	Without current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	With 100 % rated current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	With 100 % rated breaking current	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3.5	Maximum time interval between opening interrupters between first & last phases	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3.6	Maximum time interval between opening of interrupters in same phases		[Insert]	NA	NA	NA				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.3.3.7	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3.8	Mechanical time staggering in Gang Pole CB									
	First-to-Second phase	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	Second-to-Third Phase	ms	[Insert]	[Insert]	[Insert]	[Insert]				
2.3.3.9	Minimum time for auto reclosing (dead time)									
	Single phase	ms	[Insert]	[Insert]	[Insert]	[Insert]				
	Three Phase	ms	[Insert]	[Insert]	[Insert]	[Insert]				
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]	[Insert]	[Insert]	[Insert]				
2.3.3.11	Rated Mechanical Terminal Loads									
	Static horizontal force, longitudinal FthA	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static horizontal force, transversal FthB	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static vertical force Ftv	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	[Insert]	[Insert]	[Insert]				
2.4	Accessories in central control panel/ LCC									
2.4.1	Anti-pumping relay	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.4.2	Local/remote control selector switch	Yes/ No	Yes	Yes	Yes	Yes				
2.4.3	Single Pole/Gang operation switch	Yes/ No	Yes	Yes	Yes	Yes				
2.4.4	Local operation push buttons	Yes/ No	Yes	Yes	Yes	Yes				
2.4.5	Bulb Indication for Open/Close/Spring Charged	Yes/ No	Yes	Yes	Yes	Yes				
2.4.6	Anti-Condensation Heater	Yes/ No	Yes	Yes	Yes	Yes				
2.4.6.1	Supply Voltage	V.AC , 50Hz	230	230	230	230				
2.4.6.2	Power	W	[Insert]	[Insert]	[Insert]	[Insert]				
2.4.7	Humidity Controller	Yes/ No	Yes	Yes	Yes	Yes				
2.4.8	Minimum pressure lock-out and alarm relays	Yes/ No	Yes	Yes	Yes	Yes				
2.4.9	Operation counter	Yes/ No	Yes	Yes	Yes	Yes				
2.4.10	DC MCB for Control Circuit	Yes/ No	Yes	Yes	Yes	Yes				
2.4.10.1	NO/NC Contact in MCB for signaling	Min 02	[Insert]	[Insert]	[Insert]	[Insert]				
2.4.11	AC MCB	Yes/ No	Yes	Yes	Yes	Yes				
2.4.11.1	NO/NC Contact in MCB for signaling	Yes/ No	Yes	Yes	Yes	Yes				
2.4.12	Service outlet socket	Min 01, 10A	[Insert]	[Insert]	[Insert]	[Insert]				
2.4.13	Cu -earthing rails inside control cabinet	Yes/ No	Yes	Yes	Yes	Yes				
2.4.14	Detachable plates, the bottom of control cabinet	Yes/ No	Yes	Yes	Yes	Yes				
2.4.15	Set of cables for connection of operating mechanism and central control panel of circuit breaker	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.4.16	Time phase discrepancy relay	Yes/ No	Yes	Yes	Yes	Yes				
2.4.17	Weatherproof, corrosion resistance enclosure		IP55W	IP55W	IP55W	IP55W				
2.4.18	Enclosure Material		Al or stainless steel	Al or stainless steel	Al or stainless steel	Al or stainless steel				
2.5	Installation, Testing & Commissioning Supervision by Vendor Engineer	Yes/ No	Yes	Yes	Yes	Yes				
2.6	Special Rating 400kV CB									
2.6.1	PIR									
	Applicable Breaker		Line side							
	Type	Series/Parallel	[Insert]	NA	NA	NA				
	PIR value	Ω	[Insert]	NA	NA	NA				
	EIT		[Insert]	NA	NA	NA				
	MIT		[Insert]	NA	NA	NA				
	Energy	kJ	[Insert]	NA	NA	NA				
2.6.2	CSD			NA	NA	NA				
2.6.2.1	Applicable Breaker		Transformer/Reactor side	NA	NA	NA				
2.6.2.2	Control Voltage	V.DC	110	NA	NA	NA				
2.6.2.3	Analog Input			NA	NA	NA				
	Current Input	No.	04	NA	NA	NA				
	Voltage input	No.	04	NA	NA	NA				
2.6.2.4	Binary Digital I/O			NA	NA	NA				
	Binary Input			NA	NA	NA				
	Group		[Insert]	NA	NA	NA				
	Number in each group		[Insert]	NA	NA	NA				
	Binary Output			NA	NA	NA				
	Group		[Insert]	NA	NA	NA				
	Number in each group		[Insert]	NA	NA	NA				
2.6.2.5	Mounting Arrangement		[Insert]	NA	NA	NA				
2.6.2.6	Dimension (LxWxH)	mm	[Insert]	NA	NA	NA				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
2.6.2.7	Temperature Compensation	Yes/ No	Yes	NA	NA	NA				
2.6.2.8	CB operating time adaption	Yes/ No	Yes	NA	NA	NA				
2.6.2.9	Flux Management	Yes/ No	Yes	NA	NA	NA				
2.6.2.10	Anti-pumping inside CSD	Yes/ No	Yes	NA	NA	NA				
2.6.2.11	EMC Compatibility test Reference		Insert Authority & Report reference	NA	NA	NA				
2.6.2.12	Communication Port	Yes/ No	Yes	NA	NA	NA				
2.6.2.13	Supported Protocol		61850, others [Insert]	NA	NA	NA				
2.6.2.14	Supported load type by CSD for Middle CB of 1&half CB scheme		Inductive& Capacitive	NA	NA	NA				
2.7	Drawings attached									
	GA Drawing with All dimension & clearance clearly marked, Fixing Detail	Yes/ No	Yes	Yes	Yes	Yes				
	Sectional Drawing of Interrupter to show internal components	Yes/ No	Yes	Yes	Yes	Yes				
	HV terminal Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	Nameplate of CB & Operating Mechanism Box Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	LCC & Operating Mechanism Box Equipment Layout Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	Earthing Terminal Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	CB NO/NC Contact Drawing	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/ No	Yes	Yes	Yes	Yes				
	Quality & FAT/Routine Test Plan Attached	Yes/ No	Yes	Yes	Yes	Yes				
	Overall Compliance with Requirement	Yes/ No	Yes							

Disconnector without Earthing Switch

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3	Disconnect Switch									
3.1	General									
3.1.1	Manufacturer		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.2	Country of Make		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.3	Model Designation		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.4	Type		AIS / Outdoor							
3.2	Design & Construction									
3.2.1	Type of Disconnector		Double side Break	Double side Break	Double side Break	Vertical Break				
	Integrated Earth Switch	Yes/ No.	No.	No.	No.	No.				
3.2.2	Clearance & Insulation									
	Minimum clearance									
	Across Isolating Gap	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	To ground	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Between poles	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Insulator Material		Porcelain	Porcelain	Porcelain	Silicon Rubber				
	Color		Brown	Brown	Brown	[Insert]				
	Cantilever Force	kN	Min 10	Min 8	Min 6	Min 4				
	Quality of Insulator		Min C130	Min C130	Min C130	Eq. Min C120				
	Vulcanizing technique	RTV /HTV/others	NA	NA	NA	[Insert]				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Minimum creepage distance	mm/kV	Min > 25	Min > 25	Min > 25	Min > 25				
	Total creepage distance	mm	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.3	HV terminal	pcs.	06	06	06	06				
	Shape		Flat	Flat	Flat	Flat				
	Dimensions	mm x mm	Min 200 x 100	Min 100 x 100	Min 100 x 100	Min 50 x 50				
	Number of holes		Min 8	Min 4	Min 4	Min 4				
	Dimensions of holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Distance between holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Material suitable for		Al terminal	Al terminal	Al terminal	Al terminal				
	Support Structure to be provided by Vendor	Yes/ No	[Insert]	[Insert]	[Insert]	[Insert]				
	Fixing & Earthing Terminals	Yes/ No	Yes	Yes	Yes	Yes				
3.2.3 x	Dimensions & Weight									
	Dimensions									
	Support insulator height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Total height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight									
	Pole weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight of operating mechanism	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight of metal structure	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Total weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Shipping Weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.4	Number of breaks per pole	pcs	01		01					

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.5	Material of contact surfaces		[Insert]	[Insert]	[Insert]	[Insert]				
3.2.6	Operating Mechanism & Drive Box									
3.2.6.1	Number of operating mechanism	pcs.	03	03/01	01	01				
3.2.6.2	Type of operating mechanism		Motor driven	Motor driven	Motor driven	Motor driven				
3.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230V	230V	230V	230V				
3.2.6.4	Rated power of motor	W								
3.2.7	Accessories in LCC									
3.2.7.1	Voltage presence Contactor	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.2	Other Contactors	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01, A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01,A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.5	Control Circuit DC MCB	Min 01,A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.6	Selection switch (local/neutral/remote)	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.7	Manual closing button	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.8	Manual opening button	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.9	GFCI service outlet socket	A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.10	Socket MCB	A	[Insert]	[Insert]	[Insert]	[Insert]				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.7.11	Anti-condensation heater inside the operating mechanism cabinet	Yes/ No	Yes	Yes	Yes	Yes				
3.2.17.12	Total heater power	W	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.17.13	Heater- supply voltage	AC,50Hz	230 V	230 V	230 V	230 V				
3.2.17.14	Control Voltage	V.DC	110V	110V	110V					
3.2.17.15	Minimum number of available contacts (NO/NC/V)		16NO+16 NC	12NO+12 NC	8NO+8NC	6NO+ 6NC				
3.2.17.16	LED Bulb with switch	W								
3.2.17.17	Water-tight corrosion-resistant housing		IP55W	IP55W	IP55W	IP55 W				
3.2.17.18	Drive housing Material	AL or Stainless Steel	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.17.19	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/ No	Yes	Yes	Yes	Yes				
3.2.17.20	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.17.21	Whether loss of motor power also drop Control DC power	Yes/No	Yes	Yes	Yes	Yes				
3.2.8	MTBF of DS									
3.3	Rating & Characteristics									
3.3.1	Rated lightning impulse withstand voltage of DS	kVpeak								
	Phase to ground		Insert		Insert					
	Across Isolating Gap		Insert		Insert					
	Between phases		Insert		Insert					
3.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS	kVrms								
	Phase to ground		Insert		Insert					
	Across Isolating Gap		Insert		Insert					
	Between phases		Insert		Insert					
3.3.3	Corona extinction voltage	kV rms	Insert							
3.3.4	Load Switching capability									
	Capacitive Current									
	Cable charging current									
	Small inductive current									
3.3.5	Rated Current	Same as CB								
	Rated Short Time withstand Current		63	50	40	31.5				
	Duration		1s	1s	1s	3s				
	Rated Short Time Peak Withstand Current			130	100	78				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.3.6	Rated bus-transfer voltage and current									
	Rated Bus-transfer voltage for DS	V	10		20					
	Rated bus-transfer current	A	1600		1600					
3.3.7	Rated induced current and voltage for grounding switches	NA								
3.3.9	DS operation Timings									
	Closing	s								
	Opening	s								
3.3.10	Mechanical Terminal Load									
	Static horizontal force, longitudinal FthA	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static horizontal force, transversal FthB	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static vertical force Ftv	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	[Insert]	[Insert]	[Insert]				
3.3.11	Drawings attached									
	GA Drawing with All dimension & clearance clearly marked, Fixing Detail,	Yes/ No	Yes	Yes	Yes	Yes				
	Sectional Drawing of all sides	Yes/ No	Yes	Yes	Yes	Yes				
	Nameplate of DS & ES	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400Kv (N/A)	230Kv (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	LCC & Operating Mechanism Box Equipment Layout Drawing, DS-ES NO/NC Contact Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	HV terminal Drawing ,Earthing Terminal Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/ No	Yes	Yes	Yes	Yes				
3.3.12	Quality & FAT/Routine Test Plan Attached	Yes/ No	Yes	Yes	Yes	Yes				
	Overall Compliance with Requirement	Yes/ No	Yes							

Disconnector 132 kV with Earthing Switch

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3	Disconnect Switch									
3.1	General									
3.1.1	Manufacturer		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.2	Country of Make		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.3	Model Designation		[Insert]	[Insert]	[Insert]	[Insert]				
3.1.4	Type		AIS / Outdoor							
3.2	Design & Construction									
3.2.1	Type of Disconnector		Double side Break	Double side Break	Double side Break	Vertical Break				
	Integrated Earth Switch	Yes/ No.	No.	No.	No.	No.				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.2	Clearance & Insulation									
	Minimum clearance									
	Across Isolating Gap	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	To ground	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Between poles	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Insulator Material		Porcelain	Porcelain	Porcelain	Silicon Rubber				
	Color		Brown	Brown	Brown	[Insert]				
	Cantilever Force	kN	Min 10	Min 8	Min 6	Min 4				
	Quality of Insulator		Min C130	Min C130	Min C130	Eq. Min C120				
	Vulcanizing technique	RTV/HTV/others	NA	NA	NA	[Insert]				
	Minimum creepage distance	mm/kV	Min > 25	Min > 25	Min > 25	Min > 25				
	Total creepage distance	mm	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.3	HV terminal	pcs.	06	06	06	06				
	Shape		Flat	Flat	Flat	Flat				
	Dimensions	mm x mm	Min 200 x 100	Min 100 x 100	Min 100 x 100	Min 50 x 50				
	Number of holes		Min 8	Min 4	Min 4	Min 4				
	Dimensions of holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Distance between holes	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Material suitable for		Al terminal	Al terminal	Al terminal	Al terminal				
	Support Structure to be provided by Vendor	Yes/No	[Insert]	[Insert]	[Insert]	[Insert]				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Fixing & Earthing Terminals	Yes/ No	Yes	Yes	Yes	Yes				
3.2.3x	Dimensions & Weight									
	Dimensions									
	Support insulator height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Total height	mm	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight									
	Pole weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight of operating mechanism	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Weight of metal structure	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Total weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
	Shipping Weight	kg	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.4	Number of breaks per pole	pcs	01		01					
3.2.5	Material of contact surfaces		[Insert]	[Insert]	[Insert]	[Insert]				
3.2.6	Operating Mechanism & Drive Box									
3.2.6.1	Number of DS operating mechanism	pcs.	03	03/01	01	01				
3.2.6.2	Type of operating mechanism		Motor driven	Motor driven	Motor driven	Motor driven				
3.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230V	230V	230V	230V				
3.2.6.4	Rated power of motor	W								
3.2.6.1x	Number of ES operating mechanism	pcs.	03	03	01	01				
3.2.6.2x	Type of operating mechanism		Motor driven	Motor	Manual	Manual				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.6.3x	Motor- auxiliary supply voltage	AC,50Hz	230V	230	NA	NA				
3.2.6.4x	Rated power of motor	W			NA	NA				
3.2.6.5	Mechanical & Electrical Interlock between DS & ES	Yes/ No.	Yes	Yes	Yes	Yes				
3.2.7	Accessories in LCC									
3.2.7.1	Voltage presence Contactor	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.2	Other Contactors	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01, A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01,A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.5	Control Circuit DC MCB	Min 01,A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.6	Selection switch (local/neutral/remote)	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.7	Manual closing button	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.8	Manual opening button	Yes/ No	Yes	Yes	Yes	Yes				
3.2.7.9	GFCI service outlet socket	A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.10	Socket MCB	A	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.7.11	Anti-condensation heater inside the operating mechanism cabinet	Yes/ No	Yes	Yes	Yes	Yes				
3.2.17.12	Total heater power	W	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.17.13	Heater- supply voltage	AC,50Hz	230 V	230 V	230 V	230 V				
3.2.17.14	Control Voltage	V.DC	110V	110V	110V					

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
3.2.17.15	Minimum number of available contacts (NO/NC/V)		16NO+16NC	12NO+12NC	8NO+8NC	6NO+6NC				
3.2.17.16	LED Bulb with switch	W								
3.2.17.17	Water-tight corrosion-resistant housing		IP55W	IP55W	IP55W	IP55W				
3.2.17.18	Drive housing Material	AL or Stainless Steel	[Insert]	[Insert]	[Insert]	[Insert]				
3.2.17.19	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	Yes	Yes	Yes				
3.2.17.20	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment	Yes/No	Yes	Yes	Yes	Yes				
3.2.17.21	Whether loss of motor power also drop Control DC power	Yes/No	Yes	Yes	Yes	Yes				
3.2.8	MTBF of DS									
3.3	Rating & Characteristics									
3.3.1	Rated lightning impulse withstand voltage of DS-ES	kVpeak								
	Phase to ground		Insert		Insert					
	Across Isolating Gap		Insert		Insert					

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Between phases		Insert		Insert					
3.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS-ES	kVrms								
	Phase to ground		Insert		Insert					
	Across Isolating Gap		Insert		Insert					
	Between phases		Insert		Insert					
3.3.3	Corona extinction voltage	kV rms	Insert							
3.3.4	Load Switching capability									
	Capacitive Current									
	Cable charging current									
	Small inductive current									
3.3.5	Rated Current	Same as CB								
	Rated Short Time withstand Current		63	50	40	31.5				
	Duration		1s	1s	1s	3s				
	Rated Short Time Peak Withstand Current			130	100	78				
3.3.6	Rated bus-transfer voltage and current									
	Rated Bus-transfer voltage for DS	V	20	20	10	10				
	Rated bus-transfer current	A	1600		1600					
3.3.7	Rated induced current and voltage for grounding switches									
	Electromagnetic coupling									

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	Induced Voltage	kV (rms)	Insert							
	Induced Current	A (rms)	Insert							
	Electrostatic coupling									
	Induced Voltage	kV (rms)	Insert							
	Induced Current	A (rms)	Insert							
3.3.9	DS operation Timings									
	Closing	s								
	Opening	s								
	Earthing	s								
3.3.10	Mechanical Terminal Load									
	Static horizontal force, longitudinal FthA	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static horizontal force, transversal FthB	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Static vertical force Ftv	N	[Insert]	[Insert]	[Insert]	[Insert]				
	Dynamic horizontal force, longitudinal Fwx	N	[Insert]	[Insert]	[Insert]	[Insert]				
3.3.11	Drawings attached									
	GA Drawing with All dimension & clearance clearly marked, Fixing Detail,	Yes/ No	Yes	Yes	Yes	Yes				
	Sectional Drawing of all sides	Yes/ No	Yes	Yes	Yes	Yes				
	Nameplate of DS & ES	Yes/ No	Yes	Yes	Yes	Yes				

No.	Description	Minimum Requirements					Guaranteed by Bidder			
		Unit	Data				Data			
			400kV (N/A)	230kV (N/A)	132kV	33kV	400kV	230kV	132kV	33kV
	LCC & Operating Mechanism Box Equipment Layout Drawing, DS-ES NO/NC Contact Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	HV terminal Drawing ,Earthing Terminal Drawing	Yes/ No	Yes	Yes	Yes	Yes				
	Schematic Drawing of Control Circuit with BoM , make & specification of each item	Yes/ No	Yes	Yes	Yes	Yes				
3.3.12	Quality & FAT/Routine Test Plan Attached	Yes/ No	Yes	Yes	Yes	Yes				
	Overall Compliance with Requirement	Yes/ No	Yes							

Current Transformer 132 kV

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	
1.6	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	132	
2.2	Highest voltage for equipment Un	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV peak	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency fr	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	40	
2.7	Rated dynamic current Idyn	kV peak	100	
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	 800-1600-2400/1 800-1600-2400/1 800-1600-2400/1 800-1600-2400/1 3200/1	
2.10	Accuracy class: I core II core III core IV core V core		 0.2S 0.2S 5P20 5P20 5P20	
2.11	Security factor: I core II core		 Fs=5	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.12	Rated power: I core II core III core IV core V core	 VA VA VA VA VA	10-20 for metering cores 30-60VA for protection cores Calculation is required during design stage	
3.	Current Transformers - Design and Construction			
3.1	Insulator material		Composite/Silicon	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. to IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: Test voltage 1.2*UM/√3 Test voltage UM	 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)			

Voltage Transformer 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Voltage Transformers - General			
1.1	Manufacturer		Insert	
1.2	Type		Capacitive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	132	
2.2	Highest voltage for equipment Un	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV peak	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency fr	Hz	50	
2.8	Rated primary voltage	kV	132/√3	
2.9	High frequency capacitance for entire carrier frequency range		Within 80% to 150% of rated capacitance	
2.10	Rated Voltage Factor		1.2 continuous; 1.5 for 30 seconds	
2.11	Rated total capacitance(pF)		4400, +10% and -5%	
2.12	Standard reference range of frequencies for which the accuracies are valid		97% to 103% for protection 99% to 101% for metering	
2.13	Rated secondary voltage I winding II winding III winding	 V V V	 110/√3 110/√3 110/√3	
2.14	Accuracy class: I winding II winding III winding		 0.2 3P 3P	
2.15	Rated power: I winding II winding III winding	 VA VA VA	 10-20 20-50 20-50 Calculation is required during design	
2.16	Load		Simultaneously	
3.	Voltage Transformers - Design and Construction			
3.1	Insulator material		Composite/Silicon	
3.2	Insulating medium		paper - Mixed dielectric	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Permissible level of partial discharges: Test voltage 1.2*UM/√3 Test voltage UM	 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)			

Post Insulator 132 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, Porcelein/Composite/Silicon, outdoor	
2	Post Insulators – Characteristics			
2.1	Nominal system voltage	kV rms	132	
2.2	Highest voltage for equipment Un	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV peak	650	
2.4	Rated short duration power frequency voltage	kV	275	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5	Rated frequency fr	Hz	50	
2.6	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
2.7	Failing load bending (p0) (C10)	N	≥ 10000	
2.8	Failing load torsion	Nm	≥ 4000	
3	Post Insulators - Design and Construction			
3.1	Insulation material		Composite/Silicon	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	Insulator height	mm	Insert	
3.4	Max. diameter of insulating part	mm	Insert	
3.5	Diameter of upper base	mm	Insert	
3.6	Number of holes on upper base		Insert	
3.7	Diameter distance between holes on upper base	mm	Insert	
3.8	Hole type on upper base		Insert	
3.9	Diameter on lower base	mm	Insert	
3.10	Number of holes on lower base		Insert	
3.11	Diameter distance between holes on lower base	mm	Insert	
3.12	Hole type on lower base		Insert	
3.13	Insulator weight	kg	Insert	
	Overall compliance with the requirements (yes/no)			

Surge Arrester 230 kV & 132kV

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
1	Surge Arresters - General							
1.1	Manufacturer		Insert	Insert	Insert	Insert		
1.2	Type		SM	SM	SM	SM		
1.3	Model designation		Insert	Insert	Insert	Insert		
1.4	Country of origin		Insert	Insert	Insert	Insert		
1.5	Standards		IEC 60099-4	IEC 60099-4	IEC 60099-4	IEC 60099-4		
1.6	Quality control		ISO 9001	ISO 9001	ISO 9001	ISO 9001		
1.7	Design		Metal oxide, gapless, outdoor	Metal oxide, gapless, outdoor	Metal oxide, gapless, outdoor	Metal oxide, gapless, outdoor		
1.8	Short circuit testing authority		Insert authority	Insert authority	Insert authority	Insert authority		

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
1.9	Type Test Report Reference		Insert	Insert	Insert	Insert		
2	Surge Arresters - Characteristics							
2.1	Voltage							
2.1.1	Nominal System Voltage	kV rms	400	230	132	33		
2.1.2	Highest voltage for equipment Um	kV rms	420	245	145	36		
2.1.3	Rated voltage of surge arrester Ur	kV rms	390	198	120	30		
2.1.4	Max. continuous operating voltage Uc	kV rms	312	158	102	24		
2.1.5	Reference Voltage	KVrms	Insert	Insert	Insert	Insert		
2.1.6	Gap between Vref & MCOV	% of MCOV	Insert	Insert	Insert	Insert		
2.1.7	TOV [Curve to be attached]							
	0.1s	pu [of MCOV]	Insert	Insert	Insert	Insert		
	1s	pu [of MCOV]	Insert	Insert	Insert	Insert		
	3s	pu [of MCOV]	Insert	Insert	Insert	Insert		
	10s	pu [of MCOV]	Insert	Insert	Insert	Insert		
2.1.8	Maximum residual voltage Ures							
	For switching impulse current 30/60 µs at 0,5 kA	kV peak	≤ 745	≤ 390	≤ 235	55		
	For switching impulse current 30/60 µs at 1 kA	kV peak	≤ 775	≤ 400	≤ 240	58		
	For switching impulse current 30/60 µs at 2 kA	kV peak	≤ 805	≤ 415	≤ 255	62		
	For lightning impulse current 8/20 µs at 5 kA	kV peak	≤ 862	≤ 455	≤ 280	67		
	For lightning impulse current 8/20 µs at 10 kA	kV peak	≤ 916	≤ 480	≤ 300	72		
	For lightning impulse	kV peak	≤ 990	≤ 535	≤ 320	77		

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
	current 8/20 µs at 20 kA							
2.1.9	Dielectric endurance of arrester housing							
	Lightning impulse withstand voltage of arrester housing up (1.2/50 µs)	kV	Insert	Insert	Insert			
	Power frequency withstand voltage of arrester housing (1 min wet)	kV	Insert	Insert	Insert			
2.1.10	Arrester Protection Margin/level							
	Lightning Impulse Protection Margin/level		Min 1.55	Min 2.2	Min 2.1	Min 2.3		
	Switching Impulse Protection Margin/level		Min 1.3	Min 1.5	Min 1.4	Min 1.4		
	steep current impulse protection Margin/level		Min 1.4	Min 2.0	Min 2.0	Min 2.0		
2.2	Current							
2.2.1	Reference Current	mA	Insert	Insert	Insert	Insert		
2.2.2	Long duration current impulse (2000 µs)	A	≥ 1100	≥ 850	≥ 850	≥ 850		
2.2.3	Nominal discharge current In (8/20 µs)	kA peak	10	10	10	10		
2.2.4	High current impulse of an arrester (4/10 µs)	kA peak	100	100	100	100		
2.3	Others							
2.3.1	Line discharge class	Class	3					
2.3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 8	≥ 7	≥ 6	≥ 6		
2.3.3	Thermal Charge Transfer Rating, Qth	Coulombs	Insert	Insert	Insert	Insert		
2.3.4	Repetitive Charge Transfer Rating, Qrs		Insert	Insert	Insert	Insert		
2.3.5	Rated frequency	Hz	50					

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
2.3.6	Partial Discharge Level	pC	≤ 10	≤ 10	≤ 10			
3	Surge Arresters - Design and Construction							
3.1	Designed Life	Years	30+	Insert	Insert	Insert		
3.2	MTBF		Insert	Insert	Insert	Insert		
3.3	MTTR		Insert	Insert	Insert	Insert		
3.4	Resistor Block							
3.4.1	Diameter	mm	Insert	Insert	Insert	Insert		
3.4.2	No. of ZnO Block in series at One unit	No.	Insert	Insert	Insert	Insert		
3.4.3	No. of separately housed arrester unit	No.						
3.4.4	Housing design							
	Open or Case Design Closed or Wrap Design Hollow Tube Design		Insert	Insert	Insert	Insert		
	Pressure relief device No. & Location		Insert	Insert	Insert	Insert		
	Highest pressure developed during rated discharge current	kPa	Insert	Insert	Insert	Insert		
	Highest pressure developed during rated pressure Relief Class	kPa	Insert	Insert	Insert	Insert		
	Alternate shed housing	Yes/No	Yes	Insert	Insert	Insert		
	Color of housing			Insert	Insert	Insert		
	Material of housing	SIR	Silicone Rubber	Insert	Insert	Insert		
	Volcanizing Technology			Insert	Insert	Insert		
3.4.5	Design Considerations							
	Designed for Ambient Temperature	ºC	-40 to +40	-40 to +40	-40 to +40			
	Solar Radiation	kW/m2	≥1.1	≥1.1	≥1.1			

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
	Altitude	m	1000	1000	1000			
	Frequency of AC Power Supply	Hz	48-62	48-62	48-62			
	Wind Velocity	m/s	≤ 34 m/s	≤ 34 m/s	≤ 34 m/s			
3.4.6	Similar Model that passed Short Circuit Test							
	100% fault current	kA	Insert	Insert	Insert	Insert		
	50% fault current	kA	Insert	Insert	Insert	Insert		
	25% fault current	kA	Insert	Insert	Insert	Insert		
3.6.	Mechanical requirements							
3.6.1	Specified short-term load SSL (Fdyn)	N	Insert	Insert	Insert	Insert		
3.6.2	Specified long-term load SSL (Fstat)	N	Insert	Insert	Insert	Insert		
3.6.3	Maximum cantilever strength	Nm	Insert	Insert	Insert	Insert		
3.6.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	Insert	Insert	Insert		
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	≥ 25 mm/kV	≥ 25 mm/kV	≥ 25 mm/kV		
3.8.	Housing insulating material		Composite/ Silicon	Composite/ Silicon	Composite/ Silicon	Composite/ Silicon		
3.9	Insulating basement			Yes				
3.10	Surge arrester height	mm	Insert	Insert	Insert	Insert		
	Total leakage distance across outer insulator shedding for the complete arrester	mm	Insert	Insert	Insert	Insert		
	Protected leakage distance across outer insulator shedding for the complete arrester	mm	Insert	Insert	Insert	Insert		
	Clearance		Insert					
	phase to earth (from center line)	mm	Insert	Insert	Insert	Insert		

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
	phase to phase (center line to center line)	mm	Insert	Insert	Insert	Insert		
3.11	Surge arrester weight	kg	Insert	Insert	Insert	Insert		
3.12	Voltage distribution ring present	Yes/No	Yes	Yes	Yes	Yes		
3.12.1	Ring Diameter	mm	Insert					
3.14	HV terminal							
3.14.1	Shape		Flat	Flat	Flat	Flat		
3.14.2	Dimension	mm x mm	Min 100 x 100	Min 100 x 100	Min 100 x 100	Min 100 x 100		
3.14.3	Number of holes		Min 4	Min 4	Min 4	Min 4		
3.14.4	Distance between holes	mm x mm	50 x 50	50 x 50	50 x 50	50 x 50		
3.14.5	Material suitable for		Al terminal	Al terminal	Al terminal	Al terminal		
3.15	Arrester Grounding	Yes/No	Yes	Yes	Yes	Yes		
3.16	Surge Counter		Insert	Insert	Insert	Insert		
3.16.1	Manufacturer		Insert	Insert	Insert	Insert		
3.16.2	Type		Insert	Insert	Insert	Insert		
3.16.3	Model designation		Insert	Insert	Insert	Insert		
3.16.4	Country of origin		Insert	Insert	Insert	Insert		
3.16.5	Leakage Current Measurement		Yes	Insert	Insert	Insert		
3.16.5	Range of Measurement	uA-mA	Insert	Insert	Insert	Insert		
3.16.6	Sensitivity of surge counter peak at a wave shape of micro sec		Insert	Insert	Insert	Insert		
3.16.7	Minimum counted Surge Ampere		Insert	Insert	Insert	Insert		
3.16.8	Error		Insert	Insert	Insert	Insert		
3.16.9	Grounding of Counter		Insert	Insert	Insert	Insert		
	Separate Insulated (from Counter housing) terminal at bottom of Counter		Insert	Insert	Insert	Insert		
	Separate Insulated (from Counter housing) terminal at		Insert	Insert	Insert	Insert		

No.	Description	Minimum Requirements					Guaranteed	
		Unit	Data				Data	
			400 (N/A)	230	132	33	400	230
	top of Counter							
	Counter Body Earthing		Insert	Insert	Insert	Insert		
	Earthing Conductor Material		Copper	Copper	Copper	Insert		
	Conductor Size	mm2	Insert	Insert	Insert	Insert		
	Conductor Insulation		Insert	Insert	Insert	Insert		
3.16.10	Short Circuit Test of Counter		Yes	Yes	Yes	Yes		
3.16.10.1	Test Authority		Insert	Insert	Insert	Insert		
4	Drawings							
4.1	GA Drawing with All dimension & clearance clearly marked		Yes	Yes	Yes	Yes		
4.2	Sectional Drawing to show internal blocks, PRD etc.		Yes	Yes	Yes	Yes		
4.3	HV terminal Drawing		Yes	Yes	Yes	Yes		
4.4	Surge Counter Drawing		Yes	Yes	Yes	Yes		
4.5	Surge Counter installation Drawing		Yes	Yes	Yes	Yes		
4.6	Earthing Terminal Drawing		Yes	Yes	Yes	Yes		
4.7	Quality & FAT/Routine Test Plan Attached		Yes	Yes	Yes	Yes		
Overall compliance with the requirements (yes/no)								

4.2.2 Part 2: GIS Switchgear

GIS Switchgear 230kV & 132kV

SL	Type of SS	Associated Voltage level	Transformer Size	Remarks
	A	400/230kV	1000MVA & 750MVA	Only Contains Two voltage levels for Power Transmission: 400kV & 230kV. There will be 33kV voltage level for station Power only.
	B	400/132kV	520MVA , 325MVA,	Only Contains Two voltage levels for Power Transmission: 400kV & 132kV. There will be 33kV voltage level for station Power only.
		230/132kV	450MVA, 350MVA, 300MVA	Only Contains Two voltage levels for Power Transmission: 230kV & 132kV. There will be 33kV voltage level for station Power only.
3.	C	230/33kV	140MVA	Only Contains Two voltage levels for Power Transmission & Distribution: 230kV & 33kV. Station Power will be taken from 33kV Bus through Delta Wye-station transformer.
	D	132/33kV	120MVA	Only Contains Two voltage levels for Power Transmission & Distribution: 132kV & 33kV. Station Power will be taken from 33kV Bus through Delta Wye-station transformer.

Guaranteed Technical Particulars (GTP) for GIS [132kV & 230kV]

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.	General Information & Rating					
1.1.1	Manufacturer					
1.1.2	Type		Indoor	Indoor		
1.1.3	Model designation		Insert	Insert		
1.1.4	Country of Make					
1.1.5	Designed Lifetime	Years	Min 50	Min 50		
1.1.5.1	MTBF		Insert	Insert		
1.1.5.2	MTTR		Insert			
1.1.6	Nominal system voltage	kV rms	132	230		
1.1.6.1	Highest voltage for equipment Un	kV rms	145	245		
1.1.7	Rated lightning impulse [2/50 µs] withstand voltage	kV peak	650	1050		
1.1.7.1	Rated Switching impulse [500/2500 µs] withstand voltage	kV peak	NA	NA		
1.1.8	Rated short duration power frequency Voltage					
1.1.8.1	For New Equipment	kV, 1 min	275	450		
1.1.8.2	For Equipment in Service [Manufacturer to Recommend the data]					
1.1.8.2.1	After 5 years	kV, 1 min	[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.1.8.2.2	After 10 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.3	After 20 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.4	After 30 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.5	After 40 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.6	After 50 years	kV, 1 min	[Insert]	[Insert]		
1.1.9	Rated frequency fr	Hz	50	50		
1.1.10	Rated current Ir					
1.1.10.1	Busbars	A	≥ 3150	≥4000		
1.1.10.2	Line bay	A	≥ 1600A	≥ 3150A		
1.1.10.3	Transformer bay	A	NA	≥ 3150 [For 140MVA transformer]		
		A	≥ 1600 [For 120MVA transformer]	NA		
1.1.10.4	Bus Coupler bay	A	≥ 3150	≥ 4000		
1.1.10.5	Bus Section bay	A	≥ 3150	≥ 4000		
1.1.10.6	Maintenance Bus Section bay					
1.1.11	Rated short-circuit breaking current Isc	kA rms	≥ 40/50 [As per sch. A]	50		
1.1.12	Duration of short-circuit	s	≥ 3	≥ 3		
1.1.13	Rated peak withstand current Ip (equal short-circuit making current)	kA	≥ 100/125	≥ 125		
1.1.14	Control & Auxiliary Voltage					
1.1.14.1	Control voltage	V. DC	110	110		
1.1.14.2	Motor - auxiliary supply voltage	V. AC, Hz	230,50	230,50		
1.1.14.3	Motor Rated Current / Starting current	A/A	Insert	Insert		
1.1.14.4	Heater supply voltage	V. Hz	230, 50	230, 50		
1.2	Design & Construction					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.2.1	Type of busbars	-	Double, sectionalize	Double, sectionalize		
1.2.2	Enclosure					
1.2.2.1	Material		Al	Al		
12.2	Diameter	mm	[Insert]	[Insert]		
1.2.2.2	Enclosure Design Type	1/3Phase	3Phase	1p/3p		
1.2.2.2.1	Busbar		3Phase	1p/3p		
1.2.2.2.2	Bay		3Phase	1p/3p		
1.2.2.2.3	Feeder Connection		3Phase	1p/3p		
1.2.2.3	Enclosure Construction	Continuous/Non-continuous	Continuous	Continuous		
1.2.2.3.1	Discontinuity in Enclosure	Mention locations	[Insert]	[Insert]		
1.2.2.4	Temperature at RCCR [Rated Continuous Current Rating]	Deg C	[Insert]	[Insert]		
1.2.2.5	Connection to adjacent enclosures	Bolted/other (mention)	[Insert]	[Insert]		
1.2.2.5.1	Bellows/ Compensators between enclosures	Yes/No	Yes	Yes		
1.2.2.5.2	Location		[Insert]	[Insert]		
1.2.2.5.3	Electrical segregation		[Insert]	[Insert]		
1.2.2.6	Shunting varistor	Yes/No	Yes	Yes		
1.2.2.7	Induced current in Enclosure in Percent of Rated current					
1.2.2.7.1	Busbar	% Ir	[Insert]	[Insert]		
1.2.2.7.2	Line bay	% Ir	[Insert]	[Insert]		
1.2.2.7.3	Transformer bay	% Ir	[Insert]	[Insert]		
1.2.2.7.4	Bus Coupler	% Ir	[Insert]	[Insert]		
1.2.2.7.5	Bus section	% Ir	[Insert]	[Insert]		
1.2.2.8	Grounding Philosophy					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.2.2.8.1	Proposed Grounding Locations with readily accessible connectors		[Insert]	[Insert]		
1.2.2.8.2	Size of Grounding Conductor at each location		[Insert]	[Insert]		
1.2.2.8.3	Sufficient mechanical strength to withstand electromagnetic forces and normal abuse	Yes/No	Yes	Yes		
1.2.2.8.4	Manufacturer to provide Main Grounding Bus	Yes/No	Yes	Yes		
1.2.2.8.5	Subassembly-to-subassembly bonding	Yes/No	Yes	Yes		
1.2.2.8.6	Grounding of GIS-to-Cable Termination ---- Separate	Yes/No	Yes	Yes		
1.2.2.8.7	Recommendation by Manufacturer for proper procedures of Grounding connections during execution	Yes/No	Yes	Yes		
1.2.2.9	Gas-Tight Seals	Years	Min 50			
1.2.3	Conductor					
1.2.3.1	Material		Al	Al		
1.2.3.2	Diameter	mm	[Insert]	[Insert]		
1.2.3.3	Temperature at RCCR [Rated Continuous Current Rating]	Deg C	[Insert]	[Insert]		
1.2.3.4	Connection type	Removable/Fixed/ bolted-type/ Spring Loaded	[Insert]	[Insert]		
1.2.3.4.1	Connection has prevention of particle generation	Yes/No	Yes	Yes		
1.2.3.5	Length of maximum section	mm	[Insert]	[Insert]		
1.2.3.6	No. of support insulator in maximum section	No.	[Insert]	[Insert]		
1.2.3.7	Support insulator					
1.2.3.7.1	Three phase/Single phase	1p/3p	[Insert]	[Insert]		
1.2.3.8	Time required for 1p fault to convert into 3p fault	ms	[Insert]	[Insert]		
1.2.4	Access for operations and maintenance [Access to all viewports, gas sample ports, density monitors etc]	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.2.5	Moveable ladders or platforms	Yes/No	Yes	Yes		
1.2.6	Bus expansion joints		At both end			
1.2.7	Interface Points Design					
1.2.7.1	Busbar Enclosure	Bolted/Welded flange design	Bolted			
1.2.7.2	Busbar conductor	Bolted/Sliding design	Insert			
1.2.8	Expansion Modules					
1. 2.8.1	At both end of busbar		Yes			
1. 2.8.2	Isolating Distance Arrangement at Extension module		Yes			
1.2.9	Gas zones					
1.2.9.1	No of independent Gas zones in each bay & associated Busbar	No.	[Insert]	[Insert]		
1.2.9.2	No of Gas compartments in each bay & associated Busbar	No.	[Insert]	[Insert]		
1.2.9.3	Desiccant material for absorption of water vapor and gaseous breakdown products in each switching compartments	Yes/No	Yes	Yes		
1.2.9.4	Gas Partitions/ Compartment and Separate Gas Buffer Zone for MRE requirement		Yes	Yes		
1.2.9.4.1	Separate Gas Buffer Zone for MRE requirement at Following locations					
1.2.9.4.1.1	At Busbar side of CB		Yes	Yes		
12.9.4.1.2	At Busbar for maintenance		After each Bay section	After each Bay section		
1.2.9.4.1.3	At Busbar end for expansion		At Both end	At Both end		
1.2.9.4.2	Gas Partitions/ Compartment at Following locations					
1. 2.9.4.2.1	CB		Yes	Yes		
1. 2.9.4.2.2	Maintenance DS-ES		As per Design	As per Design		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1. 2.9.4.2. 3	Bubar DS-ES		Yes	Yes		
1. 2.9.4.2. 4	CT		No, integrated in CB zone	No, integrated in CB zone		
1. 2.9.4.2. 5	Feeder VT/ Bus VT		As per Design	As per Design		
1. 2.9.4.2. 6	HSES		As per Design	As per Design		
1. 2.9.4.2. 7	Cable joining terminal		Yes	Yes		
1.2.10	Rated pressure at each compartment					
1.2.10. 1	CB +CT	MPa	[Insert]	[Insert]		
1.2.10. 2	Busbar DS -ES	MPa	[Insert]	[Insert]		
1.2.10. 3	Line DS -ES	MPa	[Insert]	[Insert]		
1.2.104	Bus compartment	MPa	[Insert]	[Insert]		
1.2.10. 5	VT	MPa	[Insert]	[Insert]		
1.2.10. 6	FES	MPa	[Insert]	[Insert]		
1.2.11	Pressure Coordination inside partitions at following sequence [High to Low]					
1.2.11. a	Bursting pressure		Yes	Yes		
1.2.11. b	Type test pressure					
1.2.11. c	Routine test pressure					
1.2.11. d	Design pressure					
1.2.11. e	Rated filling pressure					
1.2.11.f	Alarm pressure					
1.2.11. g	Minimum functional pressure					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.2.12	Accessories in Each gas Compartment					
1.2.12.1	Density sensor		Yes/make	Yes/make		
1.2.12.1.1	Temperature correction		Yes	Yes		
1.2.12.1.2	Digital		Yes	Yes		
1.2.12.1.3	Sensor at same temp. as Enclosure		Yes	Yes		
1.2.12.2	SF6 Valve		Yes/make	Yes/make		
1.2.12.3	Moisture absorber		Yes/make	Yes/make		
1.2.12.3.1	Adsorption surface		20-800 sq. m/g	20-800 sq. m/g		
1.2.12.3.2	Adsorption ratio		10-20% by mass	10-20% by mass		
1.2.12.4	Pressure relief Device		Yes/make	Yes/make		
1.2.12.4.1	Heat-resistant deflectors		Yes	Yes		
1.2.12.4.2	Location in Gas Compartment		Opposite to Personnel access	Opposite to Personnel access		
1.2.13	PD Monitoring		Yes	Yes		
1.2.13.1	Internal PD terminal		Yes	Yes		
1.12.13.2	PD Detection Method Employed	UHF/Optical/Ultrasonic/Pulse Current/ Chemical	UHF	UHF		
1.2.13.3	Type		Offline Externally	Offline Externally		
1.2.14	Bus section CB for MRE [only required if there is no. Bus section CB as per cope of work/requirement/BoQ]		In Live Bus (during Maintenance) only	In Live Bus (during Maintenance) only		
1.2.14.1	CT (at Both side)		Yes	Yes		
1.2.14.2	DS-ES (at Both side)		Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
1.2.15	Viewport	For each DS , ES & FES	[Insert]	[Insert]		
1.2.16.1	GIS Nameplate as per IEEE		Yes	Yes		
1.2.16.2	GIS Gas SLD as per IEEE		Yes	Yes		
1.2.17	Allowable maximum temperature and allowable temperature rise					
1.2.17.1	Allowable maximum temperature					
1.2.17.1.1	Points contacted during routine operation and inspection specifically the local control cabinet	°C	[Insert]	[Insert]		
1.2.17.1.2	Which are expected to be contacted in normal operation and routine maintenance	°C	[Insert]	[Insert]		
1.2.17.1.3	Which need not to be contacted in normal operation	°C	[Insert]	[Insert]		
1.2.17.2	Allowable Temperature Rise					
1.2.17.2.1	Points contacted during routine operation and inspection specifically the local control cabinet		[Insert]	[Insert]		
1.2.17.2.2	Which are expected to be contacted in normal operation and routine maintenance		[Insert]	[Insert]		
1.2.17.2.3	Which need not to be contacted in normal operation		[Insert]	[Insert]		
1.2.18	Endoscope		2 No.'s for whole SS	2 No.'s for whole SS		
2.0	Circuit Beaker					
2.1	General					
2.1.1	Manufacturer		[Insert]	[Insert]		
2.1.2	Country of Make		[Insert]	[Insert]		
2.1.3	Model		[Insert]	[Insert]		
2.1.4	Type of circuit breaker		GIS , Indoor	GIS , Indoor		
2.1.5	Isolating and quenching medium		Same as GIS	Same as GIS		
2.2	Design & Construction					
2.2.1	Interrupter Design		Single breaking	Single breaking		
2.2.2	Operating mechanism		Motor-wound spring	Motor-wound spring		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.2.3	Rated operating sequence		O-0.3 s-CO- 3 min-CO			
2.2.4	Number of operating mechanisms per circuit breaker					
	Line bay	pcs.	As per design	3		
	Transformer bay	pcs.	1	1		
	Bus Coupler bay	pcs.	1	1		
	Bus section Bay	pcs.	1	1		
2.2.5	Auto reclosing					
	Line bay		1p+3p	1p+3p		
	Transformer bay		3p	3p		
2.2.6	Number of successive auto-Reclosing operations without derating		Insert	Insert		
2.2.7	Rated supply pressure of gas for interruption					
	Maximum	MPa (g)	Insert	Insert		
	Normal	MPa (g)	Insert	Insert		
	Minimum	MPa (g)	Insert	Insert		
	Low Pressure Alarm	MPa (g)	Insert	Insert		
	Lockout Alarm	MPa (g)	Insert	Insert		
2.2.8	Limits for correct operation					
	Max	MPa (g)	Insert	Insert		
	Normal	MPa (g)	Insert	Insert		
	min	MPa (g)	Insert	Insert		
	Maximum pressure rise in circuit breakers due to the making or breaking of rated current		Insert			
2.2.9	Is lockout facility fitted?	Yes/No	Yes	Yes		
2.2.9.1	Whether Lockout will trip CB	Yes/No	No	No		
2.2.10	Trip free/or fixed trip		Trip Free	Trip Free		
2.2.11	Is circuit-breaker re-strike free	Yes/No	Yes	Yes		
2.2.12	Restrike performance during capacitive current switching	Class	C2	C2		
2.2.13	Number of operations without maintenance					
	CO at no-load		≥ 10000	≥ 10000		
	CO at rated current		≥ 2500	≥ 2500		
	CO at rated breaking current Isc		≥ 8	≥ 8		
	Curve for above attached to CB		Yes	Yes		
2.2.14	The frequency of mechanical operations	Class	M2	M2		
2.2.15	Rated electrical endurance	Class	Min E1	Min E1		
2.2.16	Interrupter					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.2.16.1	No. of Interrupter		01	01		
2.2.16.2	Type	Self-Blast/Puffer	Auto-Puffer	Auto-Puffer		
2.2.16.3	Model Designation		[Insert]	[Insert]		
2.2.16.4	Material of Male-Female part		[Insert]	[Insert]		
2.2.16.5	Length of each break	mm	[Insert]	[Insert]		
2.2.16.6	Length of stroke	mm	Insert	[Insert]		
2.2.17.1	Type		Motor Wound Spring	Motor Wound Spring		
2.2.17.2	Make		[Insert]	[Insert]		
2.2.17.3	Country of Manufacturer		[Insert]	[Insert]		
2.2.17.4	Model Designation		[Insert]	[Insert]		
2.2.17.5	Motor - auxiliary supply voltage	V. AC	[Insert]	[Insert]		
2.2.17.6	Rated power of motor	W	Insert	[Insert]		
2.2.17.7	Current required at rated supply voltage to open circuit-breaker	A	Insert	[Insert]		
2.2.17.8	Number of making coils	pcs.	1	1		
2.2.17.8.1	Rated Operating Voltage	V.DC	110	110		
2.2.17.8.2	Power	W	[Insert]	[Insert]		
2.2.17.9	Number of breaking coils	pcs.	2	2		
2.2.17.9.1	Rated Operating Voltage	V.DC	110	110		
2.2.17.9.2	Power	W	[Insert]	[Insert]		
2.2.17.10	Minimum number of available contacts (NO/NC)		12NO+12NC	16NO+16NC		
2.2.17.11	Hearer & No.		Yes- Min 1	Yes- Min 1		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.2.17.11.1	Rated Voltage	V.AC/50HZ	230V	230V		
2.2.17.11.2	Power	W	[Insert]	[Insert]		
2.2.17.12	Operating mechanism material		[Insert]	[Insert]		
2.2.17.13	Water-tight corrosion-resistant housing		AL	AL		
2.2.17.14	A crank for manual spring loading	Yes/No	Yes	Yes		
2.2.17.15	Whether there is provision for manual spring charging. (in case of hydraulic manual operation, to build oil pressure)	Yes/No	Yes	Yes		
2.2.17.16	Whether facility to close / open the CB manually in the Absence of DC control supply to the operating mechanism	Yes/No	Yes	Yes		
2.2.17.17	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	Yes		
2.2.17.18	Whether anti pumping facility is provided in the Circuit breaker mechanism	Yes/No	Yes	Yes		
2.2.17.19	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	Insert		
2.2.17.20	Number of close-open operations possible without recharging		O-CO	O-CO		
2.2.17.21	Emergency Trip Switch	Yes/No	Yes	Yes		
2.2.17.22	MTBF of CB		Insert	Insert		
2.2.17.23	MTTR of CB		Insert	Insert		
2.3	Characteristics & Performance					
2.3.1	Voltage					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.3.1.1	Rated lightning impulse withstand voltage	kVpeak				
	Phase to ground		Insert	Insert		
	Across interrupting chamber		Insert	Insert		
	Between phases		Insert	Insert		
2.3.1.2	Rated Power frequency withstand voltage (dry), 1 minute	kVrms				
	Phase to ground		Insert	Insert		
	Across interrupting chamber		Insert	Insert		
	Between phases		Insert	Insert		
2.3.1.3	Maximum TRV (transient recovery voltage) withstand capability of the CB					
a.1	During Opening of Fault , T100	kV	[Insert]	[Insert]		
a.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
b.1	During Opening of Cable	kV	[Insert]	[Insert]		
b.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
c.1	During Opening of capacitor bank	kV	[Insert]	[Insert]		
c.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
d.1	During Opening of line	kV	[Insert]	[Insert]		
d.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
e.1	During Opening of Transformer	kV	[Insert]	[Insert]		
e.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
f.1	During Opening of Reactor	kV	[Insert]	[Insert]		
f.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
g.1	Maximum switching surge per unit value	p.u	[Insert]	[Insert]		
2.3.1.4	Corona extinction voltage with CB open or close	kV rms	[Insert]	[Insert]		
2.3.1.5	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/√3)	μV	[Insert]	[Insert]		
2.3.1.6	First-pole-to-clear factor					
	Terminal fault		1.3	1.3		
	Short-line fault		1.0	1.0		
	Out-of-phase		2.0	2.0		
2.3.2	Ampacity Rating					
2.3.2.1	Rated Current	A				
	Line Bay	A	State As scope	State As scope		
	Transformer Bay	A	State As scope	State As scope		
	Bus Coupler Bay	A	State As scope	State As scope		
	Bus Section Bay	A	State As scope	State As scope		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.3.2.2	Rated short-circuit breaking currents, Isc (equal to short circuit withstand/making current):	kA rms				
	Three phase Symmetrical breaking currents	kA rms	40	50		
	Three phase Asymmetrical breaking currents	kA rms	[Insert]	[Insert]		
	Single phase Symmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]		
	Single phase Asymmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]		
2.3.2.3	D.C. component of the rated short-circuit breaking current	%	> 45	> 45		
2.3.2.4	Rated short-time withstand currents, Ith					
	Three phase	kA,3s	> 100/125	> 125		
	Single phase	kA,3s	[Insert]	[Insert]		
2.3.2.5	Rated short line fault breaking current capability					
a)	Percentage of rated breaking current	%	Insert	Insert		
b)	Surge Impedance	Ohms	Insert	Insert		
c)	Amplitude factor		Insert	Insert		
d)	Critical percentage of rated breaking current	%	Insert	Insert		
e)	Maximum arc duration	ms	Insert	Insert		
2.3.2.6	Rated capacitive switching capability (breaking currents):					
	Line charging	A rms	Insert	Insert		
	Cable charging	A rms	Insert	Insert		
	Capacitor Bank breaking current	A rms	Insert	Insert		
2.3.2.7	Rated inductive switching/ breaking capability:	A	Insert	Insert		
2.3.3	Timing Performance					
2.3.3.1	Maximum total break time (trip initiation to final arc extinction) (3.7.135 acc. to IEC 62271-100)	ms	60	60		
2.3.3.2	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	20 ± 5		
2.3.3.3	Opening time (trip initiation to contact separation)					
	Without current	ms	[Insert]	[Insert]		
	With 100 % rated current	ms	[Insert]	[Insert]		
	With 100 % rated breaking current	ms	[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.3.3.4	Closing time					
	Without current	ms	[Insert]	[Insert]		
	With 100 % rated current	ms	[Insert]	[Insert]		
	With 100 % rated breaking current	ms	[Insert]	[Insert]		
2.3.3.5	Maximum time interval between opening interrupters between first & last phases	ms	[Insert]	[Insert]		
2.3.3.6	Maximum time interval between opening of interrupters in same phases		NA	NA		
2.3.3.7	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	Insert	[Insert]		
2.3.3.8	Mechanical time staggering in Gang Pole CB					
	First-to-Second phase	ms	Insert	Insert		
	Second-to-Third Phase	ms	Insert	Insert		
2.3.3.9	Minimum time for auto reclosing (dead time)					
	Single phase	ms	insert	Insert		
	Three Phase	ms	insert	Insert		
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	[Insert]		
2.3.3.11	Force					
	Dynamic horizontal force, longitudinal Fwx	N	Insert	[Insert]		
	Dynamic horizontal force, transversal	N	Insert	[Insert]		
2.4	Accessories in central control panel/ LCC					
2.4.1	Anti-pumping relay	Yes/No	Yes	Yes		
2.4.2	Local/remote control selector switch	Yes/No	Yes	Yes		
2.4.3	Single Pole/Gang operation switch	Yes/No	Yes	Yes		
2.4.4	Local operation push buttons	Yes/No	Yes	Yes		
2.4.5	Minimum pressure lock-out and alarm relays	Yes/No	Yes	Yes		
2.4.6	Operation counter	Yes/No	Yes	Yes		
2.4.7	DC MCB for Control Circuit	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
2.4.7.1	NO/NC Contact in MCB for signaling	Min 02	Insert	Insert		
2.4.8	AC MCB	Yes/No	Yes	Yes		
2.4.8.1	NO/NC Contact in MCB for signaling					
2.4.9	Service outlet socket	Min 01, 10A	Insert	Insert		
2.4.10	Cu -earthing rails inside control cabinet	Yes/No	Yes	Yes		
2.4.11	Detachable plates, the bottom of control cabinet	Yes/No	Yes	Yes		
2.4.12	Set of cables for connection of operating mechanism and central control panel of circuit breaker	Yes/No	Yes	Yes		
2.4.13	Time phase discrepancy relay	Yes/No	Yes	Yes		
2.4.14	Weatherproof, corrosion resistance enclosure		IP55/ IP66W for outdoor	IP55		
2.4.15	Enclosure Material		Al or stainless steel	Al or stainless steel		
3	Disconnect Switch					
3.1	General					
3.1.1	Manufacturer		[Insert]	[Insert]		
3.1.2	Country of Make		[Insert]	[Insert]		
3.1.3	Model Designation		[Insert]	[Insert]		
3.1.4	Type		GIS / Indoor	GIS / Indoor		
3.2	Design & Construction					
3.2.1	Type of Disconnector					
	Three pole, three position (close/open/earthed), motor operated, insulated, with earthing switch		Yes	Yes		
	Three pole, make-proof, motor operated earthing switch with operating mechanism		Yes	Yes		
	Three pole, Disconnector Link with earthing switch , hand operated		Yes	Yes		
3.2.2	Number of poles	pcs.	03	03		
3.2.3	Number of breaks per pole	pcs	01	01		
3.2.4	Type of Contacts					
	DS-ES		[Insert]	[Insert]		
	HSES		[Insert]	[Insert]		
3.2.5	Material of contact surfaces					
	DS-ES		[Insert]	[Insert]		
	HSES		[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
3.2.6	Operating Mechanism & Drive Box					
3.2.6.1	Number of operating mechanism	pcs.	01	As per Design		
3.2.6.2	Type of operating mechanism					
	Three position		Motor driven	Motor driven		
	Make-proof		Motor-wound spring	Motor-wound spring		
	Disconnector Link		Manual/lever	Manual/lever		
3.2.6.3	Motor- auxiliary supply voltage	DC/AC	[Insert]	[Insert]		
3.2.6.4	Rated power of motor					
	Three position	W	[Insert]	[Insert]		
	Make-proof	W	[Insert]	[Insert]		
3.2.6.5	Anti-condensation heater inside the operating mechanism cabinet					
3.2.6.5.1	Total heater power	W	[Insert]	[Insert]		
3.2.6.5.2	Heater- supply voltage		230 V, 50 Hz	230 V, 50 Hz		
3.2.6.6	Control Voltage	V.DC	110V	110V		
3.2.6.7	Minimum number of available contacts (NO/NC/V)		12NO+12NC	16NO+16NC		
3.2.6.8	Water-tight corrosion-resistant housing		IP55/ IP66W for outdoor	IP55		
3.2.6.9	Drive housing Material		AL or Stainless Steel	AL or Stainless Steel		
3.2.6.10	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	Yes		
3.2.6.11	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment		Yes	Yes		
3.2.7	Accessories in LCC for DS					
3.2.7.1	Voltage presence Contactor	Yes/No	Yes	Yes		
3.2.7.2	Other Contactors	Yes/No	Yes	Yes		
3.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01	[Insert]	[Insert]		
3.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01	[Insert]	[Insert]		
3.2.7.5	Control Circuit DC MCB	Min 01	[Insert]	[Insert]		
3.2.7.6	Selection switch (local/neutral/remote)	Yes/No	Yes	Yes		
3.2.7.7	Manual closing button	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
3.2.7.8	Manual opening button	Yes/No	Yes	Yes		
3.2.8	MTBF of DS		[Insert]	[Insert]		
3.2.8.1	MTBF of HSES		[Insert]	[Insert]		
3.2.9	MTTR of DS		[Insert]	[Insert]		
3.2.9.1	MTTR of HSES		[Insert]	[Insert]		
3.3	Rating & Characteristics					
3.3.1	Rated lightning impulse withstand voltage of DS-ES/HSES	kVpeak				
	Phase to ground		Insert	Insert		
	Across Isolating Gap		Insert	Insert		
	Between phases		Insert	Insert		
3.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS-ES/HSES	kVrms				
	Phase to ground		Insert	Insert		
	Across Isolating Gap		Insert	Insert		
	Between phases		Insert	Insert		
3.3.3	Corona extinction voltage	kV rms	Insert			
3.3.4	Load Switching capability					
	Capacitive Current	A	[Insert]	[Insert]		
	Cable charging current	A	[Insert]	[Insert]		
	Small inductive current	A	[Insert]	[Insert]		
3.3.5	Rated Current	A	Same as GIS/CB	Same as GIS/CB		
3.3.6	Rated Short Circuit Withstand current	kA	Same as CB	Same as CB		
3.3.7	Rated bus-transfer voltage and current					
	Rated Bus-transfer voltage for DS	V	10	20		
	Rated bus-transfer current	A	1600	1600		
3.3.8	Rated induced current and voltage for grounding switches					
	Electromagnetic coupling					
	Induced Voltage	kV (rms)	[Insert]	[Insert]		
	Induced Current	A (rms)	[Insert]	[Insert]		
	Electrostatic coupling					
	Induced Voltage	kV (rms)	[Insert]	[Insert]		
	Induced Current	A (rms)	[Insert]	[Insert]		
3.3.9	FES special rating					
	Closing time	ms	As per Design	As per Design		
	Opening time	ms	As per Design	As per Design		
	No. of closing operation without Maintenance	No.	Min 02	Min 02		
3.3.10	Maintenance DS-ES Timings					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Closing	s	[Insert]	[Insert]		
	Opening	s	[Insert]	[Insert]		
	Earthing	s	[Insert]	[Insert]		
4.	Current Transformer					
4.1	General					
4.1.1	Manufacturer		[Insert]	[Insert]		
4.1.2	Country of Manufacture		[Insert]	[Insert]		
4.1.3	Model Designation		[Insert]	[Insert]		
4.1.4	Type		Toroidal-ring-type/ As per Design	Toroidal-ring-type/ As per Design		
4.2	Design & Construction					
4.2.1	Location of Primary winding in GIS- External/Internal to GIS		[Insert]	[Insert]		
4.2.2	Location of Primary in GIS- External/Internal to GIS		[Insert]	[Insert]		
4.2.3	Method of Voltage control		[Insert]	[Insert]		
4.2.4	Pressure adjustment for dynamic condition like Short circuit		[Insert]	[Insert]		
4.2.5	Maintenance Free		Yes	Yes		
4.2.6	Secondary terminal Box		Yes	Yes		
4.2.6.1	Shorting link		Yes	Yes		
4.2.6.2	Earthing link		Yes	Yes		
4.2.7	Two CT in each side of CB		No	Yes		
4.2.8	No. of cores in Each CT					
	Feeder CT					
	Bus side CT		NA	03		
	Feeder side CT		05	03		
	Bus Coupler CT					
	BB 01		02	02		
	BB 02		02	03		
	Bus section CT					
	BB section-01		02	02		
	BB section-02		02	03		
4.3	Ratings					
4.3.1	Accuracy class:					
4.3.1.1	Feeder CT					
	Bus side CT					
	Core- I		NA	Protection/5P20		
	Core- II		NA	Protection/5P20		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Core- III		NA	Protection/5P20		
	Core- IV		NA	NA		
	Feeder side CT					
	Core- I		Metering/0.2S	Metering/0.2S		
	Core- II		Metering/0.2S	Metering/0.2S		
	Core- III		Protection /5P20	Protection/5P20		
	Core- IV		Protection /5P20	NA		
	Core- V		Protection /5P20	NA		
4.3.1.2	Bus Coupler CT					
	BB 01 side					
	Core- I		Protection /5P20	Measuring/0.2s		
	Core- II		Protection /5P20	Protection /5P20		
	BB 02 side					
	Core- I		Measuring/0.2s	Protection /5P20		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
4.3.1.3	Bus section CT					
	BB section-01 side					
	Core- I		Protection /5P20	Measuring/0.2s		
	Core- II		Protection /5P20	Protection /5P20		
	BB section-02 side					
	Core- I		Measuring/0.2s	Protection /5P20		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
4.3.2	Protection class CT core Allocation					
4.3.2.1	Feeder CT					
	Bus side CT					
	Core- I		Main-1 Protection	Main-1 Protection		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Core- II		Main-2 Protection/	Main-2 Protection/		
	Core- III		Metering, BCU	DFDR		
	Core- IV		Metering,			
	Core- V		BBP			
	Feeder side CT					
	Core- I		Metering, BCU	Metering, BCU		
	Core- II		Metering	Metering,		
	Core- III		Main-1 Protection	BBP		
	Core- IV		Back-up Protection//DFDR	NA		
	Core- V		BBP	NA		
4.3.2.2	Bus Coupler CT					
	BB 01 side					
	Core- I		BBP	Metering		
	Core- II		OC	BBP		
	BB 02 side					
	Core- I		Metering	Metering		
	Core- II		BBP	BBP		
	Core-III		NA	OC		
4.3.2.3	Bus section CT					
	BB section-01 side					
	Core- II		BBP	Metering		
			OC	BBP		
	BB section-02 side					
	Core- I		Metering	Metering		
	Core- II		BBP	BBP		
	Core-III		NA	OC		
4.3.3	Ampacity & Burden					
4.3.3.1	Bay/Feeder CT					
	Bus side CT-Transformer Bay					
	Core- I	A, VA	NA	600-1200-2400,30-60VA		
	Core- II	A, VA	NA	600-1200-2400,30-60VA		
	Core- III	A, VA	NA	600-1200-2400,30-60VA		
	Core- IV	A, VA	NA	NA		
	Feeder side CT-Transformer Bay					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Core- I	A, VA	800-1600-2400,30-60VA	600-1200-2400,15 VA		
	Core- II	A, VA	800-1600-2400,30-60VA	600-1200-2400,15 VA		
	Core- III	A, VA	800-1600-2400,30-15VA	600-1200-2400,30-60VA		
	Core- IV	A, VA	800-1600-2400,30-15VA	NA		
	Core- V	A, VA	800-1600-2400,30-60VA	NA		
	Bus side CT-Line Bay					
	Core- I	A, VA	800-1600-2400,30-60VA	800-1600-3200,30-60VA		
	Core- II	A, VA	800-1600-2400,30-60VA	800-1600-3200,30-60VA		
	Core- III	A, VA	800-1600-2400,30-15VA	800-1600-3200,30-60VA		
	Core- IV	A, VA	800-1600-2400,30-15VA	NA		
	Core- V		800-1600-2400,30-60VA			
	Feeder side CT-Line Bay					
	Core- I	A, VA	NA	800-1600-3200,15 VA		
	Core- II	A, VA	NA	800-1600-3200,15 VA		
	Core- III	A, VA	NA	800-1600-3200,30-60VA		
4.3.3.2	Bus Coupler CT					
	BB 01 side					
	Core- I	A, VA	1600-3200, 30-60VA	2000-4000, 15VA		
	Core- II	A, VA	1600-3200, 30-60VA	2000-4000,, 30-60VA		
	BB 02 side					
	Core- I	A, VA	1600-3200, 15VA	2000-4000, 15VA		
	Core- II	A, VA	1600-3200, 30-60VA	2000-4000, 30-60VA		
	Core-III	A, VA	NA	2000-4000, 30-60VA		
4.3.3.3	Bus section CT					
	BB section-01 side					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Core- I	A, VA	1600-3200, 30-60VA	2000-4000, 15VA		
	Core- II	A, VA	1600-3200, 30-60VA	2000-4000,, 30-60VA		
	BB section-02 side					
	Core- I	A, VA	1600-3200, 15VA	2000-4000, 15VA		
	Core- II	A, VA	1600-3200, 30-60VA	2000-4000, 30-60VA		
	Core-III	A,VA	NA	2000-4000, 30-60VA		
Burden rating of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design during execution to prove the adequacy of the Burden proposed, which will be subject of the PGCB's approval. If required by design calculation, higher burden CT shall be provided within the Bid price.						
4.3.4	Rated continuous thermal current (40°C): All Core	% In	120			
4.3.5	Security factor for Metering Core: Core I Core II (when applicable)		 Fs<5 Fs<5			
5.	Voltage Transformer					
	General					
5.1.1	Type		GIS / Indoor/outdoor	GIS / Indoor		
5.1.2	Model					
5.2	Design & Construction					
5.2.1	Impulse Voltage					
	-to earth	kVp	[Insert]	[Insert]		
5.2.2	Power Frequency Voltage	KVrms	[Insert]	[Insert]		
	-to earth					
5.2.3	Isolation lever with earthing facility from Primary Circuit		Yes	Yes		
5.2.4	Damping resistor		As per Design	As per Design		
5.2.4.1	Ohm		As per Design , Insert	As per Design , Insert		
5.2.5	Suitable for Long line DC voltage discharge through VT winding	Yes/NO	Yes	Yes		
5.2.6	VFTO suppression		Yes	Yes		
5.2.7	Secondary Box					
	Secondary Box Material		AL or Stainless steel	AL or Stainless steel		
	Secondary Box IP rating		IP55/ IP66W for outdoor	IP55		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	MCB for each core	Yes/NO	Yes	Yes		
	NO/NC contact in MCB for signaling	Yes/NO	Yes	Yes		
5.3	Rating					
5.3.1	Rated primary voltage	kV	132/√3	230/√3		
5.3.2	Rated secondary voltage I winding II winding	 V V	 110√3 110√3	 110√3 110√3		
5.3.3	Accuracy class: I winding II winding		 0.2s 3P	 0.2s 3P		
5.3.4	Rated power: I winding II winding	 VA VA	 10 25	 10 25		
5.3.5	Load		Simultaneously	Simultaneously		
6	LCC					
6.1	Type		Integrated / Separate	Integrated / Separate		
6.2	Dimension					
6.3	Housing Material		AL or Stainless Steel with Glass Door	AL or Stainless Steel with Glass Door		
6.3.1	Thickness		Insert	Insert		
6.3.2	IP rating		IP55/ IP66W for outdoor	IP55		
6.4	Accessories					
6.4.1	DC MCBs	Yes/No	Yes	Yes		
6.4.1.1	Control Voltage	V.DC	110	110		
6.4.2	AC MCBs	Yes/No	Yes	Yes		
6.4.2.1	Voltage	V.AC	230V, 50Hz	230V, 50Hz		
6.4.3	Heater	Yes/No	Yes	Yes		
6.4.3.1	Rated Voltage	V.AC	230V, 50Hz	230V, 50Hz		
6.4.3.2	Rated Power	W	Insert	Insert		
6.4.4	Humidity Controller	Yes/No	Yes	Yes		
6.4.5	GFI Socket	Yes/No	Yes	Yes		
6.4.5.1	Rating	A	Insert	Insert		
6.4.6	LED Light with ON/OFF switch					
6.4.6.1	Rated Power	W	Insert	Insert		
6.4.6.2	Rated Voltage	V	Insert	Insert		
6.4.7	L/R switch [with gang/single pole operation for CB]					
	CB		Yes	Yes		
	DS		Yes	Yes		
	HSES		Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	ES		Yes	Yes		
6.4.8	Operation Switch [Close/Open/Neutral]					
	CB		Yes	Yes		
	DS		Yes	Yes		
	HSES		Yes	Yes		
	ES		Yes	Yes		
6.4.9	Mimic/line diagram with semaphore & switch					
6.4.9.1	LED with semaphore		Yes	Yes		
6.4.9.2	Line diagram color					
	Primary Circuit		Red	Green		
	Earth		Black	Black		
6.4.10	Hardware Interlock at LCC	Yes/No	Yes	Yes		
	Manual operation of the disconnect and grounding switches is only possible under electrical interlock release conditions.	Yes/No	Yes	Yes		
	Mechanical and electrical interlock between disconnect and grounding switch operation is provided.	Yes/No	Yes	Yes		
	The electrical interlock scheme is fail-safe to prevent loss of interlock function upon loss of control voltage.	Yes/No	Yes	Yes		
	Electrical interlock between the line PT secondary voltage and respective high speed grounding switch operation is provided through under voltage relay contacts.	Yes/No	Yes	Yes		
	The feeder grounding switch is interlocked with the corresponding circuit breaker and disconnect switch.	Yes/No	Yes	Yes		
	The bus bar grounding switch is interlocked with all disconnect switches on the same busbar section.	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	The high speed grounding (fast-acting grounding) switch is interlocked with the associated circuit breaker open.	Yes/No	Yes	Yes		
	No switching of the earthing switch when the bus bar or equipment is energized.					
	No paralleling of buses by dis-connectors when bus coupler is open.	Yes/No	Yes	Yes		
	Only local mode operation for CB when dis-connectors are open.	Yes/No	Yes	Yes		
	No closing of dis-connector when a load is connected.	Yes/No	Yes	Yes		
	No switching of the earthing switch when the bus bar or equipment is energized [It shall not be possible to override this interlock]	Yes/No	Yes	Yes		
6.4.11	Interlock Override switch [A key switch for overriding interlocks between disconnect and grounding switches associated with circuit breakers during maintenance]		Yes	Yes		
6.4.12	SYNC bypass switch		Yes	Yes		
6.4.13	Locking Padlock for switchgear	Yes/No	Yes	Yes		
6.4.14	Separate Terminal Board (TB) Block for CB/DS/HSES etc.	Yes/No	Yes	Yes		
6.4.15	Shielded Control cable upto LCC	Yes/No	Yes	Yes		
6.4.15.1	Grounding of control cable shield at both the equipment and the LCC ends at the location where the control cable first enters the cabinet.	Yes/No	Yes	Yes		
6.4.15.2	Grounding Material		either coaxial ground bushings or short connections to the cabinet walls	either coaxial ground bushings or short connections to the cabinet walls		
6.4.16	Minimum Alarm					

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
	Loss of DC supply to circuit breaker motor.		Yes	Yes		
	SF6 gas pressure Low–Low, Stage 1 alarm for each gas zone/section (in the case of a single phase, an alarm is provided for each phase)		Yes	Yes		
	SF6 gas pressure Low–Low, Stage 2 alarm for each gas zone/section (in case of a single phase, the alarm is grouped for all phases)		Yes	Yes		
	Excess run time of the motor for the circuit breaker, disconnecting switch, and ground switch		Yes	Yes		
	Spring overcharged for the circuit breaker mechanism		Yes	Yes		
	Loss of DC for the trip and close circuit		Yes	Yes		
	Circuit breaker trip		Yes	Yes		
	VT supply fail (VT MCB trip)		Yes	Yes		
	Loss of AC supply		Yes	Yes		
	Circuit breaker mechanism failure		Yes	Yes		
	Local/remote switch		Yes	Yes		
	Pole discrepancy operated (for single-phase breaker)		Yes	Yes		
	Trip circuit failure		Yes	Yes		
6.4.16	BCU in LCC		As per design	As per design		
7	Termination Connection					
7.1	Type: GIL – Gas Insulated Line, Outdoor & Indoor		Yes	Yes		
7.2	Type: Three phase, according to the design		Yes	Yes		
7.3	Insulator, Single phase, SF6 / Air		Yes	Yes		
7.4	Insulating material		Composite/Silicon	Composite/Silicon		
7.5	Minimum external housing insulation creepage distance	mm/kV	≥ 25 mm/kV	≥ 25 mm/kV		
7.6	Rated continuous Current	A	Same as feeder	Same as feeder		

No.	Description	Minimum Requirements			Guaranteed by Bidder	
		Unit	Data		Data	
			132kV	230kV	132kV	230kV
7.7	Minimum centerline phase-to-phase spacing	mm	NA	[Insert]		
7.8	Length of longest bus sections	mm	[Insert]	[Insert]		
7.9	Outside diameter	(mm)	[Insert]	[Insert]		
7.10	Wall thickness	(mm)	[Insert]	[Insert]		
7.11	SF6 gas pressure at 20C	KPa	[Insert]	[Insert]		
8	MRE Requirement					
8.1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays		Yes	Yes		
8.2	Repair of any circuit breaker shall be possible without interruption of adjacent bays		Yes	Yes		
8.3	Extension of GIS bay shall be possible without interruption of adjacent bays		Yes	Yes		
8.4	HV testing in any bay shall be possible without complete “Out of service” of the GIS		Yes	Yes		
8.5	Separate HV Test Bushing (for cable connected feeder)		1 set for each Voltage level	1 set for each Voltage level		
9	Dimensions					
9.1	Length					
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
9.2	Width	mm	[Insert]	[Insert]		
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
9.3	Height					
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
	Overall Compliance		Yes	Yes		

4.2.3 Switchgear 33 kV

Circuit Breaker 33 kV

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		Vacuum	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single 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 Un	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 fr	Hz	50	
2.6	Rated current Ir	A	≥ 2500 (for 120MVA Tr.)	
		A	≥ 3150 (for 140MVA Tr.)	
2.7	Rated short-circuit breaking current Isc	kA rms	≥ 31.5	
2.8	Rated peak withstand current Ip (equal short-circuit making current)	kA	≥ 80	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor Terminal fault Short-line fault 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	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.16	Auto reclosing		3p	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 100	
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) Without current 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) Without current 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance CO at no-load CO at rated current CO at rated breaking current Isc	No.	 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	Min M1	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal FthA	N	Insert	
2.30.2	Static horizontal force, transversal FthB	N	Insert	
2.30.3	Static vertical force Ftv	N	Insert	
2.30.4	Dynamic horizontal force, longitudinal Fwx	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		Composite/porcelian	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
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	
3.4	Local operation push buttons			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Operation counter		Yes	
3.4.3	Motor MCB (miniature circuit breakers)		Yes	
3.4.4	Heater - 230 V, 50 HZ		Yes	
3.4.5	Cu earthing rails inside central control cabinet		Yes	
3.4.6	Detachable plates, the bottom of central control cabinet		Yes	
3.4.7	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

Disconnector 33 kV

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		Hand operated/Motorized	
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 Un	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 fr	Hz	50	
2.7	Rated current Ir	A	≥ 2500 (for 120MVA Tr.)	
		A	≥ 3150(for 140MVA Tr.)	
2.8	Rated short withstand current Ik	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	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	Min M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static Fb	N	Insert	
2.17.3	Vertical force Fc	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	Disconnector - Design and Construction			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1	Disconnector			
3.1.1	Insulator material		Composite/ porcelian	
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	
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)			

Disconnector 33 kV with integrated fuse

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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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, with integrated fuse 10 A for 300kVA Auxiliary Transformer And Vertical break, horizontal or wall mounting, with integrated fuse 10 A for 200kVA Auxiliary Transformer	
1.9	Number of poles	pcs.	3	
1.10	Type of operating mechanism		Hand & Motor 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 Un	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 fr	Hz	50	
2.7	Rated current Ir	A	≥ 200	
2.8	Rated short withstand current Ik	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	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	Min M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static Fb	N	Insert	
2.17.3	Vertical force Fc	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	Disconnector - Design and Construction			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1	Disconnector			
3.1.1	Insulator material		Composite/ porcelian	
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	
3.2.3	Minimum number of available contacts (NO/NC)		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	
3.3	Fuse			
3.3.1	Integrated fuse 10 A		Yes	
	Overall compliance with the requirements (yes/no)			

Current Transformer 33 kV,

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 Un	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 fr	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	31.5	
2.7	Rated dynamic current Idyn	kV peak	80	
2.8	Rated continuous thermal current (40°C): I core II core III core	 % In % In % In	 200 200 120	
2.9	Rated transformer ratio: I core II core III core	 A/A A/A A/A	 As per Volume-3, Schedule-A	
2.10	Accuracy class: I core II core III core		 0.2 0.2 5P20	
2.11	Security factor: I core II core		 Fs=10 Fs=10	
2.12	Rated power: I core II core III core	 VA VA VA	10 10 30 (Calculation required on design stage)	
3.	Current Transformers - Design and Construction			
3.1	Insulator material		Composite/ porcelian	
3.2	Insulating medium		RIP	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Permissible level of partial discharges: Test voltage 1.2*UM/√3 Test voltage UM	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP55	
3.8	HV terminals			
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)			

Voltage Transformer 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Voltage Transformers - General			
1.1	Manufacturer		Insert	
1.2	Type		Inductive	
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, post type	
2.	Voltage Transformers - Characteristics			
2.1	Nominal system voltage	kV rms	33	
2.2	Highest voltage for equipment Un	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 fr	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	31.5	
2.7	Rated dynamic current Idyn	kV peak	80	
2.8	Rated primary voltage	kV	33/√3	
2.9	Rated secondary voltage I winding II winding III winding	 V V V	 110√3 110√3 110√3	
2.10	Accuracy class: I winding II winding III winding		 0.2 0.2 3P	
2.11	Rated power: I winding II winding III winding	 VA VA VA	 10 10 30 (Calculation required on execution stage)	
2.12	Load		Simultaneously	
2.13	Voltage factor	p.u./s	1.5/30	
2.14	Rated mechanical strength	Class	Min. Class I	
2.15	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
3.	Voltage Transformers - Design and Construction			
3.1	Insulator material		Composite/ porcelian	
3.2	Insulating medium		RIP	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 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: Test voltage 1.2*UM/√3 Test voltage UM	 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 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)			

Surge Arrester 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Surge Arresters - General			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
2.	Surge Arresters - Characteristics			
2.1	Nominal system voltage	kV rms	33	
2.2	Highest voltage for equipment Un	kV rms	36	
2.4	Rated voltage of surge arrester Ur	kV rms	30	
2.5	Max. continuous operating voltage Uc	kV rms	24	
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	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 µs)	A	≥ 850	
3.4	Maximum residual voltage Ures			
3.4.1	For switching impulse current 30/60 µs at 0,5 kA	kV peak	≤ 65	
3.4.2	For switching impulse current 30/60 µs at 1 kA	kV peak	≤ 67.5	
3.4.3	For switching impulse current 30/60 µs at 2 kA	kV peak	≤ 70	
3.4.4	For lightning impulse current 8/20 µs at 5 kA	kV peak	≤ 75	
3.4.5	For lightning impulse current 8/20 µs at 10 kA	kV peak	≤ 80	
3.4.6	For lightning impulse current 8/20 µs at 20 kA	kV peak	≤ 90	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 µs)	kV	≥ 235	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 105	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (Fdyn)	N	≥ 7500	
3.6.2	Specified long-term load SSL (Fstat)	N	≥ 5000	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	

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

4.2.4 Transformers

230/34.5 kV, 120/140 MVA power transformer

Guaranteed Technical Particulars (GTP) for Auto/Power Transformer
Note:
The GTP shall be provided by the respective Vendor in their letterhead pad mentioning contractor/supplier Name, Users' name as PGCB and Consultant Name (if any) as per provision of contract between PGCB & Contractor. GTP must have Revision No. & date of submission. Responsible personnel of Manufacturer (Prepared by, checked by & Approved by, as appropriate) shall sign the GTP. The Project Manager/Design & Quality Control Personnel of Contractor shall also sign the GTP before submission to PGCB.
The items that require detail design of the offered transformer, may be kept unfilled mentioning "TBA" [To be Announced] during detailed design. All other data shall be filled during bidding.

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	230/34.5kV	
2.2	Rated voltage of windings: • HV winding • MV winding	 kV kV	 230 34.5	
2.3	Rated power: • Primary / secondary winding • Tertiary - minimum	 MVA MVA	 140 / 140 NA	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4	Rated power by cooling ONAN / ONAF • Primary / secondary winding • Tertiary – minimum	 MVA MVA	 120/140 NA	
2.5	Rated current on HV/ LV windings at CMR a) HV at Highest Voltage Tap b) HV at Nominal Voltage Tap c) HV at Lowest Voltage Tap d) LV	 A A A A		
2.6	**Tap changer:**			
	• Manufacturer		Insert	
	• Country of origin		Insert	
	• Model designation		insert	
	• Type of tap changing		On-load Local, remote, supervisory electrical and hand operation	
	• DS Type and Number		Vacuum Tap Insert	
	• Tap changer location		At High voltage side	
	• Type of voltage regulation		C.F.V.V.	
	• Tapping range	%	±10	
	• Tapping step size	%	1.25	
	• Number of tapping steps	Nos.	Insert	
	• Rating		Rated power 140 MVA, all taps	
	• 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 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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:** • 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: • HV winding • LV winding • Pre-fault voltage	 kA kA kA p.u.	 50 31.5 31.5 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: • HV winding • LV winding • Pre-fault voltage	 kA kA p.u.		
3.4	**Guaranteed losses**			
3.4.1	(a) No-load losses with tap changer in nominal position:at rated voltage and rated frequency	kW	Insert	
	(b)No-load losses with tap changer in nominal position: at 110 % rated voltage, at rated frequency	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	(c)No-load losses with tap changer in nominal position:at 90 % rated voltage, at rated frequency	kW	Insert	
	Average No-Load Loss **(this value will be evaluated),N**	kW	(a+b+c)/3	
3.4.2	No-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C			
	(a) On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position at maximum rating 140MVA	kW	Insert	
	(b)On-load losses at 75°C, with tap changer in plus (+) extreme position at maximum rating 140MVA at rated frequency	kW	Insert	
	(c)On-load losses at 75°C, with tap changer in minus (-) extreme position at maximum rating 140MVA at rated frequency	kW	Insert	
	Average On-load losses **(this value will be evaluated),L**	kW	(a+b+c)/3	
3.4.5	On-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.6	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.4.7	Ancillary equipment (fans, pumps, heaters, etc.)			
3.4.8	Load of ancillary equipment ***(this value will be evaluated),M***	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 1050, AC 460	
3.6.2	Low voltage (LV)		LI 170, AC 70	
3.6.3	Neutral		LI 95, AC 38	
3.6.4	Induced voltage (ACSD, ACLD)	kV	In acc. To IEC 60076-3	
3.7	**The highest voltage for equipment (effective value)**			
3.7.1	High voltage (HV)	kV	245	
3.7.2	Low voltage (LV)	kV	36	
3.7.3	Neutral	kV	17.5	
3.8	**Regulation at 75°C and normal ratio –** (A) At unity power factor (B) At 0.8 lagging powerfactor	 % %		
3.9	**Efficiencies**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.9.1	If cosφ = 1.0 and: • 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: • 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	• 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 under service conditions stated in Schedule of Technical Requirement: a) CMR b) ONAN rating	 K K	 ≤ 55 ≤ 55	
3.12.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement:	K	≤ 60	
3.12.3	Hottest spot rise in core, metallic parts and adjacent Parts in contact with oil at rated power	K	≤ 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)		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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.13	At the emergency cases it is allowed: • 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 • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.3	After operation under 120 min • 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 • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.3	After operation under 120 min • 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: • 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	≥ 1000	
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)**			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	31.5	
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	31.5	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.3.19	De-rating Factor		Insert	
6	**Design Data**			
6.1	Maximum flux density in the legs • 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: • 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: • 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: • 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		Cu –'Interleaved'	
6.10.5	LV winding		Cu – Interleaved / disc – transposed, cured in epoxy coating	
6.10.6	Type of Insulation of Tapping Connections		Insert	
7	**Weights and dimensions**			
7.1	Core and winding assembly	kg	Insert*	
7.2	Tank, conservator , cooler banks & cooling assembly & other accessories	kg	Insert*	
7.3	Total mass excluding oil	kg	Insert*	
7.4	Oil mass in tank & conservator	kg	Insert*	
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: • 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*	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.10	Outer dimensions: • Length • Width	 mm mm	 Insert* Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	
7.12	Maximum shipping dimensions of tank: • 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: 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14.2	Thickness of transformer tank: • 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	
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 Tankis 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 autotransformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.6	Diagraph design parameters: • 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	
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	

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

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

132/33 kV 80/120 MVA ONAN/ONAF power transformer

Guaranteed Technical Particulars (GTP) for Power Transformer

Note:

The GTP shall be provided by the respective Vendor in their letterhead pad mentioning contractor/supplier Name, Users' name as PGCB and Consultant Name (if any) as per provision of contract between PGCB & Contractor. GTP must have Revision No. & date of submission. Responsible personnel of Manufacturer (Prepared by, checked by & Approved by, as appropriate) shall sign the GTP. The Project Manager/Design & Quality Control Personnel of Contractor shall also sign the GTP before submission to PGCB.

The items that require detail design of the offered transformer, may be kept unfilled mentioning "TBA" [To be announced] during detailed design. All other data shall be filled during bidding.

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	132/33kV	
2.2	Rated voltage of windings: • HV winding • MV winding	 kV kV	 132 33	
2.3	Rated power: • Primary / secondary winding • Tertiary - minimum	 MVA MVA	 120 / 120 NA	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4	Rated power by cooling ONAN / ONAF • Primary / secondary winding • Tertiary – minimum	 MVA MVA	 80/120 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		
2.6	**Tap changer:**			
	• Manufacturer		Insert	
	• Country of origin		Insert	
	• Model designation		insert	
	• Type of tap changing		On-load Local, remote, supervisory electrical and hand operation	
	• 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 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			
	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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:** • 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: • HV winding • LV winding • Pre-fault voltage	kA kA kA p.u.	40 31.5 31.5 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: • HV winding • LV winding • Pre-fault voltage	kA kA p.u.		
3.4	**Guaranteed losses**			
3.4.1	(a) No-load losses with tap changer in nominal position:at rated voltage and rated frequency	kW	Insert	
	(b)No-load losses with tap changer in nominal position: at 110 % rated voltage, at rated frequency	kW	Insert	
	(c)No-load losses with tap changer in nominal position:at 90 % rated voltage, at rated frequency	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Average No-Load Loss **(this value will be evaluated),N**	kW	(a+b+c)/3	
3.4.2	No-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C			
	(a) On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position at maximum rating 120MVA	kW	Insert	
	(b)On-load losses at 75°C, with tap changer in plus (+) extreme position at maximum rating 120MVA at rated frequency	kW	Insert	
	(c)On-load losses at 75°C, with tap changer in minus (-) extreme position at maximum rating 120MVA at rated frequency	kW	Insert	
	Average On-load losses **(this value will be evaluated),L**	kW	(a+b+c)/3	
3.4.5	On-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.6	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.4.7	Ancillary equipment (fans, pumps, heaters, etc.)			
3.4.8	Load of ancillary equipment ***(this value will be evaluated),M***	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	
3.6.3	Neutral		LI 95, AC 38	
3.6.4	Induced voltage (ACSD, ACLD)	kV	In acc. To IEC 60076-3	
3.7	**The highest voltage for equipment (effective value)**			
3.7.1	High voltage (HV)	kV	145	
3.7.2	Low voltage (LV)	kV	36	
3.7.3	Neutral	kV	17.5	
3.8	**Regulation at 75°C and normal ratio –** (A) At unity power factor (B) At 0.8 lagging powerfactor	% %		
3.9	**Efficiencies**			
3.9.1	If cosφ = 1.0 and: • 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.9.2	If cosφ = 0.8 (inductive) and: • 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	• 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 under service conditions stated in Schedule of Technical Requirement: c) CMR d) ONAN rating	K K	≤ 55 ≤ 55	
3.12.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement:	K	≤ 60	
3.12.3	Hottest spot rise in core, metallic parts and adjacent Parts in contact with oil at rated power	K	≤ 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)		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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.13	At the emergency cases it is allowed: • 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 • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.3	After operation under 120 min • 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 • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.3	After operation under 120 min • 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: • 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**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	≥ 1000	
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)**			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	31.5	
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	31.5	
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	
5.3.16	Weight of insulator	kg	Insert	
5.3.17	Electrostatic capacity of complete bushings	pF	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 • 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: • 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: • 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: • 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 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		Cu –'Interleaved'	
6.10.5	LV winding		Cu – Interleaved / disc – transposed, cured in epoxy coating	
6.10.6	Type of Insulation of Tapping Connections		Insert	
7	**Weights and dimensions**			
7.1	Core and winding assembly	kg	Insert*	
7.2	Tank, conservator , cooler banks & cooling assembly & other accessories	kg	Insert*	
7.3	Total mass excluding oil	kg	Insert*	
7.4	Oil mass in tank & conservator	kg	Insert*	
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: • 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*	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.10	Outer dimensions: • Length • Width	 mm mm	 Insert* Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	
7.12	Maximum shipping dimensions of tank: • 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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: • Sides • Bottom • Top	 mm mm mm	 Insert Insert Insert	
14.3	Material of the autotransformer tank		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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) 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 Tankis 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 autotransformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: • 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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**

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
21.1	Buchholz Relay			
21.2	Oil Surge Relay for OLTC			
21.3	Air Bag Rupture Relay			
21.4	Pressure Relief Device			
21.4.1	Pressure Relief Device for OLTC			
21.4.2	Pressure Relief Device for main tank			
21.5	Air Bag for Conservator			
21.6	Magnetic Oil Level Gauge			
21.7	Oil Temperature Indicator			
21.8	Winding Temperature Indicator			
21.9	Radiator			
21.10	Cooling Fan			
21.11	Bushing Current Transformer			
21.12	Neutral Current Transformer			
21.13	Anti-Vibration Pad			
21.14	AVR Panel			
21.15	Dehydrating breather			
21.16	Control cable			
21.17	Marshalling cubicle			
21.18	control cubicle			
21.19	Gasket			
	Name of Raw Material	**Make**	**Country of Origin**	**Guaranteed make & Country of Origin**
21.20	Copper Conductor			
21.21	CRGO			
21.22	Insulating Paper			
21.23	Press Boards			
21.24	Steel Plate			
	Overall compliance with the requirements & detail specification described in volume-2	**(yes/no)**	**Yes**	

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

33/0.415 kV 200 or 300kVA, Dyn11, Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, two windings, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	Ratings and properties			
2.1	Rated power:	kVA	200 or 300	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage	kV/V	34.5/ 415	
2.4	Percent Impedance	%	5	
2.5	Tap changer: Type of tap changing Tapping range Tapping step Rating	 % %	 Off-load ±5 2.5 Rated power 250 and 350 kVA, all taps	
2.6	Frequency	Hz	50	
2.7	Connection of three-phase windings (group of vector IEC 60076)		Dyn11	
3	Special technical requirements			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: HV winding 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.3	Insulation level			
3.3.1	Medium voltage (MV)		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	≤ 60	
3.5.2	Winding	K	≤ 65	
3.5.3	Hottest spot	K	≤ 65	
4	Oil			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm2/s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	Bushing			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36/170/70	
5.1.3	Manufacturer		Insert	
5.1.4	Type		RIP (Composite/silicone)	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 100	
5.1.7	Rated Short Circuit Current	kA,1s	31.5	
5.1.8	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2	LV bushings (3 kV)			
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		RIP (Composite/silicone)	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 500	
5.2.7	Rated Short Circuit Current	kA,3s	15	
5.2.8	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	Weights and dimensions			

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

33/0.415 kV 350 kVA, ZNyn11, Auxiliary Transformer (Not applicable)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		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	350	
2.2	Type of cooling ONAN / ONAF	-	ONAN	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3	Rated voltage	kV/V	33 ± 2 x 2,5 % / 415	
2.4	Percent Impedance			
2.5	Tap changer: Type of tap changing Tapping range Tapping step Rating	 % %	 Off-load ±5 2.5 Rated power 350 kVA, all taps	
2.6	Raed Frequency	Hz	50	
2.7	Connection of three-phase windings (group of vector IEC 60076)		ZNyn11	
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: HV winding 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			
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	≤ 60	
3.5.2	Winding	K	≤ 65	
3.5.3	Hottest spot	K	≤ 65	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	mm2/s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	Bushing			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36/170/70	
5.1.3	Manufacturer		Insert	
5.1.4	Type		RIP (Composite/silicone)	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 100	
5.1.7	Rated Short Circuit Current	kA,1s	31.5	
5.1.8	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2	LV bushings (3 kV)			
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		RIP (Composite/silicone)	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 600	
5.2.7	Rated Short Circuit Current	kA,3s	15	
5.2.7	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	Weights and dimensions			
6.1	Total weight of transformer, ready for service	kg	Insert	
6.2	Outer dimensions: Length Width	 mm mm	 Insert Insert	
6.3	Informative dimensional sketch		To be enclosed with bid	
7	Dehydrating breather			
7.1	Type of dehydrating breather		Insert	
7.2	Dehumidifying agent	kg	Insert	
8	Conservator			
8.1	Type		With dehydrating breather	
8.2	Number of compartments	pcs.	1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.3	Oil level indicators with alarm for minimum oil level	pcs.	1	
9	Operating conditions			
9.1	At the altitude (above sea level)	m	≤ 1000	
9.2	Maximum ambient temperature	°C	+ 40	
9.3	Average daily temperature	°C	+ 35	
9.4	Average annual temperature	°C	+ 30	
9.5	Minimum ambient temperature	°C	– 5	
	Overall compliance with the requirements (yes/no)			

4.2.5 Control, Protection, Substation Automation & Metering

4.2.5.1 Line Distance Protection

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

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

No.	Description	Unit	Minimum Requirements	Guaranteed
		No		
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 to 1000 or higher with the step size of 0.001/In	
17.18	Relay Operating Time' i) Output contact making time ii) Relay Time	ms	Insert	
18	Back up protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchro check and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement)	
20	Monitoring functions			
20.1	Fuse failure supervision, current circuit supervision	Yes/ No	Yes	
20.2	U, I, P, Q, S, f, PF monitoring	Yes/ No	Yes	
20.3	Fault locator	Yes/ No	Yes	
20.4	Event records and oscillographic disturbance records		Event recorder should keep at least 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	

4.2.5.2 Line Differential Protection

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

	capacity			
11.5	Maximum operating time	ms	5ms & 2ms for high speed contact	
12	Number of LEDs	Nos.	15 (programmable) (Should be increased as per the scheme design)	
13	HMI		Front mounted, should be suitable to access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license	
15	GPS Time synchronization	Yes/No	Yes	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
16.3	Protection communication		Should be suitable for multiplexed, routed switched or dedicated fiber optic communication	
16.4	Binary input transfer		Should be able to transfer at least 8Nos binary signals between the IEDs	
17	Main protection function		Line differential protection	
17.1	Tripping options		Single and/or three phases	
17.2	Number of parameters setting groups	Nos	Minimum 4 (Independently settable)	
17.3	Pre-configuration		For all basic functions	
17.4	Differential characteristics		Restrained biased characteristics with charging current compensations	
17.5	Harmonics blocking		2nd and 5th harmonics	
17.6	CT summation		Internal CT summation facility should be available for 1 and ½ CB arrangement	
17.7	Emergency protection (Should be enabled in case of differential communication failure)		Impedance protection with at least 4 mho/quadrilateral zone setting options, PSB, SOTF, VTFF and all scheme communication features1	
17.8	Display options		There must be provision of displaying restraining and differential current on the HMI	
17.9	Tripping time		Instantaneous	

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

17.10	Protected distance		Should be able to protect at least 150km of line and further facility of extending protected line length in the relay should be provided	
18	Back up protection function		Instantaneous/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchrocheck and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double busbar arrangement)	
20	Monitoring functions			
20.1	Fuse failure supervision, current circuit supervision	Yes/No	Yes	
20.2	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.3	Event records and oculographic disturbance records		Event recorder should keep at least 20Nos previous records and disturbance recorder should handle at least 8Nos analogue channels and at least 24Nos binary channels	
21	Tripping and indication logics		Programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

4.2.5.3 Transformer Differential Protection (3 Winding):

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL or equivalent. (Switzerland/Sweden/Germany/UK/USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Insert (Main-01 & Main-02 shall be from different manufacturer)	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
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)	
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3 *Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs		6 (For Line VT & Bus VT)	
9.2	Nominal voltage	V AC	110	
9.3	Minimum continuous withstand voltage	V AC	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	20 (programmable) (Should be increased as per the scheme design)	
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	20 (minimum 8 Nos high speed trip output and 2 Nos watchdog outputs) (Should be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC (±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/delayed, directional/non-directional, over current and earth fault	
19	Control functions		Synchrocheck and 1P/3P auto-reclose for single and multi CB arrangements (1 set for Double Busbar arrangement)	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
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	
21	Tripping and indication logics		Programmable	
22	Standards		Should conform IEC-60255 in all	

			aspects	
23	Type test certificate		Should be provided	

Over current and Earth fault protection:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer		ABB/SIEMENS/GE/SEL or equivalent. (Switzerland/Sweden/Germany/UK/USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	4	
8.2	Nominal current	A	Operable in 1A and 5A (User settable)	
8.3	Minimum continuous current capacity	A	3*Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos	4	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable)	Should be increased as per the scheme design
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
11	Binary output module			
11.1	Minimum number of outputs	Nos.	10 (minimum 6 Nos high speed trip output and 2 Nos watchdog outputs)	Should be increased as per the scheme design
11.2	Minimum operating range	V	110V and 220V DC (±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)	
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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
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 Synchrocheck for single and multi CB arrangements if required by PSLD	1 set for Double Busbar arrangement
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 20Nos previous records and disturbance recorder should handle at least 8Nos analogue channels and at least 24Nos binary channels	
21	Tripping and indication logics		Should be programmable	
22	Standards		Should conform IEC-60255 in all aspects	
23	Type test certificate		Should be provided	

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

No.	Description	Unit	Minimum Requirements	Guaranteed
			Data	
1	Manufacturer		ABB/SIEMENS/GE/SEL or equivalent. (Switzerland/Sweden/Germany/UK/USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin (Place of Manufacturing)			

3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50/60Hz, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos	4	
8.2	Nominal current	A	Operable in 1A and 5A	
8.3	Minimum continuous current capacity	A	3*Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos	10 (For Line voltage and Bus voltages)	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos	10 (programmable) (Can be 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 (minimum 5 Nos fast operating trip output and 1 Nos watchdog outputs) (Can be increased as per the scheme design)	
11.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	10	
12	Number of LEDs	Nos	08 (programmable) (Can be increased as per	

			the scheme design)	
13	HMI		Front mounted, should be suitable to issue close& open commands to switching devices through visual animation, access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
15	GPS Time synchronization		Should be available	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Instantaneous/delayed, directional/non-directional, 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	A	0.5*In to at least 35*In	

	Directional/Non-directional OC		(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 and residual over-voltage protection	
19	Control functions		Synchrocheck Implementing interlocking logics Execution of close and open command for switching devices coming from SAS and Device HMI	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/No	Yes	
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 10Nos previous records and disturbance recorder should handle at least 8Nos analogue channels and at least 16Nos 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	

4.2.5.5 Frequency Protection

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer			
2	Country of Origin (Place of Manufacturing)			
3	Relay Identification			
3.1	Relay Type & model		Should be filled up by bidder	
3.2	Relay Software version		Should be filled up by bidder	
3.3	Relay Hardware version		Should be filled up by bidder	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50/60Hz, ±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	
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	
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,	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
			under-frequency, frequency rate of change with rate of change of rise and rate of change of fall freely.	
17.1	Number of parameter setting groups	Nos	Minimum 4 (Independently settable)	
17.2	Pre-configuration		For all basic functions	
17.3	Frequency setting range	Hz	40 to 60 or higher range (in step size of 0.01Hz)	
17.4	Time setting range of U/F and O/F	sec	0 to 100 or higher range (in step size of 0.01s)	
17.5	Setting range of Rate of Change of Frequency (ROCOF))	Hz/sec	0.1 to 10 or higher range (in step size of 0.01Hz/sec)	
17.5	Time setting range of ROCOF	sec	0 to 50 or higher range (in step size of 0.01s)	
18	Event records and oscillographic disturbance records		Event recorder should keep at least 10Nos previous records and disturbance recorder should handle at least 4Nos analogue channels and at least 8Nos 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	

4.2.5.6 Busbar and Breaker Failure Protection

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Manufacturer		ABB/SIEMENS/GE/SEL or equivalent. (Switzerland/Sweden/Germany/UK/USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin (Place of Manufacturing)			
3	Relay Installation			
3.1	Operating architecture		Distributed	
3.2	Number of Central Unit	Nos	1	
3.3	Number of Bay Units	Nos	As mentioned in Substation Single Line Diagram; For Breaker Failure Protection of Tie CB in 1 and Half CB bus arrangement, stand-alone relays will also be accepted.	
3.4	Minimum number of Bay Units supported by single Central Unit	Nos	30	
4	Central Unit Requirements			

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
4.1	Relay Type & model			Should be filled up by bidder	
4.2	Relay Software version			Should be filled up by bidder	
4.3	Relay Hardware version			Should be filled up by bidder	
4.4	Language			English	
4.5	Housing & mounting			Flush mounting housing and capable of sustaining in harsh environmental condition	
4.6	Relay auxiliary voltage		V DC	Minimum range of 48V to 250V; with protective fuse	
4.7	Maximum ripple			≤15%	
4.8	Operating frequency		Hz	50Hz, ±5%	
4.9	Binary Inputs of Central Unit				
	4.8.1	Minimum number of binary inputs	Nos.	12 (programmable)	
	4.8.2	Minimum operating range	V DC	Substation nominal DC voltage ±15%	
	4.8.3	Operating time	ms	<1	
4.10	Binary Outputs of Central Unit				
	4.9.1	Minimum number of outputs	Nos.	9	
	4.9.2	Operating time	ms	3	
	4.9.3	Operating voltage	V	Upto 250 V AC/DC	
	4.9.4	Continuous current capacity	A	8	
	4.9.5	Short time current capacity	A	30A for at least 0.5s	
	4.9.6	Binary output reset response		Programmable for latched and self reset	
4.11	Number of LEDs		Nos.	20 (programmable)	
4.12	HMI			Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer	
5	Bay Unit Requirements				
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	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	5.9.2	Operating time	ms	3	
	5.9.3	Operating voltage	V	Upto 250 V AC/DC	
	5.9.4	Continuous current capacity	A	8	
	5.9.5	Short time current capacity	A	30A for at least 0.5s	
	5.9.6	Binary output reset response		Programmable for latched and self reset	
5.11	CT requirements of Bay Unit				
	5.10.1	No of CT Inputs	Nos.	4	
	5.10.2	Nominal current	A	Operable in 1A and 5A (User settable)	
	5.10.3	Minimum continuous current capacity	A	4*Nominal current	
	5.10.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
	5.10.5	Burden per phase	VA	≤0.2	
5.12	Number of LEDs		Nos.	8 (programmable)	
5.13	HMI			Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer	
5.14	Test socket			Should be installed in the front side of the panel with each Bay Unit	
5.15	Supply of applicable test plug		Nos	2 Nos for each substation	
6	Communication interface & Software				
6.1	Software requirement			1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
6.2	GPS Time synchronization			Should be available	
6.3	Standard protocol			IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
6.4	Ethernet speed and connector			100Mbps, RJ45 plug connector/RS232 serial connector as front port	
6.5	Protection communication interface				
	6.5.1	Type of communication		Optical fibre	
	6.5.2	Number of cores per Bay Unit	Nos	2	
	6.5.3	Core/sheath diameter		62.5/125µm (multi-mode)	
	6.5.	Maximum permissible	dB	5	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	4	attenuation			
	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	
	7.1.10	Typical tripping time		20 to 30ms at IDiff/IRest ≥5	
	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.	Through-fault stability during		Must be complied	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	4	CT saturation			
	7.3.5	CT switching/selection		Must be done internally	
	7.3.6	Minimum fault current pick-up setting	A	0.2 to 4 x IN in step size of 0.01	
	7.3.7	Differential restraining characteristics slope setting		0.5 to 0.8; in step size of 0.05	
	7.3.8	Differential current alarms Current setting Time delay setting		5 to 50% of minimum pick-up in steps of 5% 2 to 10s in steps of 1s	
	7.3.9	Isolator alarm time delay		0.5 to 90s	
	7.3.10	Typical tripping time		20 to 30ms at IDiff/IRest ≥5	
	7.3.11	Settable CT ratio per feeder		50 to 10,000/1A	
7.4	Additional protection function 2				
	7.4.1	Required function		Breaker failure protection	
	7.4.2	Current setting range		0.1 to 2 x IN in step size of 0.1 x IN	
	7.4.3	Measurement accuracy		±5%	
	7.4.4	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip	
	7.4.5	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms	
	7.4.6	Setting range of remote trip timer (t2)	ms	10 to 5,000ms in steps of 10ms	
	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.	Forced blocking		Should be provided with selector switches	

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	3			installed in the panel for following options: BBP block, BFP block, EFP block, Output contacts block, All functions block	
7.7	Pre-configuration			For all basic functions with respect to the complete Single Line Diagram of the substation	
8	Monitoring & Supervision functions				
8.1	Current measurement			For all feeders and all phases, Differential Current, Restraining current	
8.2	Switching object monitoring			Should be available	
8.3	Self supervision system			Should be available for Central Unit and Bay Units	
8.4	Event records			Event recorder should keep at least 100 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	ºC	-10 to +55	
	12.1.2	Storage and Transport	ºC	-40 to +85	
12.2	Climate tests				
	12.2.1	Cold		-25ºC/16h	
	12.2.2	Dry heat		+70ºC/16h	
	12.2.3	Damp heat		-25ºC to +70ºC, 1ºC, 2 cycles	
	12.2.4	Damp heat (long time)		+40ºC, 93% relative humidity/4 days	
12.3	Insulation resistance tests			>100 MOhm @0.5kV	
12.4	Dielectric tests			2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
12.5	Impulse test			1.2/50 µS/0.5 Joule, 5kV AC	

4.2.5.7 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 or equivalent. (Switzerland/Sweden/Germany/UK/ USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Supervision mode		Pre-close and post-close	
5	Maximum operating time	ms	70	
6	Rated voltage	V DC	100-125 or higher range	
7	Minimum threshold voltage	V DC	25% lower than the nominal voltage	
8	Thermal rating of the coil	%	120% of the rated voltage, continuous	
9	Maximum coil burden	W	20W at rated voltage	
10	Number of Normally Open contacts	Nos	As required for standard scheme	
11	Number of Normally Close contacts	Nos	As required for standard scheme	
12	Standards		Should conform IEC-60255 in all aspects	

4.2.5.8 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 or equivalent. (Switzerland/Sweden/Germany/UK/ USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Reset mechanism		Self reset	
5	Maximum operating time	ms	10	
6	Maximum reset time	ms	20	
7	Rated voltage	V DC	100-125 or higher range	
8	Minimum threshold voltage	V DC	35% lower than the nominal voltage	
9	Minimum Rated capacity of		AC 1250VA with maxima of 5A and	

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

4.2.5.9 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 or equivalent. (Switzerland/Sweden/Germany/UK/ USA/ France or from other eligible countries with equivalent quality).	
2	Country of Origin			
3	Type, model		Should be filled up by bidder	
4	Reset mechanism		Hand reset	
5	Maximum operating time	ms	10	
6	Rated voltage	V DC	100-125 or higher range	
7	Minimum threshold voltage	V DC	35% lower than the nominal voltage	
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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
11	Number of Normally Close contacts	Nos	As required for standard scheme	
12	Standards		Should conform IEC-60255 in all aspects	

4.2.5.10 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, and performing whole tripping test with following AR		Yes	
1.7	Test socket should have enough contacts to: Short-circuit current inputs from CT's Isolate voltage inputs from VT's Isolate trip circuit for each phase separately Isolate CB close command Isolate signalling voltage Inhibit breaker failure initialising Inhibit sending of communication signal Allow functional testing of protection		Yes	
1.8	Socket should be designed for 4 mm banana plugs access		Yes	
2.2.1	Number of outputs	NO/NC	Min. 2/2	

4.2.5.11 Energy Meter (3-phase, 4-wire, 3-element, Numerical Indoor Type with Power Quality Monitoring):

SL. No.	Description	Unit	PGCB's requirements	Bidder's data

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
1	Manufacturer's name		CEWE/Elster/Landis+Gyr/EDMI/SEL	
2	Country of Origin		France/UK/USA/Switzerland/Sweden/Germany/EU	
3	Model		Should be filled up by bidder	
4	Meter type		Numerical, programmable, multi-function	
5	Display language		English	
6	Connection type		CT/VT operated, 3-phase, 4 wires, solidly grounded neutral	
7	Installation		Indoor installation	
8	Type of socket		To be mentioned	
9	Number of element	Nos	3 (three)	
10	Number of terminals	Nos	At least 10 (ten)	
11	Current range	A	1 to 10, user programmable	
12	Starting Current	A	0.1% of nominal	
13	Continuous Thermal current rating	A	1.5*In or higher	
14	Short time thermal rating	A	10*In or higher for 1sec	
15	Voltage range	V AC	50 to 82.5 (P-N) or higher range, Burden-10MΩ	
16	Overload voltage	V AC	1.3*Vn, continuous	
17	Burden			
	17.1 Current Circuit	VA/phase	< 0.1 @ 1A, < 0.5 @ 5A	
	17.2 Voltage Circuit (with auxiliary power)	VA/phase	< 0.1	
	17.3 Voltage Circuit (with self power)	VA/phase	< 6VA	
18	Auxiliary supply range		Dual Power Supply: 80V to 240V AC/DC or higher range Self Power with VT voltage (80V to 130V AC)	
19	Operating frequency		50Hz (±5%)	
20	Measuring mode		True 4 quadrant	
21	Accuracy class		0.2S for kWh, 0.5 for kVARh	
22	Losses at nominal load		To be mentioned	
23	Local communication		DLMS, RS232/RS485/Ethernet	
24	Remote communication		Standard metering protocol, MODBUS; Communication facility to Network Control Center should be available	
25	Software interfacing facility with PC		Should be available	
26	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. 2. Necessary software for configuration and parameterization has to be supplied free of cost and without any time-bound license	
27	Password protection		Should be available for programming, configuration and read out meter data	
28	Meter sealing condition		Hermatically or Ultrasonic welded	
29	Display options		Built-in HMI LCD display, configurable display, including meter ID, power quadrant display	
30	Integration period		30 (thirty) minutes	
	Resetting period		1 (one) month	
	Cumulative MD transfer		Built-in	
	Cycle Timing device		Built-in	
31	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	
32	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	

SL. No.	Description	Unit	PGCB's requirements	Bidder's data
33	Online testing facility		Should be available with online CT shorting facility with security sealing provision	
34	Data storage		At least 32MB of nonvolatile memory for data storage and capable of simultaneously record 4 load profile recorders x 8 channels for at least 90days at 30 minute intervals.	
35	Data logging and event recording		Should be available	
36	In built clock		Should be available	
37	Provision of GPS synchronization		Should be available	
38	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.	
39	Environment requirement			
	39.1 Ingress protection		IP54 or better	
	39.2 Operating temperature		-10ºC to +60ºC	
	39.3 Storage temperature		-40ºC to +80ºC	
	39.4 Humidity range		0% to 95%, non-condensing	
40	Weight of the meter		To be mentioned	
41	Dimension of the meter		To be mentioned	
42	Outline, drawing and leaflets		To be provided	
43	Performance curves for balanced and unbalanced load		To be mentioned	
44	Year of manufacture		To be mentioned	
45	Minimum Battery Service life and shelf life	Years	10 (ten) & 15 (fifteen) respectively	
46	Meter service life	Years	15 (fifteen)	
47	Reference standard		Relevant ANSI/IEC standard	
48	Warranty	Years	3 (three)	
49	Type test certificate		Should be provided	

4.2.5.12 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	

4.2.5.13 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	

4.2.5.14 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.

4.2.5.15 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.

4.2.5.16 SCADA Server

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	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 19"	pcs.	1	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		TFT	
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)			

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

Substation Automation System

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

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

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

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

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

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

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

4.2.5.18 Operator Workstation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Operator Workstation			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Insert	
2	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	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	

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

4.2.5.19 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)			

4.2.5.20 Monitoring Workstation

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		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	Insert	
2.6	Video display adapter type		Insert	
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	Serial interface RS232		Yes	
2.16	Fast Ethernet network interface card type		Insert	
2.17	Number of fast Ethernet network interface cards	pcs.	1	
2.18	Fans	Yes/No	Insert	
2.19	Monitor 24"	pcs.	1	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		TFT	
2.19.4	Standards		IEC	

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

4.2.5.21 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)			

4.2.5.22 Weather Station (Optional)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	

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

4.2.5.23 Ethernet Switch Process LAN

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14273	Ethernet Switch-Process LAN / Code number: 14273			

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

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

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

4.2.5.24 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	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..50°C	
2.4.2	Storage		–20..+70°C	
2.5	Switching method an layer		Store & Forward Layer 3 (IEC 61850), RSTP (802.1w); eRSTPTM or RSTP (802.1D-2004) network fault recovery	

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

4.2.5.25 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)			

4.2.5.26 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 for overall Protection & Control & Monitoring & Metering system should be foreseen and included in the bid.		Yes	
1.2	Below proposed quantities shall be verified according to specific Bidder's design.		Yes	
1.3	Final quantities must be estimated and delivered as per Single Line Diagram and Substation layouts.		Yes	
1.4	At least 20% spare in cable length, as well as in number of fibres in cable, should be foreseen.		Yes	
1.5	Fibre optic ducted cables shall be foreseen.		Yes	
1.6	Type of fibre optic		Multimode	
1.7	Number of fibres in cable		Min. 4	
1.8	Operational Wave length		Insert	
1.9	Attenuation factor maximum		Insert	
1.10	Band-width minimum		Insert	
1.11	Manufacturer		Insert	
2	Characteristics			
2.1	Fibre optic terminations. Overall quantities of specific fibre optic terminations should be closely related to number of fibres in each cable (each fibre, used or spare, should be properly terminated). At least 20% spare terminations for each proposed type should be foreseen.		Yes	
2.1.1	Plug connectors type		Insert	
2.1.2	Connection technology		Insert	
2.1.3	Plug pin type		Insert	
2.1.4	Manufacturer		Insert	

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

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

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

4.2.5.27 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)			

4.2.5.28 Automatic Voltage Regulation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14008	Automatic Voltage Regulation			
1.1	Manufacturer		MR Germany or ABB Sweden make or equivalent.	
1.2	Country of origin		Germany / Sweden or from other eligible countries with equivalent quality.	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

4.2.5.29 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)			

4.2.6 Digital Fault and Disturbance Recorder (DFDR)

SL	ITEM	UNITS	PGCB'S REQUIREMENT
(A)	GENERAL		
1.	Manufacture's name and address		To be mentioned
2.	Type		To be mentioned
3.	Power supply	VDC	110
4.	-Power supply for printer	VAC	240
(B)	ANALOGUE INPUTS		
1.	Number of channel Expandability		As per required number of signals for particular feeders As required for future feeders
2.	Nominal current	Amp	1A/5A
3.	Nominal voltage	Vac/Vdc	
	-Current	mA/Amp	
4.	Frequency response		
5.	Cut –off frequency		
	Bandwidth	dB	Insert
	Attenuation at	dB	Insert
	(C) Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	Yes
	(d)Simultaneously programmable sampling rate for all feeders/inputs -Locally Changeable - Remotely Changeable	 Yes/No Yes/No	3 distinct programmable Sampling rates and generate 3 simultaneously distinct records Yes Yes
	(e) Possible sampling rates	 Samples/sec Samples/sec Samples/sec	3 different sampling rates: Slow. 1Hz-500Hz Fast: 0.5kHz-6kHz Continuous (variable rate)
6.	DC coupled inputs	Yes/No	Yes, all Analog inputs should be capable of connecting AC or DC inputs as per site requirement without changing any hardware .
7.	Resolution	bits	16 bits
8.	Accuracy	%	Min 0.5
9.	Burden		
	1.Current Circuit at IN	VA	Insert
	2.Voltage Circuit	VA	Insert
10.	Over load		
	1.Current	% In	100% In continuously, Min 600% in for 1sec
	2.Voltage Circuit	% Vn	2Vn and max. 350Vn
(C)	DIGITAL INPUTS		

SL	ITEM	UNITS	PGCB'S REQUIREMENT
1.	Number of channel -Expandability(without and time skew)		As per required number of signals for particular feeders As required for future feeders
2.	Selectable input level	Vdc	N/O or N/C. 24,48,110 and220 VDC
3.	Type		Potential or potential free contract
4.	Resolution	ms	
(D)	MEMORY		
1.	Size	MB	64 MB or Higher
2.	Type		SolidState
3. 4.	Pre-fault time (fast scanning rate) Post-fault (fast scanning rate)	sec sec	0.1-2 user programmable 0.1-2 user programmable
5.	Pre and Post fault time (slow scanning rate)	sec	min. 180 user programmable
6.	In-Build Flash disk (auto-maintained)	GB	min. 4 GB
(E)	SENSORS/ TRIGGERING CRITERIA		
	All sensors/triggers are preferable Programmable and Virtually recordable	Yes/No	Yes
1.	Logical combination sensor	Yes/No	Yes
2.	Three phase over or under Voltage/ Current	Yes/No	Yes
3.	Mono phase over or under Voltage/ Current	Yes/No	Yes
4.	*du/dt,dp/dt,dq/dt, [Single/3 Phases], df/dt, etc.	Yes/No	Yes
5.	RMS [Voltage/Current]	Yes/No	Yes
6.	Zero Sequence	Yes/No	Yes
7.	Negative, Positive Sequence	Yes/No	Yes
8.	Frequency	Yes/No	Yes
9.	DC Step	Yes/No	Yes
10.	Pending/Swing	Yes/No	Yes
11.	Digital level and edge	Yes/No	Yes
12.	Sensor Trigger	Yes/No	Yes
13.	Event Trigger	Yes/No	Yes
14.	Manual Trigger	Yes/No	Yes
15.	Remote Trigger	Yes/No	Yes
(F)	CLOCK SYSTEM		
1.	Internal Clock	Yes/No	Yes
2.	Accuracy		
3.	External Synchronization	Yes/No	Yes
4.	Time resolution between 2 synchronized pulse		
(G)	OUTPUT ALARM RELAY CONTACT		
1.	Max. operation Voltage DC/AC	Vac/Vdc	250 Vac or above, 60 Vdc or above
2.	Make and carry for 0.5 sec	A	Min. 8A
3.	Carry continuously	A	Min. 5A
4.	Break (DC)-resistive	W	

SL	ITEM	UNITS	PGCB'S REQUIREMENT
(H)	INTERFACE FOR DATA COMMUNICATION		
1.	Full definition compression	Yes/No	Yes
2.	Maximum transmission rat	Bits/Sec	
3.	Standard serial port (EIA-232-D)	Yes/No	Yes
4.	Printer Port	Yes/No	Yes
5.	Dedicated serial port for modem	Yes/No	Yes
(I)	PRINTER DATA		
1.	Printer amplitude (scaling peak to peak)		
2.	Time Scale (mm/s)		
3.	Printer resolution	mm	
4.	Auto printing	Yes/No	Yes
(J)	Fault Priority transmission	Yes/No	Yes
(K)	Fault location (distance calculation)	Yes/No	Yes
(L)	Test certificate from internationally recognized Laboratories	Yes/No	Yes
(M)	COMMUNICATION AND REMOTE ANALYZING UNIT		
1.	Processor Pentium	(MHz),Yes/No	Yes, at least 450MHz Pentium
2.	Co-Processor Pentium	Yes/No	Yes
3.	Main memory capacity	(Mb), Yes/No	Yes, at least 64Mb
4.	Color graphics board S-VGA	Yes/No	Yes
5.	Screen S-VGA	Yes/No	Yes
6.	Hard disk unit	Yes/No	Yes, at least 40GB
7.	Printer	Yes/No	Yes
8.	Modem	Yes/No	Yes

4.2.7 HV & LV Cable

230kV Power Cable

Sl No.	Description	Unit	Requirement	Bidder's Data
	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	
	Voltage			
	Rated Voltage	kV	230kV	
	Maximum System Voltage	kV	245kV	
	Impulse withstand voltage	kV	1050	
	Power frequency withstand voltage	kV	460	
	Cores			
	Number of cores		1 (one)	
	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)	
	Conductor Screen			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	
	Thickness (approx.)	mm	Insert	
	Nominal Diameter over semi-conducting layer	mm	Insert	
	Insulation			
	Material		XLPE	
	Process		Triple simultaneous extrusion	
	Type of curing (dry)		Dry Curing (VCV)	
	Average Thickness		23-25 mm	
	Minimum Thickness		Insert	

Sl No.	Description	Unit	Requirement	Bidder's Data
	Nominal Diameter over insulation		Insert	
	Insulation screen			
	Material		Extruded semi conducting compound, cross linked	
	Thickness approx.		Insert	
	Nominal Diameter over semi conducting layer		Insert	
	Metallic Screen/Sheath			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
	Longitudinal water tightness			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.		Insert	
	Radial moister barrier			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	
	Outer Covering			
	Material		MDPE	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
	Completed Cable		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
	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	

Sl No.	Description	Unit	Requirement	Bidder's Data
	Three Circuit		Insert	
	In Air		Insert	
	Max Conductor temperature			
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
	Permissible overload in service condition		2 hrs in a day 100 hrs in a month 500 hrs in total life	
	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	
	Final conductor temperature	°C		
	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°	
	Max. Dielectric stress	kV/meter	Insert	
	on the conductor screen (assumed smooth)	kV/meter	Insert	
	on the insulation	kV/meter	Insert	
	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	
	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One cable in duct)		Insert	
	Maximum DC resistance per km of cable at 20°C	ohm/km		
	Of conductor	ohm/km	Insert	
	Of metallic layer	ohm/km	Insert	
	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
	Insulation Resistance per km of cable per core			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	

Sl No.	Description	Unit	Requirement	Bidder's Data
	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	
	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
	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	
	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
	Cree page	Mm	Insert	
	Total creepage distance of outdoor sealing approx. mm and porcelain.			
	Earth continuity copper Conductor (IF REQD)	mm2	Insert	
	Condition on which current carrying capacity are based			
	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	

132kV Power Cable

Sl No.	Description	Unit	Requirement	Bidder's Data
	General			
	Manufacturer		Insert	
	Type		Insert	

Sl No.	Description	Unit	Requirement	Bidder's Data
	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	 30 45	
	Voltage			
	Rated Voltage	kV	132kV	
	Maximum System Voltage	kV	145kV	
	Impulse withstand voltage	kV	650	
	Power frequency withstand voltage	kV	275	
	Cores			
	Number of cores		1 (one)	
	Conductor			
	Standard		IEC 60228	
	Nominal Current	A	≥ 1200	
	Cross sectional area	mm2	Insert	
	Nominal Diameter	mm	Insert	
	Material		Annealed Copper	
	Design (standard of segmental)		Milliken (4/5 segment)	
	Conductor Screen			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	
	Thickness (approx.)	mm	Insert	
	Nominal Diameter over semi-conducting layer	mm	Insert	
	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	
	Insulation screen			
	Material		Extruded semi conducting compound, cross linked	

Sl No.	Description	Unit	Requirement	Bidder's Data
	Thickness approx.		Insert	
	Nominal Diameter over semi conducting layer		Insert	
	Metallic Screen/Sheath			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
	Longitudinal water tightness			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.		Insert	
	Radial moister barrier			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	
	Outer Covering			
	Material		HDPE (Latest generation)	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
	Completed Cable		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
	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	
	In Air		Insert	
	Calculation as per IEC		During Execution	
	Max Conductor temperature			

Sl No.	Description	Unit	Requirement	Bidder's Data
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
	Permissible overload in service condition		Min 2 hrs in a day Min 100 hrs in a month Min 500 hrs in total life	
	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	
	Final conductor temperature	°C	Insert	
	Calculation as per IEC		During Execution	
	Sheath Earth Fault Current Carrying capacity	kA/1sec	Min 90% of conductor capacity	
	Final Conductor temperature	°C	Insert	
	Max. Dielectric stress	kV/meter	Insert	
	on the conductor screen (assumed smooth)	kV/meter	Insert	
	on the insulation	kV/meter	Insert	
	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	
	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One cable in duct)		Insert	
	Maximum DC resistance per km of cable at 20°C	ohm/km		
	Of conductor	ohm/km	Insert	
	Of metallic layer	ohm/km	Insert	
	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
	Insulation Resistance per km of cable per core			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	
	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	

Sl No.	Description	Unit	Requirement	Bidder's Data
	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
	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	
	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
	Cree page	Mm	Insert	
	Total creepage distance of outdoor sealing approx. mm and porcelain.			
	Earth continuity copper Conductor (IF REQD)	mm2	Insert	
	Condition on which current carrying capacity are based			
	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	

AUXILIARY POWER AND MULTICORE CONTROL CABLES

Item		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
IEC standard																
Number of core																
Core section	mm2															
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 radius	mm															
Maximum conductor temperature	□C															
Continuous current rating																
Short circuit rating 1s																
Short circuit temperature																

4.2.8 Batteries, Chargers and DC Distribution:

110V Battery

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Manufacturer		Insert	
	Type		Insert	
	Standard		IEC or equivalent	
	Electrolyte		Insert	
	Nominal voltage	V	110	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Capacity at 5 hour rate	Ah	-600AH @ 5 Hr (for 110 V DC,230kV & 132KV S/Y)	
	Number of cells		-Not less than 94 nos. for 110V -Not less than 42 nos. for 48V	
	Float voltage per cell	V	1.40-1.42	
	Battery voltage at end of the duty cycle	V	Insert	
	ECV	V/Cell	1.11	
	Normal charging rate	A	Insert	
	Maximum charging rate	A	Insert	
	Ampere-hour efficiency at ten hour rate	%	Insert	
	Ampere-hour efficiency at one hour rate	%	Insert	
	Discharge voltage per cell	V	1.0	
	Spec. gravity of electrolyte	1	1.19±0.01	
	Sp. gravity of electrolyte (Charged)	1	1.19 ± 1%	
	Positive plate	-	Tubular	
	Negative plate	-	Pasted	
	Type of container	-	Plastic polymer	
	Cell condition	-	Pre-charged	
	Vent plug		Anti-corrosive & fire proof	
	The battery stands steel frame		Yes	
	The battery stands earth-quake endurance type		Yes	
	Quantity of electrolyte per one cell	litre	Insert	
	Dimensions of one cell	mm	Insert	
	Dimensions of battery complete	mm	Insert	
	Weight of cell complete with electrolyte	kg	Insert	
	Internal resistance per cell when fully charged	ohms	Insert	
	Material of battery case		Insert	

Battery Charger For 110V

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	General			
1.1	Manufacturer		Insert	
1.2	Type designation		Insert	
1.3	Type		Thyristor controlled	
1.4	Country of origin		Insert	
1.5	Standards		IEC	
1.6	Installation		Indoor	
1.7	Rectifier type		Thyristor controlled.	
1.8	Rated D.C. voltage	V	110V ±5%	
1.9	Rated output current	A	170, 150, 120A, 100A (refer to BOQ for detail)	
1.10	Charging mode		Both constant current & constant voltage	
1.11	High Voltage Insulation	V	1000 V AC for 1 minute between input to output and input to ground	
1.12	Insulation resistance	MΩ	10 MΩ with 500V DC for 1minute	
1.13	Cooling system		Self & natural air cooled.	
1.14	Relative humidity	%	Up to 98%	
1.15	Ambient temperature	°C	40 (max.)	
1.16	Noise level	db	65 (max)	
1.21	Altitude		1000 m	
1.22	Applicable Standard	Hz	IEC or equivalent	
2.	AC Input			
2.1	Voltage	V	415	
2.2	Phase		3	
2.3	Frequency	Hz	50±5%	
2.4	Allowable Input AC voltage variation At Charger input terminal	V	±15%	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5	Power factor		0.8	
2.6	Efficiency (Full load)	%	85%	
2.7	Charge Characteristics		Constant current /Constant voltage (During float charge)	
2.8	Current limitation	%	110%	
3	D.C. OUTPUT			
3.1	Voltage	V	110±5%	
3.2	Ripple Voltage (Full load)	%	±3%	
3.3	Charge modes (3 level)		Charge, Float charge & Boost charge	
3.4	Float Voltage (adjustable)	V	1.42	
3.5	Boost Voltage (adjustable)	V	1.53	
4	Measurement		Input Voltage Output Voltage Output Current Battery Current Load Current Earth-fault Voltage	
	Overall compliance with the requirements (yes/no)			

48V Battery

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Manufacturer		Insert	
	Type		Insert	
	Standard		IEC or equivalent	
	Electrolyte		Insert	
	Nominal voltage	V	110	
	Capacity at 5 hour rate	Ah	250AH @ 5 Hr	
	Number of cells		-Not less than 42 nos. for 48V	
	Float voltage per cell	V	1.40-1.42	
	Battery voltage at end of the duty cycle	V	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	ECV	V/Cell	1.11	
	Normal charging rate	A	Insert	
	Maximum charging rate	A	Insert	
	Ampere-hour efficiency at ten hour rate	%	Insert	
	Ampere-hour efficiency at one hour rate	%	Insert	
	Discharge voltage per cell	V	1.0	
	Spec. gravity of electrolyte	1	1.19±0.01	
	Sp. gravity of electrolyte (Charged)	1	1.19 ± 1%	
	Positive plate	-	Tubular	
	Negative plate	-	Pasted	
	Type of container	-	Plastic polymer	
	Cell condition	-	Pre-charged	
	Vent plug		Anti-corrosive & fire proof	
	The battery stands steel frame		Yes	
	The battery stands earth-quake endurance type		Yes	
	Quantity of electrolyte per one cell	litre	Insert	
	Dimensions of one cell	mm	Insert	
	Dimensions of battery complete	mm	Insert	
	Weight of cell complete with electrolyte	kg	Insert	
	Internal resistance per cell when fully charged	ohms	Insert	
	Material of battery case		Insert	

Battery Charger For 48V

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	General			
1.1	Manufacturer		Insert	
1.2	Type designation		Insert	
1.3	Type		Thyristor controlled	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.4	Country of origin		Insert	
1.5	Standards		IEC	
1.6	Installation		Indoor	
1.7	Rectifier type		Thyristor controlled.	
1.8	Rated D.C. voltage	V	110V ±5%	
1.9	Rated output current	A	70, 150, 120A, 100A (refer to BOQ for detail)	
1.10	Charging mode		Both constant current & constant voltage	
1.11	High Voltage Insulation	V	1000 V AC for 1 minute between input to output and input to ground	
1.12	Insulation resistance	MΩ	10 MΩ with 500V DC for 1minute	
1.13	Cooling system		Self & natural air cooled.	
1.14	Relative humidity	%	Up to 98%	
1.15	Ambient temperature	°C	40 (max.)	
1.16	Noise level	db	65 (max)	
1.21	Altitude		1000 m	
1.22	Applicable Standard	Hz	IEC or equivalent	
2.	AC Input			
2.1	Voltage	V	415	
2.2	Phase		3	
2.3	Frequency	Hz	50±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%	
3	D.C. OUTPUT			
3.1	Voltage	V	110±5%	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2	Ripple Voltage (Full load)	%	±3%	
3.3	Charge modes (3 level)		Charge, Float charge & Boost charge	
3.4	Float Voltage (adjustable)	V	1.42	
3.5	Boost Voltage (adjustable)	V	1.53	
4	Measurement		Input Voltage Output Voltage Output Current Battery Current Load Current Earth-fault Voltage	
	Overall compliance with the requirements (yes/no)			

4.2.9 LVDC/AC Distribution Panel

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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4	Fault Rating for 1 sec	kA	Insert	

4.2.10 Telecommunication Equipment

Fibre Optic Multiplexer Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.0	GENERAL:			
1.1	Type of multiplexer		SDH: ADM & PDH	
1.2	Complying to ITU-T rec.		Yes	
1.3	Transmission Capacity	Mbit/s	STM-4 & STM-16	
1.4	Access capacity on 64 kbit/s	channels	Minimum 200	
1.5	Access capacity on 2 Mbit/s	channels	Minimum 40	
1.6	Redundant central processor		Shall be available	
1.7	Digital cross connect function		Fully non-blocking	
2.0	Available AGGREGATES:			
2.1	Optical aggregates (ITU-T G.957)		As per field requirement	
3.0	Available TRUNK INTERFACES:			
3.1	HDB3, 2 Mbit/s interfaces per module	Nos.	Minimum 8	
3.2	Complying to ITU-T rec.		G.703, transparent G.704, selectable	
3.3	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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

Power Line Carrier Equipment (Not Applicable)

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

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

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

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

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

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

4.2.11 Others

No	Description	Unit	Minimum Requirements	Guaranteed
1	Structural Steel			
1.1	Type and standard specification		Insert	
1.2	Manufacturer and country		Insert	
1.3	Minimum yield strength	kg/mm2	Insert	
1.4	Ultimate tensile strength	kg/mm2	Insert	
	Copper Conductors for Earthing system			
2.1	Type and standard specification		Insert	
2.2	Manufacturer and country		Insert	
2.3	Conductor material		Insert	
2.4	Size of conductors (Solid copper rods)	mm2	Insert	
2.5	Size of conductors (Flat copper bars)	mm	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
	(Width×Thickness×Bundles)			
2.6	Rated current	A	Insert	
2.7	Short time withstand current	kA rms	Insert	
2.8	Peak withstand current	kA pk	Insert	
3	High Voltage Bus Work			
3.1	Switchyard Conductor			
3.1.1	Copper Tubular Conductors for Busbar			
3.1.1.1	Type and standard specification		Insert	
3.1.1.2	Manufacturer and country		Insert	
3.1.1.3	Inner diameter	mm	Insert	
3.1.1.4	Outer diameter	mm	Insert	
3.1.1.5	Rated continuous current (site rating)	A rms	Insert	
3.1.1.6	Temperature rise at rated current	oC	Insert	
3.1.1.7	Rated short time current	kA rms	Insert	
3.1.1.8	Peak withstand current	kA pk	Insert	
3.1.1.9	Weight	kg/m	Insert	
3.1.1.10	Moment of inertia	kg-m2	Insert	
3.1.2	Aluminium Tubular Conductors for Busbar			
3.1.2.1	Type and standard specification		Insert	
3.1.2.2	Manufacturer and country		Insert	
3.1.2.3	Inner diameter	mm	Insert	
3.1.2.4	Outer diameter	mm	Insert	
3.1.2.5	Rated continuous current (site rating)	A rms	Insert	
3.1.2.6	Temperature rise at rated current	oC	Insert	
3.1.2.7	Rated short time current	kA rms	Insert	
3.1.2.8	Peak withstand current	kA pk	Insert	
3.1.2.9	Weight	kg/m	Insert	
3.1.2.10	Moment of inertia	kg-m2	Insert	
3.1.2.11	Temperature rise at rated current	oC	Insert	
3.1.2.12	Rated short time current	kA rms	Insert	
3.1.2.13	Peak withstand current	kA pk	Insert	
3.1.2.14	Rated ultimate tensile strength	kN	Insert	
3.1.2.15	Mass, nominal	kg/m	Insert	
3.1.2.16	No. of conductors per bundle		Insert	
3.1.2.17	Bundle configuration		Insert	
3.1.2.18	Bundle spacing			
3.1.3	Flexible Bus Conductor			
3.1.3.1	Type and standard specification		Insert	
3.1.3.2	Manufacturer and country		Insert	
3.1.3.3	Conductor type		Insert	
3.1.3.4	Conductor size		Insert	
3.1.3.5	Standing No. of Al wires Dia. Of each wire	 mm	Insert	
3.1.3.6	Overall conductor dia.	mm	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
3.1.3.7	Cross-sectional area	mm2	Insert	
3.1.3.8	Rated continuous current (site rating)	A rms	Insert	
3.1.3.9	Temperature rise at rated current	oC	Insert	
3.1.3.10	Rated short time current	kA rms	Insert	
3.1.3.11	Peak withstand current	kA pk	Insert	
3.1.3.12	Rated ultimate tensile strength	kN	Insert	
3.1.3.13	Mass, nominal	kg/m	Insert	
3.1.3.14	No. of conductors per bundle		Insert	
3.1.3.15	Bundle configuration		Insert	
3.1.3.16	Bundle spacing		Insert	
3.1.4	Shield Wire			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Dia. of galvanized steel wire	mm	Insert	
	Stranding No. of Al wires Dia. Of each wire	 mm	Insert	
	Grade of wire		Insert	
	Weight of wire	kg/km	Insert	
	Minimum breaking strength of wire	kN	Insert	
3.2	Insulators			
3.2.1	Station Post Type (for rigid Busbar)			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Insulator unit, length/height	mm	Insert	
	No. of units in each insulator		Insert	
	Power frequency flashover voltage Dry Wet	 kV kV	Insert	
	Impulse flashover voltage Positive Negative	 kV kV	Insert	
	Power frequency withstand voltage 1 min. dry 10 sec. wet	 kV kV	Insert	
	Power frequency puncture voltage	kV	Insert	
	Switching impulse withstand voltage, wet	kV pk	Insert	
	Lightning impulse withstand voltage	kV pk	Insert	
	Radio interference voltage Test voltage to ground Max. RIV at 1.1xUr//3 line to ground voltage, when tested as per IEC 60694	 kV rms micro V	Insert	
	Leakage distance	mm	Insert	
	Mechanical values, failing load (min.) Cantilever strength	 N	Insert	

No	Description	Unit	Minimum Requirements	Guaranteed
	Tensile strength Torsional strength Compressional strength Combined electrical and mechanical strength Impact strength	N N-m N N N-m		
3.2.2	String Type		Insert	
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Insulator unit, length	mm	Insert	
	No. of units in each insulator		Insert	
	No. of insulator strings per conductor (at each end)		Insert	
	Dia. of disc	mm	Insert	
	Disc spacing	mm	Insert	
	Power frequency flashover voltage Dry Wet	 kV kV	Insert	
	Impulse flashover voltage Positive Negative	 kV kV	Insert	
	Power frequency withstand voltage 1 min. dry 10 sec. wet	 kV kV	Insert	
	Power frequency puncture voltage	kV	Insert	
	Switching impulse withstand voltage, wet	kV pk	Insert	
	Lightning impulse withstand voltage	kV pk	Insert	
	Dry arcing distance	mm	Insert	
	Radio interference voltage Test voltage to ground 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 N-m	Insert	
3.3	Clamps and Fittings			
	Type and standard specification		Insert	
	Manufacturer and country		Insert	
	Maximum working stresses		Insert	
	All accessories for installation (bolts, nuts, etc.)		Insert	

4.3 Technical information

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
1	Contractor's quality control system:		
1.1	Copy of the QA system accreditation certificates		
1.2	Quality system manual with typical procedures and quality control sheets		
1.3	Environmental management manual		
1.4	Occupational health and safety manual		
2	Standards:		
2.1	Copy of technical standards proposed for use instead of a relevant IEC or other international standard, with list of differences from relevant international standard, if any		
3	Substation arrangement:		
3.1	Substation Single Line Diagrams		
3.2	Substation Layout drawing		
3.2	Cross-section drawing		
4	GIS Equipment		
4.1	Manufacturer’s authorization letter		
4.2	Manufacturer’s quality assurance certificates		
4.3	Technical data sheet		
4.4	Drawing		
4.5	List of performed type tests		
4.6	Type test certificates		
4.7	Descriptive catalogue		
4.8	Reference list for the last five years for the offered type		
4.9	List of mandatory special tools		
4.10	List of mandatory spare parts		
4.11	List of recommended spare parts		
4.12	Training plan and program		
5	Circuit breakers:		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
5.1	Manufacturer’s authorization letter		
5.2	Manufacturer’s quality assurance certificates		
5.3	Technical data sheet		
5.4	Drawing		
5.5	List of performed type tests		
6.6	Type test certificates		
5.7	Descriptive catalogue		
5.8	Reference list for the last five years for the offered type		
5.9	List of mandatory special tools		
5.10	List of mandatory spare parts		
5.11	List of recommended spare parts		
5.12	Training plan and program		
6	Disconnectors:		
6.1	Manufacturer's authorization letter		
6.2	Manufacturer's quality assurance certificates		
6.3	Technical data sheet		
6.4	Drawing		
6.5	List of performed type tests		
6.6	Type test certificates		
6.7	Descriptive catalogue		
6.8	Reference list for the last five years for the offered type		
6.9	List of mandatory special tools		
6.10	List of mandatory spare parts		
6.11	List of recommended spare parts		
6.12	Training plan and program		
7	Current transformers:		
7.1	Manufacturer’s authorization letter		
7.2	Manufacturer’s quality assurance certificates		
7.3	Technical data sheet		
7.4	Drawing		
7.5	List of performed type tests		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
7.6	Type test certificates		
7.7	Descriptive catalogue		
7.8	Reference list for the last five years for the offered type		
8	Voltage transformers:		
8.1	Manufacturer's authorization letter		
8.2	Manufacturer's quality assurance certificates		
8.3	Technical data sheet		
8.4	Drawing		
8.5	List of performed type tests		
8.6	Type test certificates		
8.7	Descriptive catalogue		
8.8	Reference list for the last five years for the offered type		
9	Surge arresters:		
9.1	Manufacturer’s authorization letter		
9.2	Manufacturer’s quality assurance certificates		
9.3	Technical data sheet		
9.4	Drawing		
9.5	List of performed type tests		
9.6	Type test certificates		
9.7	Descriptive catalogue		
9.8	Reference list for the last five years for the offered type		
10	Control system:		
10.1	Manufacturer's authorization letter		
10.2	Manufacturer's quality assurance certificates		
10.3	Technical data sheet		
	Drawing		
10.5	List of performed type tests		
10.6	Type test certificates		
10.7	Descriptive catalogue		
10.8	Reference list for the last five years for the offered type		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
10.9	List of mandatory special tools		
10.10	List of mandatory spare parts		
10.11	List of recommended spare parts		
10.12	Training plan and program		
11	Relay Protection System:		
11.1	Manufacturer's authorization letter		
11.2	Manufacturer's quality assurance certificates		
11.3	Technical data sheet		
11.4	Drawing, system topology, block diagrams		
11.5	General description of hardware		
11.6	General description of software		
11.7	Descriptive catalogue		
11.8	Reference list for the last five years for the offered type		
11.9	List of mandatory special tools		
11.10	List of mandatory spare parts		
11.11	List of recommended spare parts		
11.12	Training plan and program		
12	Metering System:		
12.1	Manufacturer's authorization letter		
12.2	Manufacturer's quality assurance certificates		
12.3	Technical data sheet		
12.4	Drawing		
12.5	General description of hardware		
12.6	General description of software		
12.7	Descriptive catalogue		
12.8	Reference list for the last five years for the offered type		
12.9	List of mandatory special tools		
12.10	List of mandatory spare parts		
12.11	List of recommended spare parts		
13	Communication System:		
13.1	Manufacturer's authorization letter		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
13.2	Manufacturer's quality assurance certificates		
13.3	Technical data sheet		
13.4	Drawing, system topology		
13.5	General description of hardware		
13.6	General description of software		
13.7	Descriptive catalogue		
13.8	Reference list for the last five years for the offered type		
13.9	List of mandatory special tools		
13.10	List of mandatory spare parts		
13.11	List of recommended spare parts		
	Overall compliance with the requirements (yes/no)		

4.4 Drawings and Other Technical Information to be provided

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
1	Contractor's quality control system		
1.1	Copy of the QA system accreditation certificates		
1.2	Quality system manual with typical procedures and quality control sheets		
1.3	Environmental management manual		
1.4	Occupational health and safety manual		
2	Standards		
2.1	Copy of technical standards proposed for use instead of a relevant IEC or other international standard, with list of differences from relevant international standard, if any		
3	Substation arrangement		
3.1	Substation Single Line Diagrams		
3.2	Substation Layout drawing		
4	Gas Insulated Substation & Equipment		
4.1	Manufacturer's authorization letter		
4.2	Manufacturer's QA certificates		
4.3	Technical data sheet		
4.4	List of performed type tests		
4.5	Type test certificates		
4.6	Reference list for the last ten years for the offered type		
5	Circuit breakers		
5.1	Manufacturer's authorization letter		
5.2	Manufacturer's QA certificates		
5.3	Technical data sheet		
5.4	List of performed type tests		
5.5	Type test certificates		
4.6	Reference list for the last ten years for the offered type		
6	Disconnectors		
6.1	Manufacturer's authorization letter		
6.2	Manufacturer's QA certificates		
6.3	Technical data sheet		
6.4	List of performed type tests		
6.5	Type test certificates		
6.6	Reference list for the last five ten for the offered type		
7	Current transformers		
7.1	Manufacturer's authorization letter		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
7.2	Manufacturer's QA certificates		
7.3	Technical data sheet		
7.4	List of performed type tests		
7.5	Type test certificates		
7.6	Reference list for the last ten years for the offered type		
8	Voltage transformers		
8.1	Manufacturer's authorization letter		
8.2	Manufacturer's QA certificates		
8.3	Technical data sheet		
8.4	List of performed type tests		
8.5	Type test certificates		
8.6	Reference list for the last ten years for the offered type		
9	Surge arresters		
9.1	Manufacturer's authorization letter		
9.2	Manufacturer's QA certificates		
9.3	Technical data sheet		
9.4	List of performed type tests		
9.5	Type test certificates		
9.6	Reference list for the last ten years for the offered type		
10	Control system		
10.1	Manufacturer's authorization letter		
10.2	Manufacturer's QA certificates		
10.3	Technical data sheet		
10.4	List of performed type tests		
10.5	Type test certificates		
10.6	Reference list for the last ten years for the offered type		
11	Relay Protection System		
11.1	Manufacturer's authorization letter		
11.2	Manufacturer's QA certificates		
11.3	Technical data sheet		
11.4	List of performed type tests		
11.5	Type test certificates		
11.6	Reference list for the last five years for the offered type		
12	Metering System		
12.1	Manufacturer's authorization letter		
12.2	Manufacturer's QA certificates		
12.3	Technical data sheet		
12.4	List of performed type tests		
12.5	Type test certificates		
12.6	Reference list for the last ten years forthe offered type		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
13	Communication System		
13.1	Manufacturer's authorization letter		
13.2	Manufacturer's QA certificates		
13.3	Technical data sheet		
13.4	List of performed type tests		
13.5	Type test certificates		
13.6	Reference list for the last ten years for the offered type		

5. Schedule F: Proposed Subcontractors

The following form shall be filled and attached to the bid.

Bidders are free to propose/list more than one Subcontractor for each item.
Quoted rates and prices shall be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.
In case that more than one Subcontractor has been proposed, the Employer have right to choose one or more of them, or can ask for replacement
Should a Subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable Subcontractor without any change to the bid price.
Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved Subcontractor for each item concerned.

If the Bidder will carry out any of the works and services, they shall put own name in the form

Subcontractors

The following Subcontractors are proposed for carrying out the facilities:

Item	Works and Service	Subcontractor's Name and Address	Nationality
11.1	Design		
11.2	Civil works		
11.3	Electrical works / installation, testing and commissioning		
11.4	NLDC		
Name of Bidder:			
Signature of Bidder:			

Schedule G: Proposed Alternative Standards to Which Equipment Shall Be Provided

The bidder shall list below all the alternative engineering and design Standards, which he proposes to use in his design, manufacture and testing of equipment to be supplied. Should these standards differ from the specified standard in any respect, the bidder shall detail the differences between the proposed and specified standard.
Compliance with any standard equal or superior to those specified will be considered acceptable.

In the absence of any listed alternative standard, it is deemed that the standards specified in the Tender documents are fully complied with.

Specified Standard	**Alternative Standard**	
	Number	**Title**

6. Schedule H: Drawings and Documents to Be Submitted with Bid and After Contract

6.1 Drawing and Documents to be Submitted with BID

1. The following drawings/documents shall be submitted with the Tender:

1. Typical single line, layout & sectional drawings of substation showing details of construction and dimensions.

2. Outline drawings of all switchgear equipment:-

   (a) Showing installed components, dimensions and weights;
   (b) Showing transport dimensions and weights;

3. Outline drawings of all power transformers, auxiliary transformers and Shunt Reactor (if any):-

   (a) Showing installed components, dimensions and weights;
   (b) Showing transport dimensions and weights;

4. Typical drawing of transformer remote control panel.

5. For furnishing Type Test Certificates of equipment, Please see ”Type Test Requirement”, clause 1.3, Section 6: Employer’s Requirement, Volume 01 of 03.

For each equipment, the Bidder shall provide the List of performed Type tests as following

Equipment					
No.	Type test	Name of Type test laboratory	Number of Type test report	Date of report	Number of pages

6. Quality Assurance Certificate ISO9001/9002 Certification (or equivalent) and Quality Assurance Programme & Typical Quality Plan for the work from the manufacturers of the following

equipment:

(i) Power transformer
(ii) Switchgears (CB, DS/ES) &
(iii) Instrument Transformer
(iv) Relays& substation Automation System
(v) Fibre Optic Multiplexer Equipment for protection and communication
(vi) GIL / Underground power cables
(vii) Surge arrester
(viii) Wave trap (N/A)
(ix) Bus Reactor (N/A)
(x) DFDR
(xi) Battery & charger
(xii) Insulator

6.2 Drawings and Documents to be Submitted after Contract

Technical Drawings/Documents

General:
The Contractor shall prepare necessary technical documents for the equipment including detailed engineering drawings, design calculations and specifications showing full details of the civil works, equipment and materials to be used as well as all arrangement necessary for the installation works.

Prior to manufacturing, the contractor shall submit technical documents and drawings to the Employer for approval.

The Employer will review and send to the Contractor his comments on the documents within 4 weeks from receiving them, the commented drawings/ documents will be marked by “Approved”, “Approved with Conditions”, “Not Approved” or “Not Subject for Approved”.

Any comments given by the Employer shall be taken into account before commencement of civil works, manufacturing process at factories and if any modification or change is directed by the Employer, the documents shall be revised and resubmitted for approval after making necessary revisions (Within 14 days).

Approval of the documents shall in no way relieve the Contractor from any of his contractual obligations.

All costs and expenses for preparation and submission of the documents shall be borne by the Contractor including those for revision and submission of the documents.

The Technical documents shall have the followings features:
a) Units:
International System of Units (SI) shall be applied to all works.
b) Language:
English shall be the formal language, hence all documents, correspondences, drawings, reports, schedules, instructions, name plates, rating plates, caution plates and notices shall be written in English.
c) Symbols, Marks and Abbreviations:
All symbols, marks and abbreviations, etc., used on any documents shall be clearly explained by a legend on the same document or on separate sheets.

The abbreviations and marks used for an individual device shall be identical throughout whole documentation so as to avoid confusion and misunderstanding.
d) Sizes and Identifications of Documents:
The size of the drawings shall be standardized as follows:
- Al (594 mm x 841 mm)
- A2 (420 mm x 594 mm)
- A3 (297 mm x 420 mm)
- A4 (210 mm x 297 mm)

Design calculations, specifications, lists, instruction manuals and other documents shall preferably be prepared and submitted in A4 size.
All documents shall have a uniform title block at the bottom right hand corner, inclusive of the origin of the documents. The title block shall show the drawing title with main ratings such as capacity or voltage etc., drawing number, revision number or letter, date to have been prepared, name of the Contractor and/or manufacturer and the signature of the Contractor's authorized representative. Project title block will be informed from Engineer after contract. A spare blank space shall be provided above the title block of each document for the Employer comments.

Typical Technical Documents Required to be Submitted to the Employer:

The Bidder/Contractor shall submit the following technical documents and drawings:
A) With the Bid: (Refer to also Item 10.1 above)
The following drawings shall be submitted with the Bid:

a) General arrangement of substation.
This drawing shall give the principal dimensions and approximate positions of the circuit breakers, isolating switches, etc.
b) General arrangement and overall dimension drawings of the switchgear.
c) Single line diagram of the main connections with secondary circuit of protection and metering etc.
d) General arrangement for transformers.
e) General arrangement of control and indicating panels.
f) General arrangement of relay panels
g) Drawings for MV switchgear & auxiliary buildings and guard house including floor plan, section, elevation and dimensions.
h) Catalogues, literature and reference list of proposed Switchgear equipment, protection relays and SAS.
i) Quality Management System Manual and ISO Certificate of the equipment manufacturer for 400kV & 230kV GIS, Auto Transformer, Shunt Reactor, 33kV Switchgear, Protection relays, Battery and Battery charger, Communication equipment and SAS.
j) Type testing certificates and procedures for similar switchgear, transformer, shunt reactor, circuit breaker, cable, etc.
k) Routine testing certificates and procedures for all equipment.

B) After Contract Award Stage:
The followings are minimum requirement. Additional documents/drawings shall be submitted to the Employer, when required by the Employer.

a) Master List of Drawings and Documents (Master Document List):
After contract signing, the Contractor shall create and submit a master list of drawings and documents to the Employer for approval, for the purpose of monitoring and smooth processing of document approval, which shall contain document title and number, date to be submitted, re-submission date, approval date etc. underneath each column of relevant document classification or category.
i) Single Line diagram (SLD) for main circuits and secondary circuits.
ii) Layout drawings of the substation showing buildings/rooms, equipment arrangement, overall dimensions of equipment bays, cable routes or connections between equipment, internal/access roads and phase-phase and phase-earth clearances where applicable.
iii) Outline drawings of switchgear bays, circuit breakers, disconnecting switches, earthing switches and other main plant showing overall dimensions and weights, including details for shipping.

iv) General arrangement for transformers and shunt reactors.
v) Bushings or cable termination details for switchgears and transformers/reactors.
vi) Descriptive information and drawings for transformers, dealing with tank, core and winding arrangements including type of coils, insulation, use of grading, on-load tap-changing equipment and location of all ancillary devices, these drawings shall show masses crane lift necessary for un-tanking and size of lifting lugs.
vii) Typical drawings of protection equipment, relay panels, and associated equipment enclosures.
viii) SAS system configuration and related drawings
ix) AC/DC system and panels arrangement drawing
x) Telecommunication equipment system diagram & panel arrangement
xi) Detailed schematic diagram for all equipment
Xii) Interconnection/Wiring Diagrams, Cables route & Cable schedule between panels/equipment
xiii) Civil Engineering/design drawings
xiv) Details of Building services equipment and system arrangement/calculations
xv) Others, when required

- The contractor shall include any other drawings, catalogues, descriptions and photographs necessary to present a clear picture of the type and class of equipment to be provided under the contract.
- Project Implementation Schedule/Program shall be submitted to the Employer for approval within one month after signing the contract, showing the detailed program time schedule in bar/Gantt chart or equivalent for design, manufacturing, civil works, factory testing, delivery to substations, installation, site tests/commissioning and energization.
- The project organization chart including site organization shall also be submitted to the Employer for approval within one month after signing the contract.

b) Subcontractors & manufacturers:
Summary list of the final selected subcontractors/manufacturers shall be submitted for Approval s howing materials/equipment, place of manufacturing and testing etc.

The Employer has the right to request the Contactor to submit detailed subcontract (Suborder) documents if required.

c) Specifications:
The Contractor shall prepare specifications for all major equipment/materials, installation, and commissioning for the Employer approval.

The specification shall contain the type, ratings, design, construction, materials, dimensions, corrosion protection and other necessary performance of the equipment.

d) Calculation sheets:
The Contractor shall submit all design calculation sheets for approval required for the substations systems and equipment in accordance with related IEC standards or equivalents, but not limited to:
i) 230/33kV/LV cable sizing calculation
ii) CT/VT ratings and sizing calculation (Burden, Class, Knee point voltage, Secondary resistance etc)
iii) Batteries and Battery Charger capacity
iv) Auxiliary Transformer capacity calculation
v) Earthing system, conductor sizing and safety of personnel and equipment calculations
vi) Detailed civil structural design calculations.
vii) Protective Relay settings calculations and recommendations
viii) Insulation coordination study

e) Lists:
The following lists shall be submitted for approval:
- Cable Lists
    - List of site installation equipment
    - List of Test Equipment and Special Tools.
    - List of Spare Parts

f) Factory Test Time Schedules
g) Factory Test Procedures

h) Factory Test Reports with witness signature
i) Site test time schedule and Procedures
j) Site Test /Commissioning Report
k) Operation and maintenance Instruction Manuals and installation manual.
l) Red marked As-Built Drawings
m) As-Built Drawings
n) Monthly Project progress report
o) Weekly and Daily site report

Required Numbers of Drawings/Documents:
Numbers of the documents to be submitted to Engineer shall be as follows:
a) During the Design/ Manufacturing stage:
- Documents for approval : 6 copies.
- Reference documents : 6 copies

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b) Before energizing stage:
• Red mark corrected drawings : 4 copies.
c) After commissioning test:
• Complete sets of bound prints of As-built drawings : 4 copies.
d) After Final Acceptance:
• Complete sets of bound prints of As-built documents : 4 copies.
• CD ROM containing as-built documents : 4 sets as PDF.

Corresponding Letters:

The corresponding letter shall have series letter number, with the date of submission, address, project name, substation name, subject etc.
The project letter numbering system may be instructed by the Employer after the Contract.

7. Schedule I: Departures from the Specification

Bidders are to list all departures from the requirements of the specification in this schedule.

All departures whether they be commercial, financial, technical or of a contractual nature are to be included and shall be submitted with the Technical proposal

Any item that does not have a departure listed in this schedule will be deemed to be in full accordance with the requirements of the specification.

No other document or detail accompanying the tender will be considered in evaluating departures. Bidders are not permitted to offer any alternative to this schedule.

Item	Volume	Clause	Detail of Departure from Specification
			NOT APPLICABLE

ATTACHMENT: PRICE SCHEDULES

Design, Supply, Installation, Testing and Commissioning of 230/33 kV GIS Substation at Bhola and 132/33 kV GIS Substations at Domar, Hatibandha, Shibchar, Bhanga, Jhalokathi, Pirojpur on Turnkey Basis (Package-8).