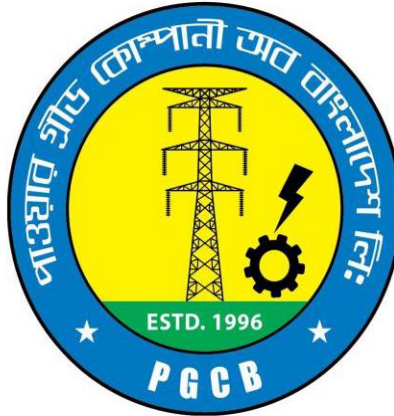


POWER GRID COMPANY OF BANGLADESH LIMITED



BIDDING DOCUMENT

FOR

Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power Plant on turnkey basis

VOLUME 3 OF 3

BID FORM, PRICES AND SCHEDULES

Issued on: **June 13, 2022**

Invitation for Tenders No.: **27.21.0000.101.07.419.22.3586**

Contract Ref. No.: **PGCB/ADB/3683/STGEP/CHARFASSON/SS**

Employer: **Power Grid Company of Bangladesh Limited (PGCB)**

Country: **Bangladesh**

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BIDDING DOCUMENT FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

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POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

(Contract No.: PGCB/ADB/3683/STGEP/CHARFASSON/SS)

SCHEDULE A

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

BRIEF DESCRIPTION OF THE WORKS

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

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification & shown in bid drawings (Volume 2 of 3).

Section-1: Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Burhanuddin, Bhola.

- 1) 230kV GIS switchyard extension:
 - Extension of existing 230kV, 1600A, 40kA/3s one & half bus scheme. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
 - One (1) nos. diameter consisting of two (02) nos. of line bays for the 230 kV double circuit transmission lines (Char Fasson 1&2)
 - Conductors, jumpers, fittings, insulators, etc.
 - 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.

Section-2: 230/33kV indoor GIS Substation at Char Fasson in Bhola:

1) 230kV GIS switchyard & AIS transformer yard:

- 230kV double busbar scheme, 3150A, 40kA/3s. Jointing plugs shall be kept in GIS hall for adding future bays and jointing plugs required for connecting GIS of different makes.
- One (1) Bus Coupler Bays
- Two (2) nos. of line bays for the 230 kV double circuit transmission lines (Nutan Bidyut-1 & 2)
- Two (2) nos. of 230kV GIS transformer bays for 230kV side of 230/33kV, 120/140MVA Transformers
- Two (2) nos. of 3-phase, 230/33kV, 120/140MVA transformers
- Two (2) nos. of 3-phase, 33/.4kV, 300kVA transformers
- Two (2) nos. of 33kV AIS incomer bays
- Conductors, jumpers, fittings, insulators, etc.
- 230kV, 3-storied GIS building shall have ground floor for cable cellar, 1st floor for GIS, 2nd floor control room. For present scope the building must accommodate 02 (Two) Nos Line Bays, 02 (Two) nos. of 230/33kV transformer bays, 01 (One) Nos Bus Coupler Bays. The building shall have space provision for future extension of 02 (Two) Nos Line Bays, 02 (Two) Nos Transformer Bay.
- The position of Bus PT with High-Speed ES shall be kept such that, it shall decrease the interruption hours when extension.
- GIS Design shall consider appropriate Buffer zone and section in Busbar & GIS compartment suitable for best MRE practice so as to minimize interruption time & maintenance complexity.

The scope of work also includes associated control, protection, metering, fiber optic multiplexer equipment for communication & protection, digital fault & disturbance and extension of existing substation automation, station power facilities (33kV Auxiliary, LVAC & LVDC system), including towers and gantry structures and relevant accessories, other ancillary system and associated civil works for switchyards, one (1) 230kV GIS Control Building to accommodate 230kV GIS, protection and control IED and associated equipment, local control kiosks, outdoor switchyards, cable tunnels and trenches, cable ducts, complete water supply & sewerage system including pump, pump house, water reservoir, etc., security wall, fences, entrance and internal access roads, security guard station, car parking, main gates and all other necessary substation facilities and supply of mandatory spare parts and maintenance tools.

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

The scope of works under this turnkey contract is: design, supply, manufacture, quality

assurance, inspection and testing, delivery, new packing for export, insurance, shipment & transport to the site, complete construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning, defect liability for all equipment, including all civil works.

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

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

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

The "Schedule of Requirements" for equipment, materials and services and the detailed technical specifications of equipment and materials of the Bidding Documents shall be read in conjunction with the scope of work described herein. The drawings provided in the Bidding Documents are indicative only and hence the entire scope of work is not fully reflected in those drawings.

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

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

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

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

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

The detailed requirements are listed in Schedule-A (Schedule of Requirements) and Schedule-B (Schedule of Rates & Prices) of volume 3 of 3 in the Bidding Documents.

The detailed requirements are listed in Schedule A and Price Schedule of volume 3 of bidding documents. The various items of work are described very briefly in the relevant Price Schedules. The various items of the Schedule of Prices shall be read in conjunction with the corresponding sections in the Technical Specifications including amendments and, additions, if any. The Bidder's quoted rates shall be based on the description of activities in the Schedule of Prices as well as other necessary operations required to complete the works detailed in these Technical Specifications.

The unit rates quoted shall include minor details which are obviously and fairly intended, and which may not have been included in these documents but are essential for the satisfactory completion of the various works.

The unit rate quoted shall be inclusive of all plant equipment, men, material skilled and unskilled labor etc. essential for satisfactory completion of various works.

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

METHODE OF REFERENCE

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

Denomination	Description
A	420 kV switchgear, structures & connections
B	245 kV switchgear, structures & connections
C	145kV switchgear, structures & connections
D	36 kV switchgear, structures & connections
E	230/33 kV transformer
F	Neutral earthing equipment
G	Earthing / auxiliary transformers
H	Control, protection, substation automation and metering
I	Telecommunication System - Fiber optic multiplexer equipment for communication and protection
J	Multicore low voltage power and control cables
K	Batteries, chargers and dc distribution
L	LVAC distribution
M	Civil works, building and foundations
N	Building lighting, small power and air conditioning
O	Switchyard lighting
P	Earthing and lightning protection
Q	230 & 33kV cable and associated structure
R	SCADA system for Telecontrol and Telemetry
S	Witnessing FAT, Training & Socia program

SCHEDULE A

(SCHEDULES OF REQUIREMENTS)

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

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

Section-I: GIS Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Burhanuddin, Bhola.

Item Description

1A 420 kV switchgear, structures & connections
Deleted.

1B 245kV GIS Switchyard, structures & connections

245kV indoor Type Gas Insulated Switchgear (GIS)

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

Item No	Quantity	Requirements
245kV indoor Type Gas Insulated Switchgear (GIS)		
1B1	One (01) Nos. of 245kV GIS complete diameter (Line & Line combination), each comprising:	
	1 Lot	245kV, 1600A, 40kA/3s, three phase one and half busbar
	8 Set	245kV, 1600A, 40kA/3s, three phase disconnector with motor operating mechanism
	4 Set	245kV, 40kA/3s, three phase fast earth switch complete with motor operating mechanism
	6 Set	245kV, 40kA/3s, three phase fast earth switch (insulated) complete with motor operating mechanism
	3 Set	245kV, 1600A, 40kA/3s, three phase, single pole operation circuit breaker, complete with spring-stored energy operating mechanism. The circuit breaker shall have auto-reclose functionality for each phase.
	6 Nos.	245kV, 1600-800-400A, 40kA/3s single phase, 5-core, current transformer with cores as follows:

		- 1600-800-400/1A, 30VA, Class PX - 1600-800-400/1A, 30VA, Class PX - 1600-800-400/1A, 15VA, Class 0.2S, - 1600/1A, 30VA, Class PX - 1600/1A, 30VA, Class PX Actual CT burden shall be determined by CT sizing calculation during execution stage
	6 Nos.	245kV, 1600-800-400A, 40kA/3s single phase, 4-core, current transformer with cores as follows: - 1600-800-400/1A, 30VA, Class PX - 1600-800-400/1A, 30VA, Class PX - 1600-800-400/1A, 15VA, Class 0.2S - 1600-800-400/1A, 30VA, Class PX Actual CT burden shall be determined by CT sizing calculation during execution stage
	6 Nos.	245kV single phase inductive voltage transformer with windings as follows: - 230,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$: 110/$\sqrt{3}$ V, 30VA/30VA/30VA, Class 0.2 /3P/3P Actual VT burden shall be determined by VT sizing calculation during execution stage.
	1 Lot	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangement for multi-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate
	1 Set	Local Control Panel
	1 Lot	Partial Discharge monitoring internal sensor
1B2	0 Lot	Deleted.

Note: The make of existing GIS at Nutan Bidyut Power Plant is Siemens, India. So, the extension of GIS shall also be supplied from the same manufacturer and have the same model.

- 1B3 One (1) lot of Gas Insulated Line (GIL) including SF6/Air bushings for 245kV GIS connection circuits with necessary connecting terminal chambers including support structures for 245kV, 1600A, 40kA/3s Circuits from 245kV GIS hall (from line IVT) up to AIS LA (near line termination gantry).

GIL length shall be quoted in 'meter' & Gas/Air bushings shall be quoted in 'nos.' and payment shall be on actual basis. GIL length shall be considered as single-phase length.

- 1B4 Deleted.

245 kV Air Insulated Switchgear (AIS)

- 1B5 Six (6) nos. of 216kV rated voltage, 186kV (rms) continuous operating voltage (shall be finalized by calculation) at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters with surge counter for 245kV transformer bays.

1B6 One (1) lot of stranded, flexible TACSR conductors, insulators, fittings, clamps, connectors, gantry, steel structures, cable trays, etc. including other accessories for each connection as required for completing 230kV GIS Switchyard and AIS line connections.

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

Deleted

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

Deleted

1E **Power Transformers**

Deleted

1F **Neutral Earthing Equipment**

Deleted

1G **Earthing/Auxiliary transformers**

Deleted

1H **Control, Protection, Substation Automation & Metering**

245kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -

1H1 Two (2) sets of Control, Monitoring, Protection including event recording function for new diameter with line circuits - Char Fasson 1&2

Note: existing BCU / relays: SIEMENS SIPROTEC 7SJ85, 7SJ8031, 7UT612, 7SJ8011.

1H2 One (1) lot of Upgradation/extension of existing Substation Automation System for new diameter with line circuits - Char Fasson 1&2

Note: existing SAS: SIEMENS SICAM PASCC V7

1H3 One (1) lot of Upgradation/extension of existing busbar protection system for 245kV system

Note: existing relay: SIEMENS SIPROTEC 7SS85.

1H4 One (1) lot of tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVARh meters (accuracy class 0.2) for two new 230kV line feeders. For each new feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the new bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

Note: existing tariff meter: CEWE Prometer 100.

- 1H5** One (1) lot of extension of existing Digital Fault and Disturbance recorder (DFDR) to include complete monitoring of the new diameter.

Note: existing DFDR: SIEMENS SIPROTEC 7KE85.

1I Telecommunication System - Fibre optic multiplexer equipment for communication and protection

1I1 Multiplexer:

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 fiber cores or backup PLC)
- 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 Fiber 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 direction 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. Two (02) sets of Primary phone (IP phone)

ii. Ten (10) sets of Secondary phone (2W phone)

- iii. One (01) lot of Extension of MDF
 - iv. One (01) lot of Pigtail cables
 - v. One (01) lot of ODF
- 3) At Bhola PP (The existing multiplexer at Bhola PP is MSE 5010 (GE) with DXC 5000) –
- i. One (01) lot of Optical STM-16 ports for 230 kV line at remote end
 - iii. Required no. of cards with 4x4 commands for distance protection

1I2 Optical Fiber:

One (1) lot of underground optical fibre cables (48cores for 230kV) from terminal box gantry 230kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room. This also includes supply and installation of MDF and pigtail cables with adequate length.

1I3 PLC Equipment
Deleted

1J Multicore Low Voltage Power & Control Cables

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

1K Batteries, Chargers and DC Distribution

- 1K1 Upgradation / extension of existing 220V DC distribution system including cables, DC distribution panels (if necessary), MCCBs (with spares) and any other equipment necessary to provide DC supplies to all DC loads in the new diameter.

On, off, trip status of all new ACB/MCB/MCCB under 220v DC system shall be incorporated in SAS.

- 1K2 48V DC system and distribution equipment to be supplied installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

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

- i. One (1) sets of 100% Ni-cadmium 48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

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

- ii. One (1) sets of 48V battery charger, 90A and input voltage shall be three phase, 50Hz,

415V AC.

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

iii. One (1) sets of DC distribution board

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

48V DC system and distribution equipment shall be located in the 230kV GIS Control Building.

On, off, trip status of all ACB/MCB/MCCB under 48v DC system shall be incorporated in SAS. For each battery charger, current & voltage of inputs (incomer AC) and current & voltage of outputs (total as well as load & battery separately) shall be incorporated in SAS. For DC distribution boards, voltage of each bus shall be incorporated in SAS.

1L LVAC Distribution

- 1L1 One (1) lot of upgradation / extension of existing AC distribution system including cables, AC distribution panels (if necessary), MCCBs (with spares) and any other equipment necessary to provide AC supplies to all AC loads in the new diameter.

On, off, trip status of all new ACB/MCB/MCCB under 415/240V AC system shall be incorporated in SAS.

1M Civil Works, Building and Foundation

- 1M1 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level suitable for existing 230kV GIS switchyards at existing Nutan Bidyut CCPP area.

- 1M2 One (1) lot of complete design, supply and construction of all civil works, including 230kV gantry foundations, 230kV equipment foundations, internal chain linked fencing, PVC pipes etc., switchyard surface finishing and gravel surfacing & gravel laying, road dismantling & construction.

(Detail design of these items shall be finalized during execution stage.)

- 1M3 One (1) lot of modification work of existing GIS hall and other adjacent rooms for the full accommodation of new diameter equipment including cabling laying, connections etc.
- 1M4 One (1) lot of upgradation/extension of existing fire alarm & firefighting system including fire extinguishers.

1N Building Lighting, Small Power, Air Conditioning and Ventilation

- 1N1 Extension of existing lighting system, emergency DC lighting system, LV power supply,

ventilation system for the substation GIS switchyard & Control / relay / charger / communication room.

10 Switchyard Lighting

- 101 One (1) lot of extension of existing lighting system (with flood light LED type) for AIS switchyard.

1P Earthing and Lightning Protection

- 1P1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the existing substation overall arrangement and provide supporting design calculations.

1Q 230kV, 33kV, .415kV cables and associated structure Deleted.

1R SCADA system for Telecontrol and Telemetry

- 1R1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetry facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation. 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 & Siddhirganj are to be carried out.

Section-II: Char Fasson 230/33kV Gas Insulated Substation in Bhola

Item	Description
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- | | |
|----|---|
| 2A | 420 kV switchgear, structures & connections
Deleted. |
| 2B | 245kV GIS Switchyard, structures & connections |

245kV indoor Type Gas Insulated Switchgear (GIS)

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

Item No	Quantity	Requirements
245kV indoor Type Gas Insulated Switchgear (GIS)		
2B1	Two (02) Nos. of 245kV GIS Line Feeder Bays, each comprising:	
	1 Lot	245kV, 3150A, 40kA/3s, three phase double busbar
	2 Sets	245kV, 2500A, 40kA/3s, three phase busbar disconnector with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram. Earth switch shall be isolated type.
	3 Nos.	245kV, 2400-1600, 40kA/3s single phase, 3-core, current transformer with cores as follows: - 2400-1600 /1 A, 30VA, Class 5P20 - 2400-1600 /1 A, 30VA, Class 5P20 - 2400-1600 /1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)
	1 Set	245kV, 2500A, 40kA/3s, three phase, single pole operation circuit breaker, complete with spring-stored energy operating mechanism. The circuit breaker shall have auto-reclose functionality for each phase.
	3 Nos.	245kV, 2400-1600A, 40kA/3s single phase, 2-core, current transformer with cores as follows: - 2400-1600/1 A, 30VA, Class 0.2S - 2400-1600 /1 A, 30VA, Class PX Actual CT burden shall be determined by CT sizing calculation during execution stage (Please refer to single line diagram)
	1 Set	245kV, 2500A, 40kA/3s, three phase line disconnector with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram. Earth switch shall be isolated type.
	1 Set	245kV, 40kA/3s, three phase fast earth switch complete with motor operating mechanism at line side of line DS. Earth switch shall be isolated type.
	3 Nos.	245kV single phase inductive voltage transformer with windings as follows: - 230,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$: 110/$\sqrt{3}$ V, 30VA/30VA/30VA, Class 3P/3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage.

		Each VT connection shall have separate externally hand operable isolating link, as shown in SLD.
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate
	1 Set	Local Control Panel
	1 Lot	Partial Discharge monitoring internal sensor
2B2	Two (2) Nos. of 245kV GIS Transformer Feeder Bays, each comprising:	
	1 Lot	245kV, 3150A, 40kA/3s, three phase double busbar
	2 Sets	245kV, 2500A, 40kA/3s, three phase busbar disconnector with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram. Earth switch shall be isolated type.
	3 Nos.	245kV, 2400-1600, 40kA/3s, single phase, 3-core, current transformer with cores as follows: - 2400-1600/1 A, 30VA, Class 5P20 - 2400-1600/1 A, 30VA, Class 5P20 - 2400-1600/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage
	1 Set	245kV, 2500A, 40kA/3s, three phase, gang operation circuit breaker, complete with spring-stored energy operating mechanism.
	3 Nos.	245kV, 2400-1600, 40kA/3s, single phase, 2-core, current transformer with cores as follows: - 2400-1600/1 A, 30VA, Class PX - 2400-1600/1 A, 30VA, Class 0.2S Actual CT burden shall be determined by CT sizing calculation during execution stage
	1 Set	245kV, 2500A, 40kA/3s, three phase transformer disconnector with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram. Earth switch shall be isolated type.
	1 Set	245kV, 40kA/3s, three phase earth switch complete with motor operating mechanism, at transformer side of CB. Earth switch shall be isolated type.
	3 Nos.	245kV, single phase capacitive voltage transformers with windings as follows: - 230,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$: 110/$\sqrt{3}$ V, 30VA/30VA/30VA, class 3P/3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage. Each VT connection shall have separate externally hand operable isolating link, as shown in SLD.
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate
	1 Set	Local Control Panel
	1 Lot	Partial Discharge monitoring internal sensor
2B3	One (1) Nos. of 245kV Bus Coupler Bays, each comprising:	
	1 Lot	245kV, 3150A, 40kA/3s, three phase double busbar
	2 Sets	245kV, 3150A, 40kA/3s, three phase busbar disconnector with earth switch complete with motor operating mechanism (three position operation). Please refer to single line diagram. Earth switch shall be isolated type.

	3 Nos.	245kV, 3200-1600A, 40kA/3s, single phase, 3-core, current transformer with cores as follows: - 3200-1600/1 A, 30VA, Class 0.2S - 3200-1600 /1 A, 30VA, Class 5P20 - 3200-1600 /1 A, 30VA, Class PX Actual CT burden shall be determined by CT sizing calculation during execution stage.
	1 Set	245kV, 3150A, 40kA/3s, three phase, gang operation circuit breaker, complete with spring-stored energy operating mechanism.
	3 Nos.	245kV, 3200-1600A, 40kA/3s, single phase, 3-core, current transformer with cores as follows: - 3200-1600/1 A, 30VA, Class 0.2S - 3200-1600 /1 A, 30VA, Class 5P20 - 3200-1600 /1 A, 30VA, Class PX Actual CT burden shall be determined by CT sizing calculation during execution stage
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate
	1 Set	Local Control Panel
	1 Lot	Partial Discharge monitoring internal sensor
2B4	Deleted.	
2B5	One (1) Nos. of 245kV Bus VT with Busbar FES circuit Bay each comprising:	
	1 Lot	245kV 3150A, 40kA/3s Three phase double bus bar
	2 Sets	245kV, 40kA/3s, three phase fast earth switch complete with motor operating mechanism for bus. Earth switch shall be isolated type.
	6 Nos.	245kV single phase capacitive voltage transformer with windings as follows: - 230,000/$\sqrt{3}$:110/$\sqrt{3}$:110/$\sqrt{3}$, 30VA/30VA, Class 3P/0.2 Actual VT burden shall be determined by VT sizing calculation during execution stage. Each VT connection shall have separate externally hand operable isolating link, as shown in SLD
	1 Lot	Complete set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate.
	1 Set	Local Control Panel for Bus FES & Bus VT isolating link.
	1 Lot	Partial Discharge monitoring internal sensor

2B6 One (1) lot of Gas Insulated Line (GIL) including SF6/Air bushings for 245kV GIS connection circuits with necessary connecting terminal chambers including support structures for 3150A Circuits from 245kV transmission Lines to 245kV GIS and 230/33kV Transformer to 245kV GIS

(GIL length shall be quoted in 'meter' & Gas/Air bushings shall be quoted in 'nos.' and payment shall be on actual basis). GIL length shall be considered as single-phase length.

2B7 1 set portable Partial Discharge analyser for GIS

245 kV Air Insulated Switchgear (AIS)

- 2B8** Twelve (12) nos. of 216kV rated voltage, 186kV (rms) continuous operating voltage (shall be finalized by calculation) at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters with surge counter for 245kV transformer bays.
- 2B9** One (1) lot of stranded, flexible TACSR conductors, insulators, fittings, clamps, connectors, gantry, steel structures, cable trays, etc. including other accessories for each connection as required for completing 230kV GIS Switchyard and Transformer connections & Line connections. (Please refer to single line diagram)
- 2C** **145kV GIS Switchyard, structures & connections**
Deleted
- 2D** **36kV Switchgears and Connections with Transformer & Earthing / Auxiliary Transformers**

36kV Air Insulated Switchgear (AIS)

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

- 2D1** 18 (Eighteen) Nos. 30kV rated voltage, 25kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters with surge counters.
- 2D2** Six (6) nos. of single-phase, 2-secondary windings (33,000/ $\sqrt{3}$ / 110/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V, 30VA/30VA, Class 3P/0.2) 36kV, 40kA/3sec, 50Hz, 170kVp BIL, inductive voltage transformers
- 2D3** Four (4) sets of 36kV, 2500A, 40kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnector with earth switch (DS & ES both motor operated).
- Two (2) sets of 36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnector (motor operated) with integrated fuse.
- 2D4** Six (6) nos. of Current transformer 36 kV, single-phase, 4-cores (Core 1&2: 3200-1600/1A, Class: 5P20; Core 3&4: 3200-1600/1A, Class: 0.2S) 40 kA / 3 sec, 50 Hz, 170/70 kV BIL, post type current transformer.
- 2D5** Two (2) sets of 36kV, 2500A, 40kA/3sec, 50Hz, 170kVp BIL, SF6/VCB, Gang Type circuit breaker with spring-stored energy operating mechanism
- 2D6** One (1) lot of stranded, flexible TACSR conductors, insulators, fittings, clamps, connectors, 1.5m copper bus (Copper bus sizing shall be finalized during execution stage based on submitted calculation) gantry, steel structures, cable trays, fuse etc. including other accessories for each connection as required for completing auxiliary transformer bays, 36kV AIS Switchyard and Transformer connections.

2E Power Transformers

- 2E1 Two (2) nos. of 230/34.5 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformers including all necessary connections, insulators & fittings. The Transformer shall have CTs of the following specification:

Item No	Requirements
HV BCT	800-400 A, 40kA/3s single phase, 3-core, current transformer with cores as follows: - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) - 800-400/1 A, 30VA, Class 5P20 (all 3 phases) - To WTI (B-Φ) (ratio, burden & class will be as per manufacturer's design) Actual CT burden shall be determined by CT sizing calculation during execution stage
LV BCT	36kV, 3200-1600A, 40kA/3s single phase, 4-core, current transformer with cores as follows: - 3200-1600/1 A, 30VA, Class 5P20 (all 3 phases) - 3200-1600/1 A, 30VA, Class 5P20 (all 3 phases) - To WTI (B-Φ) (ratio, burden & class will be as per manufacturer's design) - To AVR (C-Φ) (ratio, burden & class will be as per manufacturer's design) Actual CT burden shall be determined by CT sizing calculation during execution stage
NCT	36kV, 3200-1600A, 40kA/3s single phase, 2-core, current transformer with cores as follows: - 3200-1600/1 A, 30VA, Class 5P20 - 3200-1600/1 A, 30VA, Class 5P20 Actual CT burden shall be determined by CT sizing calculation during execution stage

- 2E2 Two (2) sets of complete design, supply, delivery, installation, testing and commissioning of Water Spray type Fire Protection System for 230/33kV Transformers.

2F Neutral Earthing Equipment.
Deleted.

2G Earthing/Auxiliary transformers

- 2G1 Two (2) Nos Auxiliary power transformer 33/0.415 kV, 300 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; including all necessary connections & support structures. Characteristics of CTs will be defined during design & execution.

The auxiliary transformers' capacity shall be validated by calculation during execution stage; and if required, higher capacity transformer shall have to be provided within same price.

2H Control, Protection, Substation Automation & Metering**245kV Circuits**

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -

- 2H1 Two (2) sets of Control, Monitoring, Protection & Substation Automation System including event recording function for line circuits - Nutan Bidyut 1&2.

- 2H2 Two (2) sets of Control, Monitoring, Protection & Substation Automation System including event recording function for 120/140MVA, 230/33kV, three phase, power transformer circuits including transformer tap changer control, fan control & AVR
- 2H3 One (1) sets of Control, Monitoring, Protection & Substation Automation System including event recording function coupler bays
- 2H4 Deleted.
- 2H5 One (1) lot of busbar protection system for 245kV system
- 2H6 One (1) lot of tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVARh meters (accuracy class 0.2) for each 230kV line and transformer feeders. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include monitoring of the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin or other countries with equivalent quality. Printed catalogue, operation and service manual are to be provided.
- 2H7 One (1) lot of lindependent standalone Digital Fault and Disturbance recorder (DFDR) to monitor complete substation including all bays for 245kV GIS, 230/33kV Transformer and 33kV AIS incomer.

33kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of: -

- 2H8 Two (2) sets of Control, Monitoring, Protection & Substation Automation System including event recording function for two (2) sets of 33kV incomer circuits of 230/33kV transformer
- 2H9 Two (2) sets of Control, Monitoring & Substation Automation System including event recording function for two (2) sets of auxiliary transformer bays (includes both 33kV & .4kV side, for more details please see PSLD)
- 2H10 One (1) lot of tariff metering panel to accommodate programmable & recordable digital 3-phase, 4 wire import and export MWh and MVARh meters (accuracy class 0.2) for each 33kV transformer incomer feeders & each .4kV auxiliary feeders. (For each 33kV incomer bays, one (1) tariff meter (main) including one set software and communication cord shall be provided with all necessary accessories. Space provision for another tariff meter (check) shall be kept for future). Tariff Metering is to be supplied from Europe, USA or Japan origin or other countries with equivalent quality. Printed catalogue, operation and service manual are to be provided.

Substation Automation System shall include monitoring of the metering for all the bays. Also, provision shall be kept for remote control from NLDC for at least 4 Nos 33kV outgoing feeders.

132kV Circuits

Deleted.

2I **Telecommunication System - Fibre optic multiplexer equipment for communication and protection**

2I1 Multiplexer:

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 Fiber 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 fiber cores or backup PLC)
- 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 Fiber 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 direction 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)
- iii. Ten (10) sets of Secondary phone (2W phone)
- 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 –

Please see 1I1 of Section 1

2I2 Optical Fibre:

One (1) lot of Underground optical fibre cables (48cores for 230kV) from terminal box gantry 230kV double circuit transmission line termination point to MDF (Main distribution structure at each Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

2I3 PLC Equipment
Deleted

2I4 PABX system

One (1) lot of internal PABX system with phone sets located at all important civil installations i.e.: control room, main gate, ansar barrack, dormitory etc. The network shall be connected with armoured underground cable. Each connection shall be clearly labelled for easy identification and troubleshooting purpose. Cable wiring, clipping, dressing, earthing & identification shall be done using good quality kits.

2J Multicore Low Voltage Power & Control Cables

2J1 One (1) lot complete set of multicore low voltage auxiliary XLPE insulated power and control cables (IEC 60502) between all items of equipment supplied under the contract and for connection and integration of the new equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colors & tags. The overall substation cable routing and core schedules shall also be provided.

2K Batteries, Chargers and DC Distribution

2K1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed, tested and commissioned to provide all DC supplies to equipment including powering two (2) nos. 240V, 50Hz, 3kVA UPS (Inverter) for 60 minutes being supplied. One set shall be used as standby supply.

Necessary DC distribution switchboards shall be provided at the various place of the substation, according to the detail design.

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

1. Two (2) sets of 100% Ni-cadmium 110V batteries complete, each capacity shall not be less than 400Ah at the 5-hour rate of discharge.

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

2. Two (2) sets of battery chargers complete, each float charge shall not be less than 130A rating and input voltage shall be three phase, 50Hz, 415V AC.

During execution stage the capacity shall be confirmed with calculation by the

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

3. Two (2) sets of DC distribution board.

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

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

Two (2) sets of 110V battery batteries and battery chargers, DC distribution boards and UPS shall be located in the 230kV GIS control building and shall be used for the first main and second main DC supplies for 230kV & 33kV switchyards.

5. Two (2) sets of Insulation Monitoring system for complete DC system shall also be provided.

On, off, trip status of all ACB/MCB/MCCB under 110v DC system shall be incorporated in SAS. For each battery charger, current & voltage of inputs (incomer AC) and current & voltage of outputs (total as well as load & battery separately) shall be incorporated in SAS. For DC distribution boards, voltage of each bus shall be incorporated in SAS.

- 2K2 48V DC system and distribution equipment to be supplied installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication, protection. One set shall be used as standby supply.

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

- i. Two (2) sets of 100% Ni-cadmium 48V batteries complete, each capacity shall not be less than 200Ah at the 5-hour rate of discharge

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

- ii. Two (2) sets of 48V battery charger, 90A and input voltage shall be three phase, 50Hz, 415V AC.

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

- iii. One (1) sets of DC distribution board.

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

use.

- iv. Two (2) sets of Insulation Monitoring system for complete DC system shall also be provided.

48V DC system and distribution equipment shall be located in the 230kV GIS Control Building.

On, off, trip status of all ACB/MCB/MCCB under 48v DC system shall be incorporated in SAS. For each battery charger, current & voltage of inputs (incomer AC) and current & voltage of outputs (total as well as load & battery separately) shall be incorporated in SAS. For DC distribution boards, voltage of each bus shall be incorporated in SAS.

2L LVAC Distribution

- 2L1 One (1) lot of LVAC panels for 230/33kV substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this project. LVAC power shall be supplied by auxiliary transformer 1 & 2 as well as diesel generator.

On, off, trip status of all ACB/MCB/MCCB under 415/240V AC system shall be incorporated in SAS. Current & voltage of inputs/incomer shall be incorporated in SAS. For AC distribution boards, voltage of each bus shall be incorporated in SAS.

The system shall generally be as per Bid Drawings and shall include Three 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the transformers.

- 2L2 Four (4) Nos. programmable & recordable digital 3-phase, 4-wire import and export MWh and MVARh meters (accuracy class 0.2) for two 33/0.415 kV earthing/auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check) shall be installed. The meters can be installed in the metering panel of 33kV incomer feeders.

Substation Automation System shall include the metering for all incoming LVAC source feeder.

- 2L3 One (1) set Scissor Lift: Battery type for min. two persons. Maximum working high greater than 10m

- 2L4 Four (4) set Electroscopes for 230kV & 33kV voltage levels (2 sets for each voltage levels)

- 2L5 One (1) lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 175kVAR automatic power factor correction (PFC) panel complete with capacitors of various sizes, auto-switching relay, busbars, MCB/MCCB, indicators, wires, connectors, temperatures probes, exhaust fan and other accessories.

The PFC panel shall be located at 230kV GIS building. Its panel shall be connected to .4kV bus 1 & 2 in ACDB through power cables. It shall have provision for both manual & automatic switching of capacitors. The detail design including sizes of capacitors & switching stages shall be finalized during execution stage. PFC panel capacity shall be validated by calculation during execution stage; and if required, higher capacity PFC panel shall have to be provided within

same price. The PFC panel shall be incorporated in the substation automation system.

- 2L6 One (1) set of Diesel Generator with capacity of 250kW, 0.415kV, 50Hz. The DG shall have noise level Less than 55dB at a distance of 10m, expected Operation Time 24h, Fuel Tank Capacity: Adequate capacity for three days' continuous operation and Smoke reduction device.

2M Civil Works, Building and Foundation

- 2M1 Complete land development for plant including 230kV, 33kV AIS switchyards, Transformer Yard etc.

- 2M2 Deleted.

- 2M3 Complete design, supply and construction of all civil works, including 230kV gantry foundations, 230kV and 33kV equipment foundations, power transformers' foundation, oil pits & auxiliary transformers' foundations & pads, blast walls, substation main gates, security boundary walls and internal chain linked fencing (including gates for car passing and pocket gates for personnel), access road, internal roads and car port, sentry post, guard house, pump shed including deep tube well, motor, pump, water reservoir, water pipe line, electrical connection, concrete culvert, surface and switchyard drainage system with outfall, cable trench including soak pit & drainage pump, PVC pipes etc., switchyard surface finishing including a network of water pits throughout the substation connected to each other & to surface drain with pipes and gravel surfacing & gravel laying.

(Detail design these items shall be finalized during execution stage.)

- 2M4 One (1) lot of complete design, supply and construction of all civil items and facilities required for the three (3) storied 230kV GIS buildings cum main control building to install all control and protection panels including batteries & chargers etc., one in-charge's room, meeting room, including foundation works, super structure works, finishing works like rendering, color, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, septic tank, soak well, furniture etc. The 230kV, 3-storied GIS building shall have ground floor for cable cellar, 1st floor for GIS and 2nd floor for control room. For present scope the building must accommodate 02 (Two) Nos Line Bays, 03 (Three) nos. of 230/33kV transformer bays, 02 (Two) Nos Bus Coupler Bays, 02 (Two) Nos Bus Section Bays. The building shall have space provision for future extension of 02 (Two) Nos Line Bays, 01 (One) Nos Transformer Bay (building size 15mX40m, detail design of GIS building shall be finalized during execution stage).

One (1) lot of complete design, supply and construction of all civil items and facilities required for the One (1) storied Ansar Barack including foundation works, super structure works, finishing works like rendering, color, water supply, sanitary, floor finishing, rain water drainage system, septic tank, soak well, furniture etc. (Building size 21mx7m, detail design the building shall be finalized during execution stage).

One (1) lot of complete design, supply and construction of all civil items and facilities required for the Three (3) storied dormitory cum indoor store cum staff room building including foundation works, super structure works, finishing works like rendering, color, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, septic tank, soak well,

furniture etc. The ground floor shall contain indoor store & staff room. The 1st floor shall have drawing room, dining space, kitchen, toilets etc. The 2nd floor shall have general rooms, drawing rooms, verandah etc. (Building size 12mX12m, detail design of the building shall be finalized during execution stage).

One (1) lot of complete design, supply and construction of all civil items and facilities required for open yard store (full RCC) including foundation works, finishing works like rendering, floor finishing, rain water drainage system, chain linked fence including gates for car passing and pocket gates for personnel etc. (store size 25mX11m, detail design of open yard store shall be finalized during execution stage).

Note: For furniture, please refer to Section 10 of Volume 2.

- 2M5 One (1) lot of complete design, supply and construction of all civil items and facilities required for the Water Spray type Fire Protection System for transformers (Detail design & position shall be finalized during execution stage).
- 2M6 One (1) lot of complete design, supply and construction of all civil items and facilities required for Diesel Generator room. (Detail design & position shall be finalized during execution stage).
- 2M7 One (1) Lot of testing of pile Foundation, Compression & uplift on random basis.
- 2M8 One (1) lot of complete design, supply and construction of fire alarm & firefighting system for other areas. Fire extinguishers shall be supplied as per relevant sections Volume 2 of 3, for main control building and outdoors.

2N Building Lighting, Small Power, Air Conditioning and Ventilation

- 2N1 One (1) lot of Complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings, auxiliary & other houses (air cooling system shall be double of the actual requirement).
- 2N2 One (1) lot of Complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of surveillance system with IP cameras, NVRs, optical fibre, cat6 cables, switches, indoor & outdoor cabinets, lightning protection systems, power cables and other accessories to complete surveillance system of the substation. Detailed design of the surveillance system shall be finalized during execution stage.

2O Switchyard Lighting

- 2O1 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.

2P Earthing and Lightning Protection

- 2P1 One (1) lot of design, supply and installation of earthing system including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

2P2 One (1) lot of design, supply and installation of lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

2P3 Four (4) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied. (For 230kV and 33kV voltage levels)

2Q 230kV, 33kV, .415kV cables and associated structure

2Q1 One (1) lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm², 40kA/ 3 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.

Power cable installation route will prevail as indicated in the layout and cable trench section diagrams. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution).

2Q2 Twelve (12) nos of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 40kA/ 3 sec, 50Hz, 170/70 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.

The quantity of cable termination kits shall be quoted in "nos". (Payment will be at actual quantity basis if quantity increases or decreases during execution)

2Q3 One (1) lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of .415kV, 185mm², 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, single phase XLPE cable. The quantity of length shall be quoted in 'meter' for single phase cable. (Payment will be at actual quantity basis if quantity increases or decreases during execution).

2Q4 Twelve (12) nos of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.

The quantity of heat sinkable cable termination kits shall be quoted in "nos". (Payment will be at actual quantity basis if quantity increases or decreases during execution)

2R SCADA system for Telecontrol and Telemetry

2R1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetry facilities required at the existing National Load Despatch Centre (NLDC) at Rampura and backup station at Siddhirganj for integration of complete new 230/33kV substation. 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 & Siddhirganj are to be carried out.

Section-III Mandatory Spares, Tools, Erection & Test Equipment

Spares - 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. Spares shall be from the same manufacturer, country of origin and specification as the main equipment in section 1&2 and approved for construction by PGCB.

Testing instruments & special tools – These are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Employer.

Refer to the Schedule B of Volume 3 for detail of other spares, testing kit, tools etc.

Section-III: 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 (FAT) at manufacturers' works as follows:

SL	Description	No. of Engineer	Duration (Working Days)	No. of Trip/ Visit
1.	Transformers	02	10	1 visit for 230/34.5kV Transformer
2.	GIS	02	10	1 visit for 230kV GIS
3.	Circuit Breaker	NA		
4.	Shunt Reactor	NA		
5.	Disconnecter	NA		
6.	Instrument Transformer	NA		
7.	Lightning Arrester	NA		
8.	Control, protection & SAS including SCADA Gateway, Switch & firewall	NA		
9.	Communication system	N/A		
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.
- 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.
- iii. For Lightning Arrester, sample of each voltage level and 15% of the supplied quantity shall be tested in front of Employer's Engineers.
- 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.

- 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.

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

S L	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	15	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 including 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 factory acceptance tests (FAT) (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 including travel time. For on-site instruction/training, (item no (c)), the contractor shall be responsible for bearing all costs for the trainers & trainees including arranging of the training venue, transportation, meals, stationary items etc.

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.

Due to any unavoidable circumstances, if any factory acceptance tests (FAT) can't be witnessed by the engineers nominated by the Employer, such inspection may be witnessed by any 3rd party inspector nominated by the Employer, or may not be witnessed by the employer's representatives. In such case, the contract price shall be adjusted as per contract.

Note: The Contractor shall have to submit the Schedule of each Training (if any) & 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.

Training Contents

The contractor shall provide 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 requirement mentioned here, the Employer shall preserve the right to ask the contractor to change the trainer as per requirement.

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

SCHEDULE B

BID PRICES & SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

SCHEDULE B (PRICE SCHEDULES)

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:
 - Schedule No. B1: Plant (including Mandatory Spare Parts) Supplied from Abroad.
 - Schedule No. B2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country.
 - Schedule No. B3: Design Services
 - Schedule No. B4: Installation & other services.
 - Schedule No. B5: Grand Summery
 - Schedule No. B6: Recommended Spare Parts.
2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
3. If bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

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

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

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

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

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

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
7. When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Notes

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

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

Schedule B: Schedules of Rates and Prices

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

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

Schedule No. B3: Design Services

Schedule No. B4: Installation and Other Services

Schedule No. B5: Grand Summary

Schedule No. B6: Recommended Spare Parts

Please see the separate Excel file for the above.

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

Please use the attached excel file

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
SECTION-I	Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Borhanuddin, Bhola.					
1A	400kV GIS Switchyard					
	Deleted.					
1B	245kV GIS Switchyard, structures & connections					
	245kV Indoor Type Gas Insulated Switchgear (GIS)					
1B1	245kV GIS complete diameter (Line & Line combination) with Local Control Cubicle and support structure		1	nos.		
1B2	Deleted.		0	lot		
1B3	Gas Insulated Line (GIL) including Gas/Air bushings for 245kV GIS connection with necessary connecting terminal chambers including support structures					
1B.3.1	For 245kV 1600A, 40kA/3s Circuits from 245kV transmission Lines to 245kV GIS (single phase length)		710	meter		
1B.3.2	245kV 1600A, 40kA/3s Gas/Air bushings		6	nos.		
1B4	Portable Partial Discharge analyzer for GIS		0	set		
	245kV Air Insulated Switchgear (AIS)					
1B5	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz, Heavy duty class, metal oxide type, single phase surge arresters with surge counter		6	nos.		
1B6	Stranded, flexible conductors, fittings, clamps, connectors including other accessories for each connection as required for completing 230kV GIS Switchyard and AIS line connections.					
1B6.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection					
1B6.1.1	_Flexible Conductor for jumper, equipment connections		1	lot		
1B6.1.2	_Clamps & Connectors		1	lot		
1B6.2	Insulator & Fittings					
1B6.2.1	_Insulator		1	lot		
1B6.2.2	_Fittings		1	lot		
1B6.3	Steel structures & cable tray					
1B6.3.1	_Gantry Column with signle beam including nut&bolts		3	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
1B6.3.2	Gantry Column with double beam including nut&bolts		0	nos.		
1B6.3.3	Gantry beam including nut&bolts		2	nos.		
1B6.3.4	Equipment support structures including nut&bolts					
1B6.3.4.1	LA		6	nos.		
1B6.3.5	Cable tray including fitting, fixing accessories		1	lot		
1C	145kV GIS Switchyard, structures & connections					
	Deleted.					
1D	36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers					
	Deleted.					
1E	Power Transformers and Earthing/Auxiliary Transformers					
	Deleted.					
1F	Neutral earthing equipment:					
	Deleted.					
1G	Earthing /Auxiliary transformers					
	Deleted.					
1H	Control, Protection, Substation Automation and Metering					
	230kV Circuits					
1H1	Control, Monitoring, Protection including event recording function for new line circuits - Char Fasson 1&2		2	sets		
1H2	Upgradation/extension of existing Substation Automation System for new line circuits - Char Fasson 1&2		1	lot		
1H3	Upgradation/extension of existing busbar protection system for 245kV system		1	lot		
1H4	Tariff metering system for two (2) new 230kV lines		1	lot		
1H5	Extension of existing Digital Fault and Disturbance recorder (DFDR) to include complete monitoring of the new diameter		1	lot		
1I	Fiber Optic Multiplexer Equipment for Communication and Protection					
1I1	Complete set of design, supply, installation and commissioning of Fiber optic multiplexer equipment		1	lot		
1I2	Fibre Optic cable and termination box		1	lot		
1I3	PLC Equipment		0	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
1J	Multicore Low Voltage Power & Control Cables					
1J1	Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits		1	lot		
1K	Batteries, chargers & DC distribution					
1K1	Upgradation / extension of existing of 220V DC Distribution Board to power DC load of the new diameter		1	lot		
1K2	48V Ni-cad Batteries with chargers and distribution board					
1K2.1	48V Ni-cad Batteries, 200Ah @ 5h		1	sets		
1K2.2	Battery chargers		1	sets		
1K2.3	DC Distribution Board		1	sets		
1L	LVAC Distribution					
1L1	Upgradation / extension of existing of LVAC system including necessary accessories for substation services		1	lot		
1M	Civil Works, Building and Foundation					
1M1	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV GIS & AIS switchyards at Nutan Bidyut CCPP area		Please refer to Schedule 4			
1M2*	Complete civil items required for outdoor works					
1M2.1	Outdoor gantry foundation 230kV switchyard					
1M2.1.1	Gantry column					
1M2.2	Outdoor equipment foundation 230kV switchyard					
1M2.2.1	LA					
1M2.3	Chain link fencing (including gates)					
1M2.4	Internal roads (2 m wide)					
1M2.4.1	Dismantling & removal of existing road					
1M2.4.2	Construction of new road					
1M2.5	Drainage system including connection to existing drainage					
1M2.6	Gravelling in switchyard area					
1M3	Modification work at existing GIS hall and other adjacent rooms for the full accommodation of new diameter equipment including GIL entry, cabling laying, connections etc.					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
1M4	Upgradation/extension of existing fire alarm & fighting system		Please refer to Schedule 4			
	* actual payment shall be as per actual work at site					
	** one set includes foundation for three phases of a circuit					
1N	Building Lighting, Small Power, Air Conditioning and Ventilation					
1N1	Complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system (split type, 4.5 Ton each), ventilation system and emergency DC lighting for the substation GIS & Control room buildings, auxiliary & other houses (air cooling system shall be double of the actual requirement).		1	lot		
1O	Switchyard Lighting					
1O1	Upgradation/extension of existing lighting system to provide lighting (flood light LED type) for new AIS switchyard		1	lot		
1P	Earthing and Lightning Protection					
1P1	Earthing and Lightning Protection for new AIS switchyard & new GIS equipments in the GIS room		1	lot		
1Q	230kV, 132kV, 33kV cables & associated structures					
	Deleted.					
1R	SCADA system for Telecontrol and Telemetry					
1R1	Complete SCADA hardware & software		1	lot		
	Total of Section-1					
	(Carried to Schedule-5:Grand summary)					
SECTION-II	Char Fasson 230/33kV Gas Insulated Substation					
2A	400kV GIS Switchyard					
	Deleted.					
2B	245kV GIS Switchyard, structures & connections					
	245kV Indoor Type Gas Insulated Switchgear (GIS)					
2B1	245kV GIS Double Busbar, 230kV Line Feeder Bay with Local Control Cubicle and support structure		2	nos.		
2B2	245kV GIS Double Busbar, 230kV Transformer Bay with Local Control Cubicle and support structure		2	nos.		
2B3	245kV GIS Double Busbar, 245kV Bus Coupler Bay with Local Control Cubicle and support structure		1	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2B4	245kV GIS Busbar, 245kV Bus Section Bay with Local Control Cubicle and support structure		0	nos.		
2B5	245kV GIS Double Busbar , 245kV Bus VT & Busbar HSES circuit Bay with Local Control Cubicle and support structure		1	nos.		
2B6	Gas Insulated Line (GIL) including Gas/Air bushings for 245kV GIS connection with necessary connecting terminal chambers including support structures					
2B.6.1	For 3150A Circuits from 245kV transmission Lines to 245kV GIS and 230/33kV Transformer to 245kV GIS (single phase length)		773	meter		
2B.6.2	245kV 3150A, 40kA/3s Gas/Air bushings		12	nos.		
2B7	Portable Partial Discharge analyzer for GIS		1	set		
	245kV Air Insulated Switchgear (AIS)					
2B8	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz, Heavy duty class, metal oxide type, single phase surge arresters with surge counter		12	nos.		
2B9	Stranded, flexible conductors, fittings, clamps, connectors including other accessories for each connection as required for completing 230kV GIS Switchyard and Transformer connections.					
2B9.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection					
2B9.1.1	_Flexible Conductor for jumper, equipment connections		1	lot		
2B9.1.2	_Clamps & Connectors		1	lot		
2B9.2	Insulator & Fittings					
2B9.2.1	_Insulator		1	lot		
2B9.2.2	_Fittings		1	lot		
2B9.3	Steel structures & cable tray					
2B9.3.1	_Gantry Column with single beam including nut&bolts		9	nos.		
2B9.3.2	_Gantry Column with double beam including nut&bolts		0	nos.		
2B9.3.3	_Gantry beam including nut&bolts		6	nos.		
2B9.3.4	_Equipment support structures including nut&bolts					
2B9.3.4.1	LA		12	nos.		
2B9.3.5	_Cable tray including fitting, fixing accessories		0	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2C	145kV GIS Switchyard, structures & connections					
	Deleted.					
2D	36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers					
	36kV Air Insulated Switchgear (AIS)					
2D1	30kV rated voltage, 25kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters with surge counters.		18	nos.		
2D2	Single-phase, 2-secondary windings (33,000/√3 / 110/√3 / 110/√3V, 30VA/30VA, Class 3P/0.2) 36kV, 40kA/3sec, 50Hz, 170kVp BIL, inductive voltage transformers		6	nos.		
2D3	36kV Disconnecter					
2D3.1	36kV, 2500A, 40kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnecter with earth switch (DS & ES both motor operated) for 36kV AIS incomer		4	sets		
2D3.2	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnecter (motor operated) with fuse for 36/4kV auxiliary transformer bay		2	sets		
2D4	Current transformer 36 kV, single-phase, 4-cores (Core 1&2: 3200-1600/1A, Class: 5P20; Core 3&4: 3200-1600/1A, Class: 0.2S) 40 kA / 3 sec, 50 Hz, 170/70 kV BIL, post type current transformer.		6	nos.		
2D5	36kV, 2500A, 40kA/3sec, 50Hz, SF6/VCB circuit breaker with spring-stored energy operating mechanism		2	sets		
2D6	One (1) lot of stranded, flexible TACSR conductors, insulators, fittings, clamps, connectors, steel structures, cable trays, etc. including other accessories for each connection as required for completing 36kV AIS Switchyard and Transformer connections.					
2D6.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection, Copper bus		1	lot		
2D6.2	Insulator & Fittings		1	lot		
2D6.3	Steel structures & cable tray					
2D6.3.1	_Gantry Column with single beam including nut&bolts		0	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2D6.3.2	Gantry Column with double beam including nut&bolts		0	nos.		
2D6.3.3	Gantry beam including nut&bolts		0	nos.		
2D6.3.4	Equipment support structures including nut&bolts					
2D6.3.4.1	For 33kV incomer-					
2D6.3.4.1.1	Structure for LA, copper plate, cable termination		4	set		
2D6.3.4.1.2	VT		2	set		
2D6.3.4.1.3	DS/ES		4	set		
2D6.3.4.1.4	CT		2	set		
2D6.3.4.1.5	CB		2	set		
2D6.3.4.1.6	Marshalling Kiosk		2	set		
2D6.3.4.2	For 33kV auxiliary feeder-					
2D6.3.4.2.1	Structure for LA, copper plate, cable termination		2	set		
2D6.3.4.2.2	DS/ES with fuse		2	set		
2D6.3.5	Cable tray including fitting, fixing accessories		1	lot		
2E	Power Transformers and Earthing/Auxiliary Transformers					
2E.1	230/33 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformers		2	nos.		
2E.2	Complete design, supply, delivery, installation, testing and commissioning of Water Spray type Fire Protection System for 230/33kV Transformers		2	sets		
2F	Neutral Earthing Equipment.					
	Deleted.					
2G	Earthing /Auxiliary transformers					
2G1	Auxiliary power transformer 33/0.415 kV, 300 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase, 2-core current transformers in all bushings, including all necessary connections & support structures.		2	nos.		
2H	Control, Protection, Substation Automation and Metering					
	230kV Circuits					
2H1	Control, Monitoring, Protection & Substation Automation System including event recording function for line circuits - 230kV Nutan Bidyut 1&2		2	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2H2	Control, Monitoring, Protection & Substation Automation System including event recording function for 120/140MVA, 230/33kV, three phase, power transformer circuits including transformer tap changer control, fan control & AVR		2	sets		
2H3	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus coupler bays		2	sets		
2H4	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus section bays		2	sets		
2H5	Busbar protection system for 245kV system		1	lot		
2H6	Tariff metering for 230kV system		1	lot		
2H7	Digital Fault and Disturbance recorder (DFDR) to monitor complete substation (230kV & 33kV)		1	lot		
	33kV Station Power System					
2H8	Control, Monitoring, Protection & Substation Automation System including event recording function for 33kV incomer circuits of 230/33kV transformer		2	sets		
2H9	Control, Monitoring, Protection & Substation Automation System including event recording function for auxiliary transformer bays		2	sets		
2H10	Tariff metering panel for 33kV system		1	lot		
2I	Fiber Optic Multiplexer Equipment for Communication and Protection					
2I1	Complete set of design, supply, installation and commissioning of Fiber optic multiplexer equipment		1	lot		
2I2	Fibre Optic cable and termination box		1	lot		
2I3	PLC Equipment		0	lot		
2I4	PABX system		1	lot		
2J	Multicore Low Voltage Power & Control Cables					
2J1	Multicore low voltage power and control cables for control, protection, metering, monitoring and L/V power circuits		1	lot		
2K	Batteries, chargers & DC distribution					
2K1	110V Ni-cad Batteries with chargers and distribution boards					
2K1.1	110V Ni-cad Batteries, 400Ah @ 5h		2	sets		
2K1.2	Battery chargers		2	sets		
2K1.3	DC Distribution Board		2	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2K1.4	3kVA, 240V, 50Hz UPS powered from 110V DC distribution board & AC distribution board for Substation Automation System		2	sets		
2K1.5	Insulation Monitoring system for complete DC system		2	sets		
2K2	48V Ni-cad Batteries with chargers and distribution board					
2K2.1	48V Ni-cad Batteries, 200Ah @ 5h		2	sets		
2K2.2	Battery chargers		2	sets		
2K2.3	DC Distribution Board		1	sets		
2K2.4	Insulation Monitoring system for complete DC system		2	sets		
2L	LVAC Distribution					
2L1	LVAC Panles including necessary accessories for substation services		1	lot		
2L2	Tariff meters for LV system		4	Nos		
2L3	Scissor Lift: Battery type for min. two persons. Maximum working high greater than 10m		1	sets		
2L4	Electroscopes for 230kV & 33kV voltage levels (2 sets for each volate levels)		4	sets		
2L5	Complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 175kVAR automatic power factor correction (PFC) Panel		1	lot		
2L6	Diesel Generator with capacity of 250kW		1	sets		
2M	Civil Works, Building and Foundation					
2M1*	Complete land development					
2M1.1	Complete compacted land development with carried/dredged earthfilling including approach road					
2M1.2	Slpoe protection					
2M1.2.1	Slpoe (1V:2H) protection with turfing					
2M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV GIS & 33kV AIS switchyards at existing substaion.					
2M3*	Complete civil items required for outdoor works					
2M3.1	Outdoor gantry foundation 230kV switchyard					
	Gantry column					

Please refer to
Schedule 4

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2M3.2	Outdoor equipment foundation 230kV switchyard		Please refer to Schedule 4			
	LA					
2M3.3	Outdoor equipment foundation 33kV switchyard					
2M3.3.1	For 33kV incomer-					
2M3.3.1.1	Structure for LA, copper plate, cable termination					
2M3.3.1.2	VT					
2M3.3.1.3	DS/ES					
2M3.3.1.4	CT					
2M3.3.1.5	CB					
2M3.3.1.6	Marshalling Kiosk					
2M3.3.2	For 33kV auxiliary feeder-					
2M3.3.2.1	Structure for LA, copper plate, cable termination					
2M3.3.2.2	DS/ES with fuse					
2M3.4	Transformer foundation including oil pit for 230/33kV, 120/140MVA Transformer					
2M3.5	Blast wall for 230/33kV, 120/140MVA Transformer					
2M3.6	Transformer foundation for 300kVA auxiliary transformer					
2M3.7	Security boundary wall for overall plant					
2M3.8	Substation main gate					
2M3.9	Chain link fencing with gates					
2M3.10	Approach road (pavement width 6m)					
2M3.11	Internal roads:					
2M3.11.1	6m wide road:					
2M3.11.2	4.5m wide road					
2M3.11.3	3m wide road					
2M3.11.4	1.5m walk way					
2M3.12	Cable Trench with soak pit					
2M3.12.1	For control cable of 33kV incomer AIS & 33kV power cable to auxiliary Tx.					
2M3.12.2	For .4kV power cable from auxiliary Tx bay to GIS building					
2M3.13	Surface drain around the substation					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2M3.14	Whole substation surface finishing with drainage system including outlet & a network of water pits connected with pipes throughout the substation (excluding surface drain)		Please refer to Schedule 4			
2M3.15	Gravel surfacing & gravel laying					
2M3.16	Guard house					
2M3.17	Sentry post					
2M3.18	Open store yard including chain link fence, surface drain & gate					
2M3.19	RCC box culvert					
2M3.20	Property line demarkation					
2M3.21	Septic tank and soakpit					
2M3.22	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion <i>etc.</i>					
2M3.23	Car port					
2M4.1	Complete civil works for 230kV indoor GIS building including protection & metering room, battery room <i>etc.</i> (3 STORIED)					
2M4.1.1	Foundation works					
2M4.1.2	Super structures					
2M4.1.3	All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, <i>etc.</i>					
2M4.1.4	Complete EOT crain system in GIS room (minimum 7 Ton)					
2M4.1.5	Elevator system (capacity: minimum 6 people)					
2M4.2	Complete civil works for Dormitory cum Indoor Store cum Staff Room (3 STORIED)					
2M4.2.1	Foundation works					
2M4.2.2	Super structures					
2M4.2.3	All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, <i>etc.</i>					
2M4.3	Complete civil works for Ansar Barack including foundations, super structures & all finish works like rendering, painting, water supply, sanitary, floor finish, furniture, <i>etc.</i> (1 STORIED)					
2M5	Complete design, supply and construction of all civil items and facilities required for Water Spray type Fire Protection System for transformers					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2M6	Complete design, supply and construction of all civil items and facilities required for Diesel Generator room		Please refer to Schedule 4			
2M7	Testing of Foundation on random basis.					
2M7.1	Compression Test of pile					
2M7.2	Uplift Test of pile					
2M8	Fire alarm & fire fighting system for other areas					
	* actual payment shall be as per actual work at site ** one set includes foundation for three phases of a circuit					
2N	Building Lighting, Small Power, Air Conditioning and Ventilation					
2N1	Complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings, auxiliary & other houses (air cooling system shall be double of the actual requirement).		1	lot		
2N2	Complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of surveillance system with IP cameras, NVRs, optical fibre, cat6 cables, switches, indoor & outdoor cabinets, lightning protection systems, power cables and other accessories to complete surveillance system of the substation					
2N2.1	Bullet camera		24	Nos		
2N2.2	Dome camera		8	Nos		
2N2.3	32 channel NVR		1	Nos		
2N2.4	Access switch		1	lot		
2N2.5	Core switch		1	lot		
2N2.6	32" LED TV		1	Nos		
2N2.7	Fiber Optic Cable (6 core Single mode, Armored)		1	lot		
2N2.8	CAT6 Network Cable (STP Type)		1	lot		
2N2.9	Power Cable-NYFGBY		1	lot		
2N2.10	uPVC pipes & fittings, Surveillance Cabinet, 22U rack, Offline UPS, poles, MDB, SDB, ethernet LA, SPD & other necessary accessories		1	lot		
20	Switchyard Lighting					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
2O1	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.		1	lot		
2P	Earthing and Lightning Protection					
2P1	Earthing system for the substation		1	lot		
2P2	Lightning protection system for the substation		1	lot		
2P3	portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole		4	sets		
2Q	230kV, 132kV, 33kV cables & associated structures					
2Q1	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm ² , 40kA/ 3 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable (single phase length)		713	meter		
2Q2	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 40kA/ 3 sec, 50Hz, 170/70 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.		12	nos		
2Q3	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of .415kV, 185mm ² , 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, single phase XLPE cable. (single phase length)		476	meter		
2Q4	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.		12	nos		
2R	SCADA system for Telecontrol and Telemetry					
2R1	Complete SCADA hardware & software		1	lot		
	Total of Section-2					
	(Carried to Schedule-5:Grand summary)					
SECTION-III	Mandatory Spares, Erection & Test Equipment					
3.1	Nutan Bidyut PP (245kV)					
3.1.1	245kV Gas Insulated Switchgear					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.1.1.1	Operating mechanism of Circuit Breaker (1 Nos for each type of offered CB)		1	lot		
3.1.1.2	Operating mechanism of 3 position DS-ES (1 Nos for each type of offered DS-ES)		0	lot		
3.1.1.3	Operating mechanism of FES (1 Nos for each type of offered FES)		1	lot		
3.1.1.4	Operating mechanism of ES (1 Nos for each type of offered ES)		0	lot		
3.1.1.5	Operating mechanism of DS (1 Nos for each type of offered DS)		1	sets		
3.1.1.6	Each type of auxiliary contacts unit		1	sets		
3.1.1.7	Surge arrester (GIS)		0	nos.		
3.1.1.8	Surge arrester (AIS)		3	nos.		
3.1.1.9	Complete Voltage transformer module		1	nos.		
3.1.1.10	Complete Current transformer module		0	nos.		
3.1.1.11	Closing coils		4	nos.		
3.1.1.12	Tripping coils		8	nos.		
3.1.1.13	Motor for circuit breaker operating mechanism		1	nos.		
3.1.1.14	Motor for disconnecter drive		1	nos.		
3.1.1.15	Coils for Blocking magnet in disconnecter drive		0	nos.		
3.1.1.16	Gas pressure monitor with gauge and pressure switch		3	nos.		
3.1.1.17	Deleted.		0	sets		
3.1.1.18	Pressure Relief Device		1	nos.		
3.1.1.19	Supporting insulator		0	nos.		
3.1.1.20	Barrier insulator or gas tight barrier		0	nos.		
3.1.1.21	Expansion bellows		0	nos.		
3.1.1.22	Rubber gaskets "O" rings and seals for SF6 gas		0	lot		
3.1.1.23	All types of control valves for SF6 gas		0	lot		
3.1.1.24	SF6 gas cylinders - 45 kg		0	nos.		
3.1.2	36kV AIS Switchgears (incomer & auxiliary bay)		Deleted.			
3.1.3	Protection and Control					
3.1.3.1	Protection relay (Line distance protection relay)		1	nos.		
3.1.3.2	Bay unit for bus protection relay		1	nos.		
3.1.3.3	Each type of Tripping relays		1	lot		
3.1.3.4	Each type of Auxiliary relays		3	sets		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.1.3.5	Each type of Trip circuit supervision relays		1	sets		
3.1.3.6	Bay Control Unit		1	nos		
3.1.3.7	Relay Test Block & socket		2	sets		
3.1.3.8	Each type of Switch (used in SAS)		0	sets		
3.1.3.9	Each type of MCB		1	sets		
3.1.3.10	Each type of Lamps		5	sets		
3.1.3.11	Heater		5	nos.		
3.1.3.12	Humidity Sensors		5	nos.		
3.1.3.13	Thermostat		5	nos.		
3.1.3.14	Annunciator bulbs		5	nos.		
3.1.3.15	Bulbs for discrepancy switches		5	nos.		
3.1.3.16	Multifunction Meter		2	nos.		
3.1.3.17	Tariff/Energy Meter		1	nos.		
3.1.3.18	Deleted.		0	set		
3.1.4	DC & Charger Equipment (48 v)					
3.1.4.1	Each type of Card (example: control card etc.)		1	nos.		
3.1.4.2	Battery MCB/MCCB		1	nos.		
3.1.4.3	DC board incoming MCCB		1	nos.		
3.1.4.4	Outgoing MCBs		2	nos.		
3.1.4.5	Each type of fuse		1	set		
3.1.5	LVAC Equipment		Deleted.			
3.1.6	Power, Control and Auxiliary Cables					
3.1.6.1	Control Cables, 200m of each type		0	lot		
3.1.6.2	LV cables, 200m of each type		0	lot		
3.1.6.3	Other cables (communication, etc.), 100m of each type		0	lot		
3.1.7	Transformers and Shunt Reactor		Deleted.			
3.1.8	Earthing / Auxiliary Transformer		Deleted.			
3.1.9	Shunt Reactor		Deleted.			
3.1.10	Instruments for Communication & SCADA		Deleted.			
3.1.11	Post Type Insulator					
3.1.11.1	For 245kV		0	nos.		
3.1.12	Gas Insulated Line (GIL)					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.1.12.1	245kV, 1600A, GIL (with necessary bellow & angle joint)		0	m		
3.1.13	Disc Insulator					
3.1.13.1	Each type of Disc Insulator		0	nos.		
3.1.14	Conductor					
3.1.14.1	TACSR conductor		0	m		
3.1.15	Clamp and Fitting					
3.1.15.1	Each type of Clamps and Fittings (20% of total supplied or min. 3 nos., whichever is higher for each type)		1	lot		
3.1.16	Testing instruments / special tools for operation and maintenance					
3.1.16.1	SF6 Gas Treatment Plant For Gas Filling, Recovery, Evacuation, Filtering, Drying and Storage with necessary accessories		0	sets		
3.1.16.2	SF6 gas cylinder with valve (50kg)		0	sets		
3.1.16.3	Handheld SF6 gas leakage detector (alarm with proportional sound pitch)		0	sets		
3.1.16.4	Infrared type SF6 gas leakage detector (FLIR)		0	sets		
3.1.16.5	SF6 Multi-Analyser for measurement of %SF6, Moisture and SO ₂ concentration		0	sets		
3.1.16.6	Contact resistance measurement test set (suitable for measurement down to 1 µ ohm at 10A d.c.)		0	sets		
3.1.16.7	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)		0	sets		
3.1.16.8	Thermovision Camera (FLIR)		0	sets		
3.2	Char Fasson 230/33kV Substation					
3.2.1	245kV Gas Insulated Switchgear					
3.2.1.1	Operating mechanism of Circuit Breaker (1 Nos for each type of offered CB)		1	lot		
3.2.1.2	Operating mechanism of 3 position DS-ES (1 Nos for each type of offered DS-ES)		1	lot		
3.2.1.3	Operating mechanism of FES (1 Nos for each type of offered FES)		1	lot		
3.2.1.4	Operating mechanism of ES (1 Nos for each type of offered ES)		1	lot		
3.2.1.5	Operating mechanism of DS (1 Nos for each type of offered DS)		0	sets		
3.2.1.6	Each type of auxiliary contacts unit		1	sets		
3.2.1.7	Surge arrester (GIS)		0	nos.		
3.2.1.8	Surge arrester (AIS)		6	nos.		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.2.1.9	Complete Voltage transformer module		1	nos.		
3.2.1.10	Complete Current transformer module		0	nos.		
3.2.1.11	Closing coils		4	nos.		
3.2.1.12	Tripping coils		8	nos.		
3.2.1.13	Motor for circuit breaker operating mechanism		1	nos.		
3.2.1.14	Motor for disconnecter drive		1	nos.		
3.2.1.15	Coils for Blocking magnet in disconnecter drive		0	nos.		
3.2.1.16	Gas pressure monitor with gauge and pressure switch		3	nos.		
3.2.1.17	Deleted.		0	sets		
3.2.1.18	Pressure Relief Device		1	nos.		
3.2.1.19	Supporting insulator		0	nos.		
3.2.1.20	Barrier insulator or gas tight barrier		0	nos.		
3.2.1.21	Expansion bellows		0	nos.		
3.2.1.22	Rubber gaskets "O" rings and seals for SF6 gas		0	lot		
3.2.1.23	All types of control valves for SF6 gas		0	lot		
3.2.1.24	SF6 gas cylinders - 45 kg		0	nos.		
3.2.2	36kV AIS Switchgears (incomer & auxiliary bay)					
3.2.2.1	36kV Circuit Breaker		1	sets		
3.2.2.2	36kV Disconnecter Switch		1	sets		
3.2.2.3	36kV Disconnecter Switch with Fuse		1	sets		
3.2.2.4	Deleted.		0	nos.		
3.2.2.5	36kV Load Beak Switch with fuse		0	sets		
3.2.2.6	36kV IVT (same as offered type)		3	nos.		
3.2.2.7	36kV Current Transformer (same as offered type)		3	nos.		
3.2.2.8	30kV Surge Arrester		3	nos.		
3.2.2.9	Motor for circuit breaker operating mechanism		1	nos.		
3.2.2.10	Motor for disconnecter drive		0	nos.		
3.2.2.11	Closing coils for CB		3	nos.		
3.2.2.12	Tripping coils for CB		6	nos.		
3.2.2.13	Contactors, relays, selector switches, push buttons, counters, heaters, humidity sensors etc., in motor drive mechanism and control cubicle (3 nos. for each type)		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.2.3	Control, Protection, SAS, Metering & DFDR					
3.2.3.1	Protection relay (Line distance & transformer protection relay)		1	nos.		
3.2.3.2	Bay unit for bus protection relay		2	nos.		
3.2.3.3	Each type of Tripping relays		1	lot		
3.2.3.4	Each type of Auxiliary relays		3	sets		
3.2.3.5	Each type of Trip circuit supervision relays		1	sets		
3.2.3.6	Bay Control Unit		1	nos.		
3.2.3.7	Relay Test Block & socket		2	sets		
3.2.3.8	Each type of Switch (used in SAS)		1	sets		
3.2.3.9	Each type of MCB		1	sets		
3.2.3.10	Each type of Lamps		5	sets		
3.2.3.11	Heater		10	nos.		
3.2.3.12	Humidity Sensors		10	nos.		
3.2.3.13	Thermostat		10	nos.		
3.2.3.14	Annunciator bulbs		10	nos.		
3.2.3.15	Bulbs for discrepancy switches		10	nos.		
3.2.3.16	Multifunction Meter		5	nos.		
3.2.3.17	Tariff/Energy Meter		2	nos.		
3.2.3.18	Deleted.		0	set		
3.2.4	DC & Charger Equipment (for both 110v & 48v)					
3.2.4.1	Each type of Card (example: control card etc.)		1	nos.		
3.2.4.2	Battery MCB/MCCB		1	nos.		
3.2.4.3	DC board incoming MCCB		1	nos.		
3.2.4.4	Outgoing MCBs		5	nos.		
3.2.4.5	Each type of fuse		1	set		
3.2.5	LVAC Equipment					
3.2.5.1	3-phase set LVAC board incoming ACB/MCCB		1	nos.		
3.2.5.2	3-phase sets outgoing MCCBs		5	nos.		
3.2.5.3	1-phase sets outgoing MCBs		12	nos.		
3.2.6	Power, Control and Auxiliary Cables					
3.2.6.1	Power Cables (36kV), 300m of each type		0	lot		
3.2.6.2	Control Cables, 200m of each type		0	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.2.6.3	LV cables, 200m of each type		0	lot		
3.2.6.4	Other cables (communication, etc.), 100m of each type		0	lot		
3.2.7	Transformers					
3.2.7.1	Transformer					
3.2.7.2	245kV bushings		2	nos		
3.2.7.3	Neutral Bushing		1	nos		
3.2.7.4	36kV Bushing		1	nos		
3.2.7.5	Set of gaskets		1	set		
3.2.7.6	Complete WTI		1	set		
3.2.7.7	Complete OTI		1	set		
3.2.7.8	Set of Silica gel breather		0	nos		
3.2.7.9	Buchholz relay		1	nos		
3.2.7.10	Set of tap changer diverter switch		0	nos		
3.2.7.11	Tap changer control mechanism motor		1	nos		
3.2.7.12	Transformer oil 200 litter barrel		20	nos.		
3.2.7.13	Water Spray Fire Protection System for Transformers					
3.2.7.13.1	Water spray nozzles		0	nos		
3.2.7.13.2	Relase sprinklers		0	nos		
3.2.7.13.3	Set of internal parts of deluge valve		0	set		
3.2.7.13.4	Set of sealings for deluge valves of each type		0	set		
3.2.7.13.5	Set of sealings for pipes and flanges		0	set		
3.2.7.13.6	Set of spare parts for jockey pump		0	set		
3.2.7.13.7	Set of spare parts for control panel & automatic level indicator		0	set		
3.2.7.13.8	Set of spare parts for air supply and reducing devices		0	set		
3.2.7.13.9	Fire fighting pump complete with coupling		0	set		
3.2.8	Earthing / Auxiliary Transformer					
3.2.8.1	Set of gaskets		1	no.		
3.2.8.2	Complete OTI including gaskets & thermometers		1	set		
3.2.8.3	Set of Silica gel breather		1	no.		
3.2.8.4	Buchholz relay		0	no.		
3.2.8.5	Transformer oil 200 litter barrel		0	nos.		
3.2.9	Shunt Reactor					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
	Deleted.					
3.2.10	Instruments for Communication & SCADA					
3.2.10.1	Set of spare modules of necessary function		0	lot		
3.2.10.2	Digital data (Communication) analyzer		0	lot		
3.2.10.3	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility		0	lot		
3.2.10.4	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)		0	lot		
3.2.10.5	Subscriber Module for DCS 255 Exchange		0	lot		
3.2.10.6	Industrial PC		0	set		
3.2.10.7	Desktop PC for Substation incharge. Min. Spec: i7 latest gen processor, 16 GB RAM, 512 GB SSD, 24" 1080p IPS LED Monitor, 1500VA UPS, Multifunction B/W printer/scanner with ADF, keyboard, mouse, etc.		0	set		
3.2.10.8	Gateway Terminal		0	set		
3.2.10.9	Bay Ethernet Switches		0	nos.		
3.2.10.10	Optical connectors (one for each)		0	lot		
3.2.11	Post Type Insulator					
3.2.11.1	For 420kV		0	nos.		
3.2.11.2	For 245kV		0	nos.		
3.2.11.3	For 36kV		0	nos.		
3.2.12	Gas Insulated Line (GIL)					
3.2.12.1	245kV, 3150A, GIL (with necessary bellow & angle joint)		0	m		
3.2.13	Disc Insulator					
3.2.13.1	Each type of Disc Insulator		0	nos.		
3.2.14	Conductor					
3.2.14.1	TACSR conductor		0	m		
3.2.15	Clamp and Fitting					
3.2.15.1	Each type of Clamps and Fittings (20% of total supplied or min. 3 nos., whichever is higher for each type)		1	lot		

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.2.16	Surveillance system					
3.2.16.1	Bullet camera		5	Nos		
3.2.16.2	Dome camera		3	Nos		
3.2.16.3	Access switch		3	Nos		
3.2.16.4	Ethernet lightning arrester		10	Nos		
3.2.16.5	Sfp modules		0	Nos		
3.2.16.6	SPD type 1		2	Nos		
3.2.16.7	SPD type 2		2	Nos		
3.2.17	Testing instruments / special tools for operation and maintenance					
3.2.17.1	SF6 Gas Treatment Plant For Gas Filling, Recovery, Evacuation, Filtering, Drying and Storage with necessary accessories (DILO)		1	sets		
3.2.17.2	SF6 gas cylinder with valve (50kg)		2	Nos		
3.2.17.3	Handheld SF6 gas leakage detector (alarm with proportional sound pitch)		1	sets		
3.2.17.4	Infrared type SF6 gas leakage detector (FLIR)		1	sets		
3.2.17.5	Dew point Meter (DIL0)		0	sets		
3.2.17.6	SF6 Multi-Analyser for measurement of %SF6, Moisture and SO ₂ concentration		0	sets		
3.2.17.7	Contact resistance measurement test set (suitable for measurement down to 1 μ ohm at 10A d.c.)		1	sets		
3.2.17.8	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)		1	sets		
3.2.17.9	Thermovision Camera (FLIR)		1	sets		
3.2.17.10	Oil Insulation Tester (Breakdown voltage)		1	sets		
3.2.17.12	Multimeter (Fluke/Megger)		0	Nos		
3.2.17.13	Clamp mA meter (both AC & DC)		0	Nos		
3.2.17.14	Portable LA leakage current meter (3rd harmonic)		0	Nos		
3.2.18	General tools for maintenance work					
3.2.18.1	Set of General Tools		0	sets		
3.2.19	Heavy duty equipment / tools maintenance work					
3.2.19.1	Set of Heavy duty equipment / tools		0	sets		
3.2.20	Other equipment / tools					
3.2.20.1	Set of other equipment / tools		0	sets		
3.2.21	General equipment					

Schedules of Rates and Prices						
Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad						
Item	Description	Code ¹	Qty. (1)	Unit	Foreign Currency (in.....)	
					Unit Price ¹ CIP	Total Price ¹ CIP
					(2)	(1) x (2)
3.2.21.1	Desktop PC for Substation incharge. Min. Spec: i7 latest gen processor, 16 GB RAM, 1 TB SSD, 24" 1080p IPS LED Monitor, 1500VA UPS, Multifunction B/W printer/scanner with ADF, keyboard, mouse, etc.		1	set		
	Total of Section-3					
	(Carried to Schedule-5:Grand summary)					
SECTION-IV	Additional Services (Please refer to Schedule 4)					
TOTAL OF SCHEDULE NO.1 (To be indicated in Schedule No.5 Ground Summary)						

Name of Bidder _____

Signature of Bidder _____

Notes:

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

"-" Dash means included

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

² Specify currency in accordance with Bid Data Sheet 19.1

Country of Origin Declaration Form

Item	Description	Code	Country

Schedules of Rates and Prices							
Schedule 3: Design Services							
No.	Description	Unit	Qty	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
			(1)	(2)	(3)	(1) X (2)	(1) X (3)
SECTION-I	Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Borhanuddin						
a)	Design and engineering services of the whole substation, local and foreign part	Lump sum	1				
SECTION-II	Char Fasson 230/33kV Gas Insulated Substation						
a)	Design and engineering services of the whole substation, local and foreign part	Lump sum	1				
TOTAL OF SCHEDULE NO.3 (To be indicated in Schedule No.5 Ground Summary)							

Name of Bidder

Signature of Bidder

Notes:

¹ Specify currency in accordance with Bid Data Sheet 19.1

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
SECTION-I	Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Borhanuddin, Bhola.						
1A	400kV GIS Switchyard						
	Deleted.						
1B	245kV GIS Switchyard, structures & connections						
	245kV Indoor Type Gas Insulated Switchgear (GIS)						
1B1	245kV GIS complete diameter (Line & Line combination) with Local Control Cubicle and support structure	1	nos.				
1B2	Deleted.	0	lot				
1B3	Gas Insulated Line (GIL) including Gas/Air bushings for 245kV GIS connection with necessary connecting terminal chambers including support structures						
1B.3.1	For 245kV 1600A, 40kA/3s Circuits from 245kV transmission Lines to 245kV GIS (single phase length)	710	meter				
1B.3.2	245kV 1600A, 40kA/3s Gas/Air bushings	6	nos.				
1B4	Portable Partial Discharge analyzer for GIS	0	set				
	245kV Air Insulated Switchgear (AIS)						
1B5	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz, Heavy duty class, metal oxide type, single phase surge arresters with surge counter	6	nos.				
1B6	Stranded, flexible conductors, fittings, clamps, connectors including other accessories for each connection as required for completing 230kV GIS Switchyard and AIS line connections.						
1B6.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection						
1B6.1.1	Flexible Conductor for jumper, equipment connections	1	lot				
1B6.1.2	Clamps & Connectors	1	lot				
1B6.2	Insulator & Fittings						
1B6.2.1	Insulator	1	lot				
1B6.2.2	Fittings	1	lot				
1B6.3	Steel structures & cable tray						
1B6.3.1	Gantry Column with single beam including nut&bolts	3	nos.				
1B6.3.2	Gantry Column with double beam including nut&bolts	0	nos.				
1B6.3.3	Gantry beam including nut&bolts	2	nos.				
1B6.3.4	Equipment support structures including nut&bolts						
1B6.3.4.1	LA	6	nos.				
1B6.3.5	Cable tray including fitting, fixing accessories	1	lot				
1C	145kV GIS Switchyard, structures & connections						
	Deleted.						
1D	36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers						
	Deleted.						
1E	Power Transformers and Earthing/Auxiliary Transformers						
	Deleted.						
1F	Neutral earthing equipment:						
	Deleted.						
1G	Earthing /Auxiliary transformers						
	Deleted.						
1H	Control, Protection, Substation Automation and Metering						
	230kV Circuits						
1H1	Control, Monitoring, Protection including event recording function for new line circuits - Char Fasson 1&2	2	sets				
1H2	Upgradation/extension of existing Substation Automation System for new line circuits - Char Fasson 1&2	1	lot				
1H3	Upgradation/extension of existing busbar protection system for 245kV system	1	lot				
1H4	Tariff metering system for two (2) new 230kV lines	1	lot				
1H5	Extension of existing Digital Fault and Disturbance recorder (DFDR) to include complete monitoring of the new diameter	1	lot				
1I	Fiber Optic Multiplexer Equipment for Communication and Protection						
1I1	Complete set of design, supply, installation and commissioning of Fiber optic multiplexer equipment	1	lot				
1I2	Fibre Optic cable and termination box	1	lot				
1I3	PLC Equipment	0	lot				
1J	Multicore Low Voltage Power & Control Cables						
1J1	Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits	1	lot				
1K	Batteries, chargers & DC distribution						
1K1	Upgradation / extension of existing of 220V DC Distribution Board to power DC load of the new diameter	1	lot				
1K2	48V Ni-cad Batteries with chargers and distribution board						
1K2.1	48V Ni-cad Batteries, 200Ah @ 5h	1	sets				
1K2.2	Battery chargers	1	sets				
1K2.3	DC Distribution Board	1	sets				
1L	LVAC Distribution						

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
1L1	Upgradation / extension of existing of LVAC system including necessary accessories for substation services	1	lot				
1M	Civil Works, Building and Foundation						
1M1	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV GIS & AIS switchyards at Nutan Bidyut CCP area	1	lot				
1M2*	Complete civil items required for outdoor works						
1M2.1	Outdoor gantry foundation 230kV switchyard						
1M2.1.1	Gantry column	3	nos.				
1M2.2	Outdoor equipment foundation 230kV switchyard						
1M2.2.1	LA	6	nos.				
1M2.3	Chain link fencing (including gates)	140	meter				
1M2.4	Internal roads (2 m wide)						
1M2.4.1	Dismantling & removal of existing road	10	meter				
1M2.4.2	Construction of new road	10	meter				
1M2.5	Drainage system including connection to existing drainage	1	lot				
1M2.6	Gravelling in switchyard area	748	m²				
1M3	Modification work at existing GIS hall and other adjacent rooms for the full accommodation of new diameter equipment including GIL entry, cabling laying, connections etc.	1	lot				
1M4	Upgradation/extension of existing fire alarm & fighting system	1	lot				
	* actual payment shall be as per actual work at site						
	** one set includes foundation for three phases of a circuit						
1N	Building Lighting, Small Power, Air Conditioning and Ventilation						
1N1	Complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system (split type, 4.5 Ton each), ventilation system and emergency DC lighting for the substation GIS & Control room buildings, auxiliary & other houses (air cooling system shall be double of the actual requirement).	1	lot				
1O	Switchyard Lighting						
1O1	Upgradation/extension of existing lighting system to provide lighting (flood light LED type) for new AIS switchyard	1	lot				
1P	Earthing and Lightning Protection						
1P1	Earthing and Lightning Protection for new AIS switchyard & new GIS equipments in the GIS room	1	lot				
1Q	230kV, 132kV, 33kV cables & associated structures						
	Deleted.						
1R	SCADA system for Telecontrol and Telemetry						
1R1	Complete SCADA hardware & software	1	lot				
	Total of Section-1						
	(Carried to Schedule-5:Grand summary)						
SECTION-II	Char Fasson 230/33kV Gas Insulated Substation						
2A	400kV GIS Switchyard						
	Deleted.						
2B	245kV GIS Switchyard, structures & connections						
	245kV Indoor Type Gas Insulated Switchgear (GIS)						
2B1	245kV GIS Double Busbar, 230kV Line Feeder Bay with Local Control Cubicle and support structure	2	nos.				
2B2	245kV GIS Double Busbar, 230kV Transformer Bay with Local Control Cubicle and support structure	2	nos.				
2B3	245kV GIS Double Busbar, 245kV Bus Coupler Bay with Local Control Cubicle and support structure	1	nos.				
2B4	245kV GIS Busbar, 245kV Bus Section Bay with Local Control Cubicle and support structure	0	nos.				
2B5	245kV GIS Double Busbar , 245kV Bus VT & Busbar HSES circuit Bay with Local Control Cubicle and support structure	1	nos.				
2B6	Gas Insulated Line (GIL) including Gas/Air bushings for 245kV GIS connection with necessary connecting terminal chambers including support structures						
2B.6.1	For 3150A Circuits from 245kV transmission Lines to 245kV GIS and 230/33kV Transformer to 245kV GIS (single phase length)	773	meter				
2B.6.2	245kV 3150A, 40kA/3s Gas/Air bushings	12	nos.				
2B7	Portable Partial Discharge analyzer for GIS	1	set				
	245kV Air Insulated Switchgear (AIS)						
2B8	196kV rated voltage, 160kV(rms) continuous operating voltage at 50°C 10kA, 50Hz, Heavy duty class, metal oxide type, single phase surge arresters with surge counter	12	nos.				
2B9	Stranded, flexible conductors, fittings, clamps, connectors including other accessories for each connection as required for completing 230kV GIS Switchyard and Transformer connections.						
2B9.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection						
2B9.1.1	Flexible Conductor for jumper, equipment connections	1	lot				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty.	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
		(1)		(2)	(3)	(1) X (2)	(1) X (3)
2B9.1.2	Clamps & Connectors	1	lot				
2B9.2	Insulator & Fittings						
2B9.2.1	Insulator	1	lot				
2B9.2.2	Fittings	1	lot				
2B9.3	Steel structures & cable tray						
2B9.3.1	Gantry Column with single beam including nut&bolts	9	nos.				
2B9.3.2	Gantry Column with double beam including nut&bolts	0	nos.				
2B9.3.3	Gantry beam including nut&bolts	6	nos.				
2B9.3.4	Equipment support structures including nut&bolts						
2B9.3.4.1	LA	12	nos.				
2B9.3.5	Cable tray including fitting, fixing accessories	0	lot				
2C	145kV GIS Switchyard, structures & connections						
	Deleted.						
2D	36kV Switchgears and Connections with Auto Transformer & Earthing/ Auxiliary Transformers						
	36kV Air Insulated Switchgear (AIS)						
2D1	30kV rated voltage, 25kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase surge arresters with surge counters.	18	nos.				
2D2	Single-phase, 2-secondary windings (33,000/√3 / 110/√3 / 110/√3V, 30VA/30VA, Class 3P/0.2) 36kV, 40kA/3sec, 50Hz, 170kVp BIL, inductive voltage transformers	6	nos.				
2D3	36kV Disconnector						
2D3.1	36kV, 2500A, 40kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnector with earth switch (DS & ES both motor operated) for 36kV AIS incomer	4	sets				
2D3.2	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single horizontal break, post type, disconnector (motor operated) with fuse for 36/4kV auxiliary transformer bay	2	sets				
2D4	Current transformer 36 kV, single-phase, 4-cores (Core 1&2: 3200-1600/1A, Class: 5P20; Core 3&4: 3200-1600/1A, Class: 0.2S) 40 kA / 3 sec, 50 Hz, 170/70 kV BIL, post type current transformer.	6	nos.				
2D5	36kV, 2500A, 40kA/3sec, 50Hz, SF6/VCB circuit breaker with spring-stored energy operating mechanism	2	sets				
2D6	One (1) lot of stranded, flexible TACSR conductors, insulators, fittings, clamps, connectors, steel structures, cable trays, etc. including other accessories for each connection as required for completing 36kV AIS Switchyard and Transformer connections.						
2D6.1	Flexible Conductor, clamps & connectors for Jumper & equipment Connection, Copper bus	1	lot				
2D6.2	Insulator & Fittings	1	lot				
2D6.3	Steel structures & cable tray						
2D6.3.1	Gantry Column with single beam including nut&bolts	0	nos.				
2D6.3.2	Gantry Column with double beam including nut&bolts	0	nos.				
2D6.3.3	Gantry beam including nut&bolts	0	nos.				
2D6.3.4	Equipment support structures including nut&bolts						
2D6.3.4.1	For 33kV incomer-						
2D6.3.4.1.1	Structure for LA, copper plate, cable termination	4	set				
2D6.3.4.1.2	VT	2	set				
2D6.3.4.1.3	DS/ES	4	set				
2D6.3.4.1.4	CT	2	set				
2D6.3.4.1.5	CB	2	set				
2D6.3.4.1.6	Marshalling Kiosk	2	set				
2D6.3.4.2	For 33kV auxiliary feeder-						
2D6.3.4.2.1	Structure for LA, copper plate, cable termination	2	set				
2D6.3.4.2.2	DS/ES with fuse	2	set				
2D6.3.5	Cable tray including fitting, fixing accessories	1	lot				
2E	Power Transformers and Earthing/Auxiliary Transformers						
2E.1	230/33 kV, 120/140 MVA (ONAN/ONAF), Dyn1 three phase outdoor type transformers	2	nos.				
2E.2	Complete design, supply, delivery, installation, testing and commissioning of Water Spray type Fire Protection System for 230/33kV Transformers	2	sets				
2F	Neutral Earthing Equipment.						
	Deleted.						
2G	Earthing /Auxiliary transformers						
2G1	Auxiliary power transformer 33/0.415 kV, 300 kVA, Dyn11, ONAN, oil immersed, three phase, outdoor, with off-load tap changer; with single phase, 2-core current transformers in all bushings, including all necessary connections & support structures.	2	nos.				
2H	Control, Protection, Substation Automation and Metering						
	230kV Circuits						
2H1	Control, Monitoring, Protection & Substation Automation System including event recording function for line circuits - 230kV Nutan Bidyut 1&2	2	sets				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
2H2	Control, Monitoring, Protection & Substation Automation System including event recording function for 120/140MVA, 230/33kV, three phase, power transformer circuits including transformer tap changer control, fan control & AVR	2	sets				
2H3	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus coupler bays	2	sets				
2H4	Control, Monitoring, Protection & Substation Automation System including event recording function for 230kV bus section bays	2	sets				
2H5	Busbar protection system for 245kV system	1	lot				
2H6	Tariff metering for 230kV system	1	lot				
2H7	Digital Fault and Disturbance recorder (DFDR) to monitor complete substation (230kV & 33kV)	1	lot				
	33kV Station Power System						
2H8	Control, Monitoring, Protection & Substation Automation System including event recording function for 33kV incomer circuits of 230/33kV transformer	2	sets				
2H9	Control, Monitoring, Protection & Substation Automation System including event recording function for auxiliary transformer bays	2	sets				
2H10	Tariff metering panel for 33kV system	1	lot				
2I	Fiber Optic Multiplexer Equipment for Communication and Protection						
2I1	Complete set of design, supply, installation and commissioning of Fiber optic multiplexer equipment	1	lot				
2I2	Fibre Optic cable and termination box	1	lot				
2I3	PLC Equipment	0	lot				
2I4	PABX system	1	lot				
2J	Multicore Low Voltage Power & Control Cables						
2J1	Multicore low voltage power and control cables for control, protection, metering, monitoring and LV power circuits	1	lot				
2K	Batteries, chargers & DC distribution						
2K1	110V Ni-cad Batteries with chargers and distribution boards						
2K1.1	110V Ni-cad Batteries, 400Ah @ 5h	2	sets				
2K1.2	Battery chargers	2	sets				
2K1.3	DC Distribution Board	2	sets				
2K1.4	3kVA, 240V, 50Hz UPS powered from 110V DC distribution board & AC distribution board for Substation Automation System	2	sets				
2K1.5	Insulation Monitoring system for complete DC system	2	sets				
2K2	48V Ni-cad Batteries with chargers and distribution board						
2K2.1	48V Ni-cad Batteries, 200Ah @ 5h	2	sets				
2K2.2	Battery chargers	2	sets				
2K2.3	DC Distribution Board	1	sets				
2K2.4	Insulation Monitoring system for complete DC system	2	sets				
2L	LVAC Distribution						
2L1	LVAC Panels including necessary accessories for substation services	1	lot				
2L2	Tariff meters for LV system	4	Nos				
2L3	Scissor Lift: Battery type for min. two persons. Maximum working high greater than 10m	1	sets				
2L4	Electroscopes for 230kV & 33kV voltage levels (2 sets for each voltage levels)	4	sets				
2L5	Complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 175kVAR automatic power factor correction (PFC) Panel	1	lot				
2L6	Diesel Generator with capacity of 250kW	1	sets				
2M	Civil Works, Building and Foundation						
2M1*	Complete land development						
2M1.1	Complete compacted land development with carried/dredged earthfilling including approach road	115,988	Cubic meter				
2M1.2	Slope protection						
2M1.2.1	Slope (1V:2H) protection with turfing	8,903	sqm				
2M2	Complete design, supply and construction of all civil items required for the outdoor works including but not limited to filling / cutting soil and leveling up to finished level and within property line suitable for 230kV GIS & 33kV AIS switchyards at existing substation.	0	lot				
2M3*	Complete civil items required for outdoor works						
2M3.1	Outdoor gantry foundation 230kV switchyard						
	Gantry column	9	nos.				
2M3.2	Outdoor equipment foundation 230kV switchyard						
	LA	12	nos.				
2M3.3	Outdoor equipment foundation 33kV switchyard						
2M3.3.1	For 33kV incomer-						
2M3.3.1.1	Structure for LA, copper plate, cable termination	4	set**				
2M3.3.1.2	VT	2	set**				
2M3.3.1.3	DS/ES	4	set**				
2M3.3.1.4	CT	2	set**				
2M3.3.1.5	CB	2	set**				
2M3.3.1.6	Marshalling Kiosk	2	set**				
2M3.3.2	For 33kV auxiliary feeder-						

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty.	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
2M3.3.2.1	Structure for LA, copper plate, cable termination	2	set**				
2M3.3.2.2	DS/ES with fuse	2	set**				
2M3.4	Transformer foundation including oil pit for 230/33kV, 120/140MVA Transformer	2	nos.				
2M3.5	Blast wall for 230/33kV, 120/140MVA Transformer	2	nos.				
2M3.6	Transformer foundation for 300kVA auxiliary transformer	2	nos.				
2M3.7	Security boundary wall for overall plant	557	meter				
2M3.8	Substation main gate	2	nos.				
2M3.9	Chain link fencing with gates	309	meter				
2M3.10	Approach road (pavement width 6m)	42	meter				
2M3.11	Internal roads:						
2M3.11.1	6m wide road:	246	meter				
2M3.11.2	4.5m wide road	246	meter				
2M3.11.3	3m wide road	130	meter				
2M3.11.4	1.5m walk way	10	meter				
2M3.12	Cable Trench with soak pit						
2M3.12.1	For control cable of 33kV incomer AIS & 33kV power cable to auxiliary Tx.	190	meter				
2M3.12.2	For .4kV power cable from auxiliary Tx bay to GIS building	8	meter				
2M3.13	Surface drain around the substation	533	meter				
2M3.14	Whole substation surface finishing with drainage system including outlet & a network of water pits connected with pipes throughout the substation (excluding surface drain)	1	lot				
2M3.15	Gravel surfacing & gravel laying	2361	m ²				
2M3.16	Guard house	1	Nos				
2M3.17	Sentry post	2	Nos				
2M3.18	Open store yard including chain link fence, surface drain & gate	1	lot				
2M3.19	RCC box culvert	2	Nos				
2M3.20	Property line demarkation	685	meter				
2M3.21	Septic tank and soakpit	3	Nos				
2M3.22	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion etc.	3	Nos				
2M3.23	Car port	1	Nos				
2M4.1	Complete civil works for 230kV indoor GIS building including protection & metering room, battery room etc. (3 STORIED)						
2M4.1.1	Foundation works	1	lot				
2M4.1.2	Super structures	1	lot				
2M4.1.3	All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, etc.	1	lot				
2M4.1.4	Complete EOT crain system in GIS room (minimum 7 Ton)	1	lot				
2M4.1.5	Elevator system (capacity: minimum 6 people)	1	lot				
2M4.2	Complete civil works for Dormitory cum Indoor Store cum Staff Room (3 STORIED)						
2M4.2.1	Foundation works	1	lot				
2M4.2.2	Super structures	1	lot				
2M4.2.3	All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, etc.	1	lot				
2M4.3	Complete civil works for Ansar Barack including foundations, super structures & all finish works like rendering, painting, water supply, sanitary, floor finish, furniture, etc. (1 STORIED)						
2M5	Complete design, supply and construction of all civil items and facilities required for Water Spray type Fire Protection System for transformers	1	lot				
2M6	Complete design, supply and construction of all civil items and facilities required for Diesel Generator room	1	lot				
2M7	Testing of Foundation on random basis.						
2M7.1	Compression Test of pile	3	Nos				
2M7.2	Uplift Test of pile	1	Nos				
2M8	Fire alarm & fire fighting system for other areas	1	lot				
	* actual payment shall be as per actual work at site						
	** one set includes foundation for three phases of a circuit						
2N	Building Lighting, Small Power, Air Conditioning and Ventilation						
2N1	Complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the substation GIS & Control room buildings, auxiliary & other houses (air cooling system shall be double of the actual requirement).	1	lot				
2N2	Complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of surveillance system with IP cameras, NVRs, optical fibre, cat6 cables, switches, indoor & outdoor cabinets, lightning protection systems, power cables and other accessories to complete surveillance system of the substation						
2N2.1	Bullet camera	24	Nos				
2N2.2	Dome camera	8	Nos				
2N2.3	32 channel NVR	1	Nos				
2N2.4	Access switch	1	lot				
2N2.5	Core switch	1	lot				
2N2.6	32" LED TV	1	Nos				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
2N2.7	Fiber Optic Cable (6 core Single mode, Armored)	1	lot				
2N2.8	CAT6 Network Cable (STP Type)	1	lot				
2N2.9	Power Cable-NYFGBY	1	lot				
2N2.10	uPVC pipes & fittings, Surveillance Cabinet, 22U rack, Offline UPS, poles, MDB, SDB, ethernet LA, SPD & other necessary accessories	1	lot				
2O	Switchyard Lighting						
2O1	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.	1	lot				
2P	Earthing and Lightning Protection						
2P1	Earthing system for the substation	1	lot				
2P2	Lightning protection system for the substation	1	lot				
2P3	portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole	4	sets				
2Q	230kV, 132kV, 33kV cables & associated structures						
2Q1	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 800mm ² , 40kA/ 3 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable (single phase length)	713	meter				
2Q2	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 40kA/ 3 sec, 50Hz, 170/70 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.	12	nos				
2Q3	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of .415kV, 185mm ² , 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, single phase XLPE cable. (single phase length)	476	meter				
2Q4	complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36kV, 31.5kA/ 3 sec, 50Hz, 45/25 kV BIL, appropriate current capacity heat sinkable cable termination kits & associated support structures for single phase XLPE cable.	12	nos				
2R	SCADA system for Telecontrol and Telemetry						
2R1	Complete SCADA hardware & software	1	lot				
	Total of Section-2						
	(Carried to Schedule-5:Grand summary)						
SECTION-III	Mandatory Spares, Erection & Test Equipment						
3.1	Nutan Bidyut PP (245kV)						
3.1.1	245kV Gas Insulated Switchgear						
3.1.1.1	Operating mechanism of Circuit Breaker (1 Nos for each type of offered CB)	1	lot				
3.1.1.2	Operating mechanism of 3 position DS-ES (1 Nos for each type of offered DS-ES)	0	lot				
3.1.1.3	Operating mechanism of FES (1 Nos for each type of offered FES)	1	lot				
3.1.1.4	Operating mechanism of ES (1 Nos for each type of offered ES)	0	lot				
3.1.1.5	Operating mechanism of DS (1 Nos for each type of offered DS)	1	sets				
3.1.1.6	Each type of auxiliary contacts unit	1	sets				
3.1.1.7	Surge arrester (GIS)	0	nos.				
3.1.1.8	Surge arrester (AIS)	3	nos.				
3.1.1.9	Complete Voltage transformer module	1	nos.				
3.1.1.10	Complete Current transformer module	0	nos.				
3.1.1.11	Closing coils	4	nos.				
3.1.1.12	Tripping coils	8	nos.				
3.1.1.13	Motor for circuit breaker operating mechanism	1	nos.				
3.1.1.14	Motor for disconnector drive	1	nos.				
3.1.1.15	Coils for Blocking magnet in disconnector drive	0	nos.				
3.1.1.16	Gas pressure monitor with gauge and pressure switch	3	nos.				
3.1.1.17	Deleted.	0	sets				
3.1.1.18	Pressure Relief Device	1	nos.				
3.1.1.19	Supporting insulator	0	nos.				
3.1.1.20	Barrier insulator or gas tight barrier	0	nos.				
3.1.1.21	Expansion bellows	0	nos.				
3.1.1.22	Rubber gaskets "O" rings and seals for SF6 gas	0	lot				
3.1.1.23	All types of control valves for SF6 gas	0	lot				
3.1.1.24	SF6 gas cylinders - 45 kg	0	nos.				
3.1.2	36kV AIS Switchgears (incomer & auxiliary bay)	Deleted.					
3.1.3	Protection and Control						
3.1.3.1	Protection relay (Line distance protection relay)	1	nos.				
3.1.3.2	Bay unit for bus protection relay	1	nos.				
3.1.3.3	Each type of Tripping relays	1	lot				
3.1.3.4	Each type of Auxiliary relays	3	sets				
3.1.3.5	Each type of Trip circuit supervision relays	1	sets				
3.1.3.6	Bay Control Unit	1	nos				
3.1.3.7	Relay Test Block & socket	2	sets				
3.1.3.8	Each type of Switch (used in SAS)	0	sets				
3.1.3.9	Each type of MCB	1	sets				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
3.1.3.10	Each type of Lamps	5	sets				
3.1.3.11	Heater	5	nos.				
3.1.3.12	Humidity Sensors	5	nos.				
3.1.3.13	Thermostat	5	nos.				
3.1.3.14	Annunciator bulbs	5	nos.				
3.1.3.15	Bulbs for discrepancy switches	5	nos.				
3.1.3.16	Multifunction Meter	2	nos.				
3.1.3.17	Tariff/Energy Meter	1	nos.				
3.1.3.18	Deleted.	0	set				
3.1.4	DC & Charger Equipment (48 v)						
3.1.4.1	Each type of Card (example: control card etc.)	1	nos.				
3.1.4.2	Battery MCB/MCCB	1	nos.				
3.1.4.3	DC board incoming MCCB	1	nos.				
3.1.4.4	Outgoing MCBs	2	nos.				
3.1.4.5	Each type of fuse	1	set				
3.1.5	LVAC Equipment	Deleted.					
3.1.6	Power, Control and Auxiliary Cables						
3.1.6.1	Control Cables, 200m of each type	0	lot				
3.1.6.2	LV cables, 200m of each type	0	lot				
3.1.6.3	Other cables (communication, etc.), 100m of each type	0	lot				
3.1.7	Transformers and Shunt Reactor	Deleted.					
3.1.8	Earthing / Auxiliary Transformer	Deleted.					
3.1.9	Shunt Reactor	Deleted.					
3.1.10	Instruments for Communication & SCADA	Deleted.					
3.1.11	Post Type Insulator						
3.1.11.1	For 245kV	0	nos.				
3.1.12	Gas Insulated Line (GIL)						
3.1.12.1	245kV, 1600A, GIL (with necessary bellow & angle joint)	0	m				
3.1.13	Disc Insulator						
3.1.13.1	Each type of Disc Insulator	0	nos.				
3.1.14	Conductor						
3.1.14.1	TACSR conductor	0	m				
3.1.15	Clamp and Fitting						
3.1.15.1	Each type of Clamps and Fittings (20% of total supplied or min. 3 nos., whichever is higher for each type)	1	lot				
3.1.16	Testing instruments / special tools for operation and maintenance						
3.1.16.1	SF6 Gas Treatment Plant For Gas Filling, Recovery, Evacuation, Filtering, Drying and Storage with necessary accessories	0	sets				
3.1.16.2	SF6 gas cylinder with valve (50kg)	0	sets				
3.1.16.3	Handheld SF6 gas leakage detector (alarm with proportional sound pitch)	0	sets				
3.1.16.4	Infrared type SF6 gas leakage detector (FLIR)	0	sets				
3.1.16.5	SF6 Multi-Analyser for measurement of %SF6, Moisture and SO ₂ concentration	0	sets				
3.1.16.6	Contact resistance measurement test set (suitable for measurement down to 1 µ ohm at 10A d.c.)	0	sets				
3.1.16.7	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)	0	sets				
3.1.16.8	Thermovision Camera (FLIR)	0	sets				
3.2	Char Fasson 230/33kV Substation						
3.2.1	245kV Gas Insulated Switchgear						
3.2.1.1	Operating mechanism of Circuit Breaker (1 Nos for each type of offered CB)	1	lot				
3.2.1.2	Operating mechanism of 3 position DS-ES (1 Nos for each type of offered DS-ES)	1	lot				
3.2.1.3	Operating mechanism of FES (1 Nos for each type of offered FES)	1	lot				
3.2.1.4	Operating mechanism of ES (1 Nos for each type of offered ES)	1	lot				
3.2.1.5	Operating mechanism of DS (1 Nos for each type of offered DS)	0	sets				
3.2.1.6	Each type of auxiliary contacts unit	1	sets				
3.2.1.7	Surge arrester (GIS)	0	nos.				
3.2.1.8	Surge arrester (AIS)	6	nos.				
3.2.1.9	Complete Voltage transformer module	1	nos.				
3.2.1.10	Complete Current transformer module	0	nos.				
3.2.1.11	Closing coils	4	nos.				
3.2.1.12	Tripping coils	8	nos.				
3.2.1.13	Motor for circuit breaker operating mechanism	1	nos.				
3.2.1.14	Motor for disconnector drive	1	nos.				
3.2.1.15	Coils for Blocking magnet in disconnector drive	0	nos.				
3.2.1.16	Gas pressure monitor with gauge and pressure switch	3	nos.				
3.2.1.17	Deleted.	0	sets				
3.2.1.18	Pressure Relief Device	1	nos.				
3.2.1.19	Supporting insulator	0	nos.				
3.2.1.20	Barrier insulator or gas tight barrier	0	nos.				
3.2.1.21	Expansion bellows	0	nos.				
3.2.1.22	Rubber gaskets "O" rings and seals for SF6 gas	0	lot				
3.2.1.23	All types of control valves for SF6 gas	0	lot				
3.2.1.24	SF6 gas cylinders - 45 kg	0	nos.				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty.	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
		(1)		(2)	(3)	(1) X (2)	(1) X (3)
3.2.2	36kV AIS Switchgears (incomer & auxiliary bay)						
3.2.2.1	36kV Circuit Breaker	1	sets				
3.2.2.2	36kV Disconnect Switch	1	sets				
3.2.2.3	36kV Disconnect Switch with Fuse	1	sets				
3.2.2.4	Deleted.	0	nos.				
3.2.2.5	36kV Load Beak Switch with fuse	0	sets				
3.2.2.6	36kV IVT (same as offered type)	3	nos.				
3.2.2.7	36kV Current Transformer (same as offered type)	3	nos.				
3.2.2.8	30kV Surge Arrester	3	nos.				
3.2.2.9	Motor for circuit breaker operating mechanism	1	nos.				
3.2.2.10	Motor for disconnect drive	0	nos.				
3.2.2.11	Closing coils for CB	3	nos.				
3.2.2.12	Tripping coils for CB	6	nos.				
3.2.2.13	Contactors, relays, selector switches, push buttons, counters, heaters, humidity sensors etc., in motor drive mechanism and control cubicle (3 nos. for each type)	1	lot				
3.2.3	Control, Protection, SAS, Metering & DFDR						
3.2.3.1	Protection relay (Line distance & transformer protection relay)	1	nos.				
3.2.3.2	Bay unit for bus protection relay	2	nos.				
3.2.3.3	Each type of Tripping relays	1	lot				
3.2.3.4	Each type of Auxiliary relays	3	sets				
3.2.3.5	Each type of Trip circuit supervision relays	1	sets				
3.2.3.6	Bay Control Unit	1	nos.				
3.2.3.7	Relay Test Block & socket	2	sets				
3.2.3.8	Each type of Switch (used in SAS)	1	sets				
3.2.3.9	Each type of MCB	1	sets				
3.2.3.10	Each type of Lamps	5	sets				
3.2.3.11	Heater	10	nos.				
3.2.3.12	Humidity Sensors	10	nos.				
3.2.3.13	Thermostat	10	nos.				
3.2.3.14	Annunciator bulbs	10	nos.				
3.2.3.15	Bulbs for discrepancy switches	10	nos.				
3.2.3.16	Multifunction Meter	5	nos.				
3.2.3.17	Tariff/Energy Meter	2	nos.				
3.2.3.18	Deleted.	0	set				
3.2.4	DC & Charger Equipment (for both 110v & 48v)						
3.2.4.1	Each type of Card (example: control card etc.)	1	nos.				
3.2.4.2	Battery MCB/MCCB	1	nos.				
3.2.4.3	DC board incoming MCCB	1	nos.				
3.2.4.4	Outgoing MCBs	5	nos.				
3.2.4.5	Each type of fuse	1	set				
3.2.5	LVAC Equipment						
3.2.5.1	3-phase set LVAC board incoming ACB/MCCB	1	nos.				
3.2.5.2	3-phase sets outgoing MCCBs	5	nos.				
3.2.5.3	1-phase sets outgoing MCBs	12	nos.				
3.2.6	Power, Control and Auxiliary Cables						
3.2.6.1	Power Cables (36kV), 300m of each type	0	lot				
3.2.6.2	Control Cables, 200m of each type	0	lot				
3.2.6.3	LV cables, 200m of each type	0	lot				
3.2.6.4	Other cables (communication, etc.), 100m of each type	0	lot				
3.2.7	Transformers						
3.2.7.1	Transformer						
3.2.7.2	245kV bushings	2	nos				
3.2.7.3	Neutral Bushing	1	nos				
3.2.7.4	36kV Bushing	1	nos				
3.2.7.5	Set of gaskets	1	set				
3.2.7.6	Complete WTI	1	set				
3.2.7.7	Complete OTI	1	set				
3.2.7.8	Set of Silica gel breather	0	nos				
3.2.7.9	Buchholz relay	1	nos				
3.2.7.10	Set of tap changer diverter switch	0	nos				
3.2.7.11	Tap changer control mechanism motor	1	nos				
3.2.7.12	Transformer oil 200 litter barrel	20	nos.				
3.2.7.13	Water Spray Fire Protection System for Transformers						
3.2.7.13.1	Water spray nozzles	0	nos				
3.2.7.13.2	Relase sprinklers	0	nos				
3.2.7.13.3	Set of internal parts of deluge valve	0	set				
3.2.7.13.4	Set of sealings for deluge valves of each type	0	set				
3.2.7.13.5	Set of sealings for pipes and flanges	0	set				
3.2.7.13.6	Set of spare parts for jockey pump	0	set				
3.2.7.13.7	Set of spare parts for control panel & automatic level indicator	0	set				
3.2.7.13.8	Set of spare parts for air supply and reducing devices	0	set				
3.2.7.13.9	Fire fighting pump complete with coupling	0	set				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
3.2.8	Earthing / Auxiliary Transformer						
3.2.8.1	Set of gaskets	1	no.				
3.2.8.2	Complete OTI including gaskets & thermometers	1	set				
3.2.8.3	Set of Silica gel breather	1	no.				
3.2.8.4	Buchholz relay	0	no.				
3.2.8.5	Transformer oil 200 litter barrel	0	nos.				
3.2.9	Shunt Reactor						
	Deleted.						
3.2.10	Instruments for Communication & SCADA						
3.2.10.1	Set of spare modules of necessary function	0	lot				
3.2.10.2	Digital data (Communication) analyzer	0	lot				
3.2.10.3	Generator and Receiver for the following interfaces: (1) V.24/RS232 SYNC AND ASYNC (2) V.35 (3) G.703 CO-DIR AND 2048kbps and 704kbps (4) Bit Error rate measuring facility	0	lot				
3.2.10.4	Digital selective level meter (50Hz to 600kHz) plus level generator (50Hz to 2MHz)	0	lot				
3.2.10.5	Subscriber Module for DCS 255 Exchange	0	lot				
3.2.10.6	Industrial PC	0	set				
3.2.10.7	Desktop PC for Substation incharge. Min. Spec: i7 latest gen processor, 16 GB RAM, 512 GB SSD, 24" 1080p IPS LED Monitor, 1500VA UPS, Multifunction B/W printer/scanner with ADF, keyboard, mouse, etc.	0	set				
3.2.10.8	Gateway Terminal	0	set				
3.2.10.9	Bay Ethernet Switches	0	nos.				
3.2.10.10	Optical connectors (one for each)	0	lot				
3.2.11	Post Type Insulator						
3.2.11.1	For 420kV	0	nos.				
3.2.11.2	For 245kV	0	nos.				
3.2.11.3	For 36kV	0	nos.				
3.2.12	Gas Insulated Line (GIL)						
3.2.12.1	245kV, 3150A, GIL (with necessary bellow & angle joint)	0	m				
3.2.13	Disc Insulator						
3.2.13.1	Each type of Disc Insulator	0	nos.				
3.2.14	Conductor						
3.2.14.1	TACSR conductor	0	m				
3.2.15	Clamp and Fitting						
3.2.15.1	Each type of Clamps and Fittings (20% of total supplied or min. 3 nos., whichever is higher for each type)	1	lot				
3.2.16	Surveillance system						
3.2.16.1	Bullet camera	5	Nos				
3.2.16.2	Dome camera	3	Nos				
3.2.16.3	Access switch	3	Nos				
3.2.16.4	Ethernet lightning arrester	10	Nos				
3.2.16.5	Sfp modules	0	Nos				
3.2.16.6	SPD type 1	2	Nos				
3.2.16.7	SPD type 2	2	Nos				
3.2.17	Testing instruments / special tools for operation and maintenance						
3.2.17.1	SF6 Gas Treatment Plant For Gas Filling, Recovery, Evacuation, Filtering, Drying and Storage with necessary accessories (DILO)	1	sets				
3.2.17.2	SF6 gas cylinder with valve (50kg)	2	Nos				
3.2.17.3	Handheld SF6 gas leakage detector (alarm with proportional sound pitch)	1	sets				
3.2.17.4	Infrared type SF6 gas leakage detector (FLIR)	1	sets				
3.2.17.5	Dew point Meter (DILO)	0	sets				
3.2.17.6	SF6 Multi-Analyser for measurement of %SF6, Moisture and SO ₂ concentration	0	sets				
3.2.17.7	Contact resistance measurement test set (suitable for measurement down to 1 μ ohm at 10A d.c.)	1	sets				
3.2.17.8	5kV insulation resistance test set (range 0.5 –1.0 - 2.5 - 5 kV)	1	sets				
3.2.17.9	Thermovision Camera (FLIR)	1	sets				
3.2.17.10	Oil Insulation Tester (Breakdown voltage)	1	sets				
3.2.17.12	Multimeter (Fluke/Megger)	0	Nos				
3.2.17.13	Clamp mA meter (both AC & DC)	0	Nos				
3.2.17.14	Portable LA leakage current meter (3rd harmonic)	0	Nos				
3.2.18	General tools for maintenance work						
3.2.18.1	Set of General Tools	0	sets				
3.2.19	Heavy duty equipment / tools maintenance work						
3.2.19.1	Set of Heavy duty equipment / tools	0	sets				
3.2.20	Other equipment / tools						
3.2.20.1	Set of other equipment / tools	0	sets				
3.2.21	General equipment						
3.2.21.1	Desktop PC for Substation incharge. Min. Spec: i7 latest gen processor, 16 GB RAM, 1 TB SSD, 24" 1080p IPS LED Monitor, 1500VA UPS, Multifunction B/W printer/scanner with ADF, keyboard, mouse, etc.	1	set				

Schedules of Rates and Prices							
Schedule No. 4. Installation and Other Services							
Item	Description	Qty. (1)	Unit	Unit Price ¹		Total Price ¹	
				Foreign currency portion	Local currency portion	Foreign currency portion	Local currency portion
				(2)	(3)	(1) X (2)	(1) X (3)
	Total of Section-3						
	(Carried to Schedule-5:Grand summary)						
SECTION-IV	Additional Services						
	FAT and Training (Provisional Sum)*						
4.1	International Training Employer's Engineer	0	Lot			-	
4.2	FAT witness Employer's Engineer	1	Lot	29,100.00		29,100.00	
4.3	Local Training Employer's Engineer	1	Lot	52,750.00		52,750.00	
	Total of Section-4						
	(Carried to Schedule-5:Grand summary)						
	<i>*These costs are fixed ceiling and will be included in total price. But the payment shall be at actual.</i>						
TOTAL OF SCHEDULE NO.4 (To be indicated in Schedule No.5 Ground Summary)							

Name of Bidder

Signature of Bidder

Notes:Due to decrease or increase of any quantity mentioned above in unit "sets, nos., m, m², m³, liter, kg " during execution stage, the payment shall be at actual basis.

"- " Dash means included

¹Specify currency in accordance with Bid Data Sheet 19.1

Schedules of Rates and Prices			
Schedule 5: Grand Summary			
Schedule No	Description	Total Price	
		Foreign Currency (in.....)	Local Currency (in BDT)
Section-1: Bay extension at 230kv indoor GIS Substation at Nutan Bidyut Power Plant in Borhanuddin			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-1			
Section-2: Char Fasson 230/33kV indoor Gas Insulated Substation			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
Total of Section-2			
Section-3: Mandatory Spares, Tools, Erection & Test Equipment			
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Total of Section-3			
Section-4: FAT and Training			
Schedule No. 4:	Installation and Other Services	USD 81,850	
Total of Section-4		USD 81,850	
GRAND TOTAL (Schedule No.1 to Schedule No.4 (to Letter of Price Bid)			

Name of Bidder

Signature of Bidder

Schedule B6: Recommended Spare Parts

[illegible]

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

SCHEDULE C

COMPLETION TIME SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power Plant on turnkey basis

SCHEDULE C

TIMES FOR DELIVERY AND COMPLETION

The individual dates are all contractually binding.

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

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

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

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

Site	A* Latest Access Permitted	B* Guaranteed Arrival of first shipment	C* Guaranteed Completion	D* Target Completion
Bhola	7 days from the contract effective date		24(Twenty four Months)	

* Time in days, from contract effective date.

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

: Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS Substation at Char Fasson & 230kV GIS Bay
Extension at Nutan Bidyut Power Plant on turnkey basis

SCHEDULE C-1(Substation Part)
BAR CHART PROGRAMME OF KEY ACTIVITIES

	Time Period in month																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Equipment Design																								
Drawings of single line diagram																								
Drawings of 230kV, 33kV Switchgear Layout																								
Drawings of 230/33kV Power Transformer																								
Manufacture of 230kV & 33kV Switchgear																								
Manufacture of 230/33kV Power Transformer																								
Manufacture of Control, Protection, and Metering System																								
Factory Acceptance Test																								
Delivery of equipment to site																								
Building & Foundation Design																								
Calculation/Drawings of gantry structures and equipment supports																								
Calculation /Drawings of GIS/control building																								
Calculation /Drawings of earthing System																								
Construction and Installation Works																								
Site Survey																								
Geo-technical survey																								
Switchyard																								
- Piling																								
- Foundation works incl. earthing																								
- Cable trenches																								
- Gantry and equipment support installation																								
switchgear equipment installation																								
Transformer installation																								
- GIS, and other AIS Installation																								
Construction of Control Building/GIS Bulding																								
Cable laying & Termination																								
Installation of LVAC & DC system																								
Installation of Indoor equipment (Control, protection, metering,SAS etc.)																								
Testing & Commissioning																								

Note: Time to complete the plant and services from the effective date is 24(twenty four) months.

Schedule D: Manufacturers, Places of Manufacture and Testing

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

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

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

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

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

Manufacturers

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

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

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
xiii.	PRD				
xiv.	Oil Valve				
xv.	Silica Gel				
xvi.	Gas/Oil actuated relay				
xvii.	AVR				
xviii.	Indicating Instruments				
xix.	Cooler control Equipment				
xx.	Remote control panel				
xxi.	Magnetic Shunt				
xxii.	Clamp				
xxiii.	Buchholz Relay				
xxiv.	Membrane				
1.2	Power transformer 132/33 kV (Out of scope)				
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,				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
	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 300kVA, 33/0.415 kV				
2. Shunt/Bus Reactor (out of scope)					
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				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
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 (Out of scope)					
3.1	400kV GIS				
	GIS 400 kV Complete				
	Enclosure				
	SF ₆				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				
	Disconnecter				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				
3.2	400kV AIS				
3.2.1	Circuit breakers 400 kV				
	Drive Mechanism				
	Interrupter Chamber				
	Insulator				
3.2.2	Disconnectors 400 kV				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
	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				
	Disconnecter				
	Earth Switch				
	High Speed Earth Switch				
	Current Transformer				
	Voltage transformer				
	Surge Arrester				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
4.2	230kV AIS				
4.2.1	Circuit breakers 230 kV	NA	NA	NA	NA
	Drive Mechanism	NA	NA	NA	NA
	Interrupter Chamber	NA	NA	NA	NA
	Insulator	NA	NA	NA	NA
4.2.2	Disconnecter 230 kV	NA	NA	NA	NA
	Drive Mechanism	NA	NA	NA	NA
	Male-Female Contact	NA	NA	NA	NA
	Insulator	NA	NA	NA	NA
4.2.3	Current transformers 230 kV	NA	NA	NA	NA
	Core	NA	NA	NA	NA
	Winding	NA	NA	NA	NA
	Insulator	NA	NA	NA	NA
4.2.4	Voltage transformers 230 kV	NA	NA	NA	NA
	Core	NA	NA	NA	NA
	Winding	NA	NA	NA	NA
	Insulator	NA	NA	NA	NA
4.2.5	Surge arresters 230 kV				
	ZnO Resistor Block				
	Housing				
	Surge Counter				
5. 145 kV Equipment (out of scope)					
5.1	132kV GIS				
	GIS 132 kV Complete				
	Enclosure				
	SF ₆				
	Support Insulator				
	Barrier Insulator				
	Pressure Monitor				
	Circuit breaker				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
	Disconnecter				
	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				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
	kV				
6.2	Disconnectors 33 kV				
6.3	Current transformers 33 kV				
6.4	Voltage transformers 33 kV				
6.5	Surge arresters 33 kV				
7.Control, Protection, and Metering Equipment					
7.1	Control & monitoring equipment				
7.2	Relay protection equipment				
7.3.	Control & protection panels				
7.4.	Metering equipment				
7.5.	Metering panels				
7.6	Auxiliary Switches				
7.7.	Auxiliary Relays				
7.8.	Trip Relays				
7.9.	TCS Relays				
7.10.	Relay Test Block				
7.12	Humidity Sensor				
8. Substation Automation System					
8.1	Bay Control Unit				
8.2	Industrial Server				
8.3	Server Processor				
8.4	Firewall				
8.5	Gateway Server				
8.6	GPS system				
8.7	Ethernet Switch				
8.8	Modem				
8.9	LCD Monitor				
8.10	Monitor & Keyboard				
8.11	Printer				
8.12	55" LCD Monitor				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
8.13	Cables (FO, EC,CC)				
9.Digital Fault & Disturbance Recorder					
9.1	Control Card				
9.2	Data Acquisition material				
9.3	Panel				
9.4	Processor				
9.5	Copper cable				
9.6	Fibre optic Cable				
9.7	Engineering PC				
10.Telecommunication Equipment					
10.1	Communication equipment				
10.2	Multiplexer				
10.3	Fibre Optic cable				
10.4	PLC Communication	NA	NA	NA	NA
10.5	Complete				
10.6	Panel				
10.7	Line matching Unit	NA	NA	NA	NA
10.8	Surge arrester	NA	NA	NA	NA
10.9	Wave Trap	NA	NA	NA	NA
11. XLPE Cable & Cable Termination Kit & Cable Trays					
XLPE Cable					
11.1	400kV	NA	NA	NA	NA
11.2	230kV	NA	NA	NA	NA
11.3	132kV	NA	NA	NA	NA
11.4	33kV				
Cable Sealing End/ Cable Termination Kit (AIS)					
11.5	400kV	NA	NA	NA	NA
11.6	230kV	NA	NA	NA	NA
11.7	132kV	NA	NA	NA	NA
11.8	33kV				
Cable Sealing End/ Cable Termination Kit (GIS)					
11.9	400kV	NA	NA	NA	NA
11.10	230kV	NA	NA	NA	NA

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
11.11	132kV	NA	NA	NA	NA
11.12	33kV	NA	NA	NA	NA
11.13	Cable Trays for Power Cables				
12.Auxiliary Power Supply Equipment					
12.1	Battery				
12.2	Charger				
12.3	DC distribution Panel & Switchboard				
12.4	AC distribution Panel & Switchboard				
12.5	Inverter				
13.Conductors, Insulators & Fittings					
13.1	Conductors				
	Tubular Conductor				
	Flexible Conductor				
13.2	Insulators				
	Post Insulator				
	Disk Insulator				
13.3	Fittings, Clamps & connectors				
14. Earthing & Lightning					
14.1	Copper Conductor				
14.2	Insulated Copper Conductor				
14.3	Earthing Wire				
15. Multicore LV Auxiliary Power and Control Cables					
15.1	LV Cables				
15.2	Cable Trays				
Name of Bidder:					
Signature of Bidder:					

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS Substation
at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power Plant on turnkey
basis**

SCHEDULE E

TECHNICAL PARTICULARS AND GUARANTEES

Schedule E: Guaranteed Technical Particular (GTP)

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

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

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

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

Note:

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

Schedule-E: GIS

GTP & Requirement Form: GIS Switchgear

For Bay Extension of existing 230kV GIS at Nutan Bidyut PP at Burhanuddin, Bhola &
New 230/33kV Indoor GIS Substation at Char Fasson, Bhola

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
1.	GIS Switchgear 230 kV – General & Electrical					
1.1.	Manufacturer		Insert	Insert		
1.2	Country of origin		Insert	Insert		
1.3	Type: - GIS type - Type of busbars - Model designation	- - -	Indoor One & half breaker, passive Insert	Indoor Double, passive Insert		
1.4	Enclosure: -Bus bar -Bay -Enclosure material		[Single Phase, As per existing system] [Single Phase, As per existing system] Insert	Three Phase Single Phase Insert		
1.5	Nominal system voltage	kV _{rms}	230	230		
1.6	Highest voltage for equipment U _n	kV _{rms}	245	245		
1.7	Rated lightning impulse withstand voltage - phase to earth - phase to phase - across open isolator - across open gap c.b.	kV _{peak}	1050 Insert Insert Insert Insert	1050 Insert Insert Insert Insert		
1.8	Rated short duration power frequency voltage (rms value for 1 minute) - phase to earth - phase to phase - across open isolator - across open gap c.b	kV _{rms}	460 Insert Insert Insert Insert	460 Insert Insert Insert Insert		
1.9	Rated frequency f _r	Hz	50	50		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
1.10	Rated current I_r • Busbars • Line bay • Transformer bay • Bus Coupler Bay • Bus Section Bay	A A A A A	1600 A for the new diameter (one & half busbar)	[As per SLD & Schedule A of Volume 3]		
1.11	Rated short-circuit breaking current I_{sc}	kA _{rms}	≥ 40	≥ 40		
1.12	Duration of short-circuit	s	≥ 3	≥ 3		
1.13	Rated peak withstand current I_p (equal short- circuit making current)	kA _p	≥ 100	≥ 100		
1.14	Standard	-	IEC	IEC		
2	Solid Insulator					
2.1	Type of Solid Insulator		Disc type	Disc type		
2.2	Material of Solid Insulator		Epoxy cast resin	Epoxy cast resin		
2.3	Discharge level at 110% of the rated voltage	pc	10	10		
2.4	Gas tight disc type insulator - Bursting pressure - Routine test pressure	Bar Bar	Insert Insert	Insert Insert		
3	Insulation Medium					
3.1	Insulation Medium		SF ₆	SF ₆		
3.2	Max. Permissible moisture content - For circuit breaker - For other compartments	ppm ppm	≤300 ≤700	≤300 ≤700		
3.3	Max. Permissible air content	Vol %	5	5		
4	Gas Compartments					
4.1	No. of gas compartment per feeder	pcs.	Insert	Insert		
4.2	Max. Gas losses per gas compartment per year	pc	< 0.1	< 0.1		
4.3	Min operating period to 1 recharge of SF ₆ gas	Years	10	10		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
4.4	Material of filter employed for moisture absorption		Al ₂ O ₃	Al ₂ O ₃		
4.5	SF6 filling pressure at 20°C ambient temp. Min. SF6 service pressure at 40°C ambient temp. Min. SF6 service pressure at 25°C ambient temp.	Bar	Insert	Insert		
		Bar	Insert	Insert		
		Bar	Insert	Insert		
4.6	Type of gas monitoring Signal: "Loss of SF6 Gas" at 20°C ambient temp. Signal: "Min. SF6 Density" at 20°C ambient temp.		Density Monitor	Density Monitor		
			Insert	Insert		
			Insert	Insert		
4.7	Type of pressure relief device		Rupturing diaphragm	Rupturing diaphragm		
4.8	Material of pressure relief device		Stainless steel	Stainless steel		
4.9	Setting of pressure relief device		Insert	Insert		
5	Enclosure					
5.1	Temperature rise of enclosure at rated current - which have to be touched during operation - which need not to be touched during operation - which are not accessible to the operator	°C	Max. 30	Max. 30		
		°C	Max. 40	Max. 40		
		°C	Max. 55	Max. 55		
5.2	Mechanical strength of enclosure - Design pressure - Min. bursting pressure	bar	Insert	Insert		
		bar	Insert	Insert		
6.	Circuit Breaker					
6.1	Type of circuit breaker		GIS, Indoor	GIS, Indoor		

Schedule-E: GIS

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
6.2	Isolating and quenching medium		SF ₆	SF ₆		
6.3	Enclosure		[As per existing system]	Single Phase		
6.4	Enclosure Material		Insert	Insert		
6.5	Material of Contacts		Silver plated copper	Silver plated copper		
6.6	Design		Single breaking	Single breaking		
6.7	Operating mechanism -for closing -for opening		Spring Motor charged Spring Motor charged	Spring Motor charged Spring Motor charged		
6.8	Number of poles	pcs.	3	3		
6.9	No. of breaks per phase	pcs	1	1		
6.11	Number of operating mechanisms per circuit breaker: For double busbar: • Line bay CB • Transformer bay CB • Bus Coupler Bay CB • Bus section bay CB For one & half busbar: • Bus 1 CB • Tie CB • Bus 2 CB	pcs. pcs. pcs. pcs. pcs. pcs. pcs. pcs.	N/A N/A N/A N/A 3 1 3	3 1 1 1 N/A N/A N/A		
6.12	D.C. component of the rated short-circuit breaking current	%	> 30	> 30		
6.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	O-0.3 s-CO-3 min-CO		
6.13.1	Rated continuous current (at 40°C ambient temperature) I _r • Line feeder • Bus coupler • Bus section • Transformer feeder • Transformer incomer feeder • 33kV outgoing feeder	A A A A A A	[As per SLD & Schedule A of Volume 3]	[As per SLD & Schedule A of Volume 3]		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
6.14	Rated short time breaking current (for 3 sec)	kA	40	40		
6.15	Rated short time making current	kA	100	100		
6.16	Rated peak withstand current	kA	100	100		
6.17	Auto reclosing For double busbar: - Line bay CB - Transformer bay CB - Bus coupler bay CB - Bus section bay CB For one & half busbar: - Bus 1 CB - Tie CB - Bus 2 CB		N/A N/A N/A N/A 1p+3p N/A 1p+3p	1p+3p N/A N/A N/A N/A N/A N/A		
6.18	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	≤ 60		
6.19	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	20 ± 5		
6.20	Total opening time (max)	ms	Insert	Insert		
6.21	Total dead time (max)	ms	≤ 300	≤ 300		
6.22	Total closing time (max)	ms	≤ 90	≤ 90		
6.23	Restrike performance during capacitive current switching	Class	C2	C2		
6.24	Number of operations without maintenance - CO at no-load - CO at rated current - CO at rated breaking current Isc		≥ 10000 ≥ 2500 insert	≥ 10000 ≥ 2500 insert		
6.25	The frequency of mechanical operations	Class	M2	M2		
6.26	Rated electrical endurance	Class	E2	E2		
6.27	Making coil - number per operating mechanism - rated power each	Pcs W	1 Insert	1 Insert		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
6.28	Tripping coil - number per operating mechanism - rated power each - voltage tolerances	pcs. W %	2 Insert -30 / +10	2 Insert -30 / +10		
6.29	Minimum number of available contacts (NO/NC/wiping)		12NO+12NC+2	12NO+12NC+2		
6.30	Accessories in central control panel					
6.30.1	Anti-pumping relay		Yes	Yes		
6.30.2	Local/remote control selector switch		Yes	Yes		
6.30.3	Local operation push buttons		Yes	Yes		
6.30.4	Minimum pressure lock-out and alarm relays		Yes	Yes		
6.30.5	Operation counter		Yes	Yes		
6.31	First-pole-to-clear-factor		1.5	1.5		
6.32	Rated breaking current, small capacitive currents - Line charging - Cable charging - Capacitor bank	A A A	250 160 160	250 160 160		
6.33	Rated breaking current, small inductive currents - Unloaded transformers - Transformer loaded with reactor - Shunt reactors	A A A	25 >200 >250	25 >200 >250		
6.34	Switching overvoltage	p.u.	2.5	2.5		
6.35	Rated motor voltage	V d.c.	220	110		
6.36	Rated motor power	W	Insert	Insert		
7.	Disconnecter without earth switch					
7.1	Type		GIS, Indoor	N/A, as per SLD & Schedule A of volume 3		
7.2	Enclosure		[As per existing system]	N/A		
7.3	Enclosure Material		Insert	N/A		
7.4	Material of Contacts		Silver plated copper	N/A		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
7.5	Gas quantity (3-phase) for disconnecter	kg	Insert	N/A		
7.6	Type of disconnecter - Three poles, motor operated - Three pole, make-proof, motor operated earthing switch - Three pole, disconnecter link, hand operated		Yes No No	N/A		
7.7	Number of poles	pcs.	3	N/A		
7.8	Number of operating mechanisms	pcs.	1	N/A		
7.9	Type of operating mechanism - Three poles, motor operated - Three poles, make-proof - Disconnecter Link		Motor driven N/A N/A	N/A		
7.10	No. of breaks in series (per phase)	pcs.	1	N/A		
7.11	Rated breaking current (capacitive)	A	Insert	N/A		
7.11.1	Rated continuous current (at 40°C ambient temperature) I _r - Line feeder - Transformer incomer feeder 33kV outgoing feeder	A A A	[As per SLD & Schedule A of Volume 3]	N/A		
7.12	Operating mechanism - for closing - for opening		Motor Motor	N/A		
7.13	Max. operating time - for closing - for opening	sec sec	Insert Insert	N/A		
7.14	Auxiliary contacts number (NC/NO/wiping)	pcs.	12 / 12 / 2	N/A		
7.15	Rated motor voltage	V d.c.	220	N/A		
7.16	Rated motor power	W	Insert	N/A		
7.17	Hand operating facilities		Yes	N/A		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
8.	Disconnecter with Earth switch					
8.1	Type		N/A, as per existing system	GIS, Indoor		
8.2	Enclosure		N/A	Single Phase		
8.3	Enclosure Material		N/A	Insert		
8.4	Material of Contacts - Disconnecter - Earth Switch		N/A	Silver plated copper Insert		
8.5	Gas quantity (3-phase) for disconnector with earth switch	kg	N/A	Insert		
8.6	Type of disconnector - Three poles, three position (close/open/earthed), motor operated, insulated, with earthing switch - Three pole, make-proof, motor operated earthing switch - Three pole, disconnector link, hand operated		N/A	Yes No No		
8.7	Number of poles	pcs.	N/A	3		
8.8	Number of operating mechanisms	pcs.	N/A	1		
8.9	Type of operating mechanism - Three poles, three positions - Three poles, make-proof - Disconnecter Link		N/A	Motor driven N/A N/A		
8.10	No. of breaks in series (per phase)	pcs.	N/A	1		
8.11	Rated breaking current for DS (capacitive)	A	N/A	Insert		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
8.11.1	Rated continuous current of DS (at 40°C ambient temperature) I_r - Line feeder - Bus coupler - Bus section - Transformer feeder - Transformer incomer feeder 33kV outgoing feeder	A A A A A A	N/A	[As per SLD & Schedule A of Volume 3]		
8.12	Operating mechanism - for closing - for opening		N/A	Motor Motor		
8.13	Max. operating time for DS - for closing - for opening	sec sec	N/A	Insert Insert		
8.13	Max. operating time for ES - for closing - for opening	sec sec	N/A	Insert Insert		
8.14	Auxiliary contacts number - DS (NC/NO/wiping) - ES (NC/NO)	pcs. pcs	N/A	12 / 12 / 2 6 / 6		
8.15	Rated motor voltage	V d.c.	N/A	110		
8.16	Rated motor power	W	N/A	Insert		
8.17	Hand operating facilities		N/A	Yes		
9	Maintenance earthing switch					
9.1	Design		N/A	GIS, Indoor, three phase gang operation		
9.2	Enclosure		N/A	Single Phase		
9.3	Enclosure Material		N/A	Insert		
9.4	Gas quantity (3-phase) for earthing switch	kg	N/A	Insert		
9.5	Operating mechanism - for closing - for opening		N/A	Motor Motor		
9.6	Max. operating time - for closing - for opening	sec sec	N/A	Insert Insert		
9.7	Auxiliary contacts number (NC / NO)	pcs.	N/A	6 / 6		
9.8	Rated motor voltage	V d.c.	N/A	110		
9.9	Rated motor power	W	N/A	Insert		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
9.10	Hand operating facilities		N/A	Yes		
10	High speed earthing switch					
10.1	Design		GIS, Indoor, three phase gang operation	GIS, Indoor, three phase gang operation		
10.2	Enclosure		As per existing system	Single phase		
10.3	Enclosure Material		Insert	Insert		
10.4	Gas quantity (3-phase) for earthing switching	kg	Insert	Insert		
10.5	Rated short circuit making current	kA	Insert	Insert		
	Rated capacitive breaking current (at 6 kV eff.)	A	Insert	Insert		
	Rated inductive breaking current (at 10 kV eff.)	A	Insert	Insert		
10.6	Operating mechanism - for closing - for opening		Spring Motor charged Spring Motor charged	Spring Motor charged Spring Motor charged		
10.7	Max. charging time	sec	Insert	Insert		
10.8	Max. operating time					
	- for closing - for opening	ms ms	Insert Insert	Insert Insert		
10.9	Auxiliary contacts - number (NC / NO / wiping)	pcs.	6 / 6 / 2	6 / 6 / 2		
10.10	Rated motor voltage	V d.c.	220	110		
10.11	Rated motor power	W	Insert	Insert		
10.12	Hand operating facilities		Yes	Yes		
10.13	Insulated / Non-insulated		[Both, as per existing system]	Insert		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
11.	Current Transformer					
11.1	Type		GIS, Indoor	GIS, Indoor		
	Characteristics of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design, which will be subject of the PGCB's approval		Yes	Yes		
11.2	Rated continuous thermal current (40°C): - I core - II core - III core - IV core - V core - V I core	% In % In % In % In % In % In	120 For protection cores & 200 For metering cores	120 For protection cores & 200 For metering cores		
	Current Transformer Rating: Secondary current, class, burden Line, Transformer feeders, Transformer incomer feeders, outgoing feeders, Bus coupler, Bus section CT Cores: - I core - II core - III core - IV core - V core - V I core	A/A, CL, VA	(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)		
11.3	Security factor metering core		Fs = 5	Fs = 5		
12.	Voltage Transformer					
12.1	Type		GIS, Indoor	GIS, Indoor		
12.2	Rated primary voltage	kV	230/√3	230/√3		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
12.3	Voltage Transformer Rating: Secondary voltage, class, burden Line, Transformer feeders, Transformer incomer feeders, outgoing feeders, VT Cores: - I core - II core - III core - IV core	V/V, CL, VA	(VT type, number, ratio, burden & class of VT cores shall be as per SLD & Schedule A of Volume 3. All VT parameters shall be finalized by calculation during the execution stage)	(VT type, number, ratio, burden & class of VT cores shall be as per SLD & Schedule A of Volume 3. All VT parameters shall be finalized by calculation during the execution stage)		
12.4	Load		Simultaneously	Simultaneously		
13	Surge Arresters					
13.1	Type		N/A	GIS, Indoor		
	Quantity, Position & Characteristic of Surge Arresters are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design, which will be subject of the PGCB's approval		N/A	Yes		
13.2	Rated voltage of surge arrester U_r	kV _{rms}	N/A	216 (Shall be finalized by calculation)		
13.3	Max. continuous operating voltage U_c	kV _{rms}	N/A	186 (Shall be finalized by calculation)		
13.4	Nominal discharge current I_n (8/20 μ s)	kA _{peak}	N/A	10		
13.5	High current impulse of an arrester (4/10 μ s)	kA _{peak}	N/A	100		
13.6	Line discharge class	Class	N/A	3		
13.7	Energy dissipation capacity (per kV of rated voltage)	kJ/ kV	N/A	≥ 6.5		

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
13.8	Long duration current impulse (2000 μ s)	A	N/A	Insert		
13.9	Maximum residual voltage U_{res}					
	For switching impulse current 30/60 μ s at 0,5 kA	kV _{peak}	N/A	Insert		
	For switching impulse current 30/60 μ s at 1 kA	kV _{peak}	N/A	Insert		
	For switching impulse current 30/60 μ s at 2 kA	kV _{peak}	N/A	Insert		
	For lightning impulse current 8/20 μ s at 5 kA	kV _{peak}	N/A	Insert		
	For lightning impulse current 8/20 μ s at 10 kA	kV _{peak}	N/A	Insert		
	For lightning impulse current 8/20 μ s at 20 kA	kV _{peak}	N/A	Insert		
14	Site Condition					
14.1	Max. altitude above sea level	m	not more than 1000	not more than 1000		
14.2	Max. ambient temperature, outdoor	°C	+45	+45		
14.3	Min. ambient temperature, indoor	°C	+4	+4		
14.4	Max. ambient relative humidity	%	100	100		
14.5	Max. seismic accelertion at floor level	g	0.2	0.2		
	- horizontal	g	0.2	0.2		
	- vertical					
15	Secondary circuits					
15.1	Auxiliary voltages:					
	- for controlling and signalling	V d.c.	220	110		
	- for remote control	V d.c.	220	110		
	- for heating	V a.c.	415 /240, 50Hz	415 /240, 50Hz		
	- tolerance	%	-15 / +10	-15 / +10		
16	Connection (Connection type shall be GIB or Cable connection. Detail will be finalized during execution as per design requirement)					

No.	Description	Unit	Minimum Requirements		Guaranteed By bidder	
			Data		Data	
			230kV (Nutan Bidyut)	230kV (Char Fasson)	230kV (Nutan Bidyut)	230kV (Char Fasson)
16.1	Type: GIB - Gas Insulated Busbars, Indoor		Yes	Yes		
16.2	Type: Single phase or Three phase, according to the design		Yes	Yes		
16.3	Insulator, Single phase, SF6 / Air		Yes	Yes		
16.3.1	Manufacturer of SF6 to Air Bushing		Insert	Insert		
16.3.2	Enclosure		Single Phase, as per existing system	Single Phase		
16.3.3	Enclosure material		Insert	Insert		
16.3.4	Insulating material		Composite/Silicon	Composite/Silicon		
16.3.5	Minimum creepage distance	mm/ kV	≥ 31 mm/ kV	≥ 25 mm/ kV		
16.3.6	Flashover distance	mm	Insert	Insert		
17	Circuit Breaker Control Cubicle					
17.1	Material		Insert	Insert		
17.2	Material thickness	mm	Insert	Insert		
17.3	Dimensions					
	- Depth	mm	Insert	Insert		
	- Width	mm	Insert	Insert		
	- Height	mm	Insert	Insert		
18	Separate Local Control Cubicle					
18.1	Material (Steel)		Yes	Yes		
18.2	Material thickness	mm	Insert	Insert		
18.3	Dimensions					
	- Depth	mm	Insert	Insert		
	- Width	mm	Insert	Insert		
	- Height	mm	Insert	Insert		
18.4	Total weight	kg	Insert	Insert		
19	Maintenance requirement					
19.1	Compliance with maintenance, repair or extension (MRE) and HV testing requirements		[As per existing system]	As per attached MRE & testing scheme		
19.2	Overall compliance with the requirements & detail specification described in Vol-2	Yes/No	Yes	Yes		

1.1.1 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 / SF6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Spring Motor charged	
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	
2.7	Rated short-circuit breaking current Isc	kA rms	≥ 40	
2.8	Rated peak withstand current Ip (equal short-circuit making current)	kA	≥ 100	
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.	1.5 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 3	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		N/A	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
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)	ms	Insert	
	Without current	ms	Insert	
	With 100 % rated breaking current	ms	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)	ms	Insert	
	Without current	ms	Insert	
	100 % making current	ms	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	No.	≥ 10000	
	CO at no-load		≥ 2500	
	CO at rated breaking current I _{sc}		≥ 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 F _{thA}	N	Insert	
2.30.2	Static horizontal force, transversal F _{thB}	N	Insert	
2.30.3	Static vertical force F _{tv}	N	Insert	
2.30.4	Dynamic horizontal force, longitudinal F _{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	Circuit Breaker - Design and Construction			
3.1	Circuit Breaker			
3.1.1	Insulator material		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 100	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
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.	2	
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/wiping)		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	
3.2.20	Minimum m lock-out and alarm relays		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)				

33 kV Disconnecter with Earth Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Disconnecter- General			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Horizontal break, with integrated fuse 10 A	
1.9	Number of poles	pcs.	3	
2.	Disconnecter - 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	As per SLD & Schedule-A of Volume-3	
2.8	Rated short withstand current Ik	kA rms	40	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 100	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.	Disconnecter - Design and Construction			
3.1	Disconnecter			
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 100x100	
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	
3.1.4.5	Pole weight	kg	Insert	
3.1.4.6	Total weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanisms	pcs.	1	
3.2.2	Type -DS -ES		Motor Motor	
3.2.3	Minimum number of available contacts (NO/NC) -DS -ES	pcs.	6NO+6NC 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)			

33 kV Disconnecter with 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	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Horizontal break, with integrated fuse 10 A	
1.9	Number of poles	pcs.	3	
1.10	Type of operating mechanism		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	As per SLD & Schedule-A of Volume-3	
2.8	Rated short withstand current Ik	kA rms	40	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 100	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	Disconnecter - Design and Construction			
3.1	Disconnecter			
3.1.1	Insulator material		Composite/ porcelain	
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 100x100	
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	
3.1.4.5	Pole weight	kg	Insert	
3.1.4.6	Total weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanisms	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	
3.3	Integrated Fuse			
3.3.1	Rated current of fuse	A	10	
3.3.2	Rated short circuit current	kA	Insert	
3.3.3	Rated short circuit current duration	sec	Insert	
3.3.4	Temperature at continuous rated current	°C	Insert	
3.3.5	Max. sustained temperature before breakdown	°C	Insert	
	Overall compliance with the requirements (yes/no)			

Current Transformer 33 kV (AIS)

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, 3 s	kA	40	
2.7	Rated dynamic current Idyn	kA	100	
2.8	Rated continuous thermal current (40°C): I core II core III core IV core	% In % In % In % In	For protection cores 120 For metering cores 200	
2.9	Current Transformer Rating: I core II core III core IV core	A/A, VA, CI A/A, VA, CI A/A, VA, CI A/A, VA, CI	As per SLD & Schedule-A of Volume-3 All CT parameters shall be finalized by calculation during execution	
2.11	Security factor: I core II core III core IV core		Fs=5 Fs=5 Fs=5 Fs=5	
3.	Current Transformers - Design and Construction			
3.1	Insulator material		Porcelain	
3.2	Insulating medium		OIP	
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 $1.2 \cdot U_M / \sqrt{3}$ Test voltage U_M	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 100x100	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	$\varnothing 14$	
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, 3 s	kA	40	
2.7	Rated dynamic current Idyn	kA	100	
2.8	Rated primary voltage	kV	33/√3	
2.9	Voltage Transformer Rating - I winding - II winding	V, VA, CI V, VA, CI	As per SLD & Schedule-A of Volume-3 All VT parameters shall be finalized by calculation during execution	
2.10	Load		Simultaneously	
2.11	Voltage factor	p.u./s	1.2 continuous & 1.5 for 30 sec	
2.12	Rated mechanical strength	Class	Min. Class I	
2.13	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
3.	Voltage Transformers - Design and Construction			
3.1	Insulator material		Porcelain	
3.2	Insulating medium		OIP	
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 $1.2 \cdot U_M / \sqrt{3}$	pC	Max. ≤ 5	
	Test voltage U_M	pC	≤ 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 100x100	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	$\varnothing 14$	
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 U_n	kV rms	36	
2.4	Rated voltage of surge arrester U_r	kV rms	30	
2.5	Max. continuous operating voltage U_c	kV rms	24	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current I_n (8/20 μs)	kA peak	10	
2.10	High current impulse of an arrester (4/10 μs)	kA peak	100	
3.	Surge Arresters - Design and Construction			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 μs)	A	≥ 850	
3.4	Maximum residual voltage U_{res}			
3.4.1	For switching impulse current 30/60 μs at 0,5 kA	kV peak	≤ 65	
3.4.2	For switching impulse current 30/60 μs at 1 kA	kV peak	≤ 67.5	
3.4.3	For switching impulse current 30/60 μs at 2 kA	kV peak	≤ 70	
3.4.4	For lightning impulse current 8/20 μs at 5 kA	kV peak	≤ 75	
3.4.5	For lightning impulse current 8/20 μs at 10 kA	kV peak	≤ 80	
3.4.6	For lightning impulse current 8/20 μs at 20 kA	kV peak	≤ 90	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 μs)	kV	≥ 235	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 105	
3.6.	Mechanical requirements			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
3.8.	Housing insulating material		Composite / ~~porcelain~~	
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~~ 100 x 100	
3.14.3	Number of holes		Min 2	
3.14.4	Distance between holes	Mm	50	
3.14.5	Material suitable for		Al terminal	
	Overall compliance with the requirements (yes/no)			

Surge Arrester 230 kV (AIS)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Surge Arresters - General			
1.1	Manufacturer		Insert	
1.2	Type		SM	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
1.9	Type Test Report Reference		Insert	
2	Surge Arresters - Characteristics			
2.1	Voltage			
2.1.1	Nominal System Voltage	kV rms	230	
2.1.2	Highest voltage for equipment U_m	kV rms	245	
2.1.3	Rated voltage of surge arrester U_r	kV rms	216 (Shall be finalized by calculation)	
2.1.4	Max. continuous operating voltage U_c	kV rms	186 (Shall be finalized by calculation)	
2.1.5	Reference Voltage	KVrms	Insert	
2.1.6	Gap between V_{ref} & MCOV	% of MCOV	Insert	
2.1.7	TOV [Curve to be attached]			
	0.1s	pu [of MCOV]	Insert	
	1s	pu [of MCOV]	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	3s	pu [of MCOV]	Insert	
	10s	pu [of MCOV]	Insert	
2.1.8	Maximum residual voltage Ures			
	For switching impulse current 30/60 μ s at 0,5 kA	kV peak	≤ 390	
	For switching impulse current 30/60 μ s at 1 kA	kV peak	≤ 400	
	For switching impulse current 30/60 μ s at 2 kA	kV peak	≤ 415	
	For lightning impulse current 8/20 μ s at 5 kA	kV peak	≤ 455	
	For lightning impulse current 8/20 μ s at 10 kA	kV peak	≤ 480	
	For lightning impulse current 8/20 μ s at 20 kA	kV peak	≤ 535	
2.1.9	Dielectric endurance of arrester housing			
	Lightning impulse withstand voltage of arrester housing up (1.2/50 μ s)	kV	Insert	
	Power frequency withstand voltage of arrester housing (1 min wet)	kV	Insert	
2.1.10	Arrester Protection Margin/level			
	Lightning Impulse Protection Margin/level		Min 2.2	
	Switching Impulse Protection Margin/level		Min 1.5	
	steep current impulse protection Margin/level		Min 2.0	
2.2	Current			
2.2.1	Reference Current	mA	Insert	
2.2.2	Long duration current impulse (2000 μ s)	A	≥ 850	
2.2.3	Nominal discharge current In (8/20 μ s)	kA peak	10	
2.2.4	High current impulse of an arrester (4/10 μ s)	kA peak	100	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3	Others			
2.3.1	Line discharge class	Class		
2.3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 7	
2.3.3	Thermal Charge Transfer Rating, Qth	Coulombs	Insert	
2.3.4	Repetitive Charge Transfer Rating, Qrs	Coulombs	Insert	
2.3.5	Rated frequency	Hz	50	
2.3.6	Partial Discharge Level	pC	≤ 10	
3	Surge Arresters - Design and Construction			
3.1	Designed Life	Years	Insert	
3.2	MTBF		Insert	
3.3	MTTR		Insert	
3.4	Resistor Block			
3.4.1	Diameter	mm	Insert	
3.4.2	No. of ZnO Block in series at One unit	No.	Insert	
3.4.3	No. of separately housed arrester unit	No.		
3.4.4	Housing design			
	Open or Case Design Closed or Wrap Design Hollow Tube Design		Insert	
	Pressure relief device No. & Location		Insert	
	Highest pressure developed during rated discharge current	kPa	Insert	
	Pressure Relief Class		Insert	
	Alternate shed housing	Yes/No	Insert	
	Color of housing		Insert	
	Material of housing	SIR	Insert	
	Volcanizing Technology		Insert	
3.4.5	Design Considerations			
	Designed for Ambient Temperature	°C	-40 to +40	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Solar Radiation	kW/m ²	≥1.1	
	Altitude	m	1000	
	Frequency of AC Power Supply	Hz	48-62	
	Wind Velocity	m/s	≤ 34 m/s	
3.4.6	Similar Model that passed Short Circuit Test			
	100% fault current	kA	Insert	
	50% fault current	kA	Insert	
	25% fault current	kA	Insert	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F _{dyn})	N	Insert	
3.6.2	Specified long-term load SSL (F _{stat})	N	Insert	
3.6.3	Maximum cantilever strength	Nm	Insert	
3.6.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		Composite/ Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	
	Total leakage distance across outer insulator shedding for the complete arrester	mm	Insert	
	Protected leakage distance across outer insulator shedding for the complete arrester	mm	Insert	
	Clearance			
	phase to earth (from center line)	mm	Insert	
	phase to phase (center line to center line)	mm	Insert	
3.11	Surge arrester weight	kg	Insert	
3.12	Voltage distribution ring present	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12.1	Ring Diameter	mm		
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	Min 100 x 100	
3.14.3	Number of holes		Min 4	
3.14.4	Distance between holes	mm x mm	50 x 50	
3.14.5	Material suitable for		Al terminal	
3.15	Arrester Grounding	Yes/No	Yes	
3.16	Surge Counter		Insert	
3.16.1	Manufacturer		Insert	
3.16.2	Type		Insert	
3.16.3	Model designation		Insert	
3.16.4	Country of origin		Insert	
3.16.5	Leakage Current Measurement		Insert	
3.16.5	Range of Measurement	uA-mA	Insert	
3.16.6	Sensitivity of surge counter peak at a wave shape of micro sec		Insert	
3.16.7	Minimum counted Surge Ampere		Insert	
3.16.8	Error		Insert	
3.16.9	Grounding of Counter		Insert	
	Separate Insulated (from Counter housing) terminal at bottom of Counter		Insert	
	Separate Insulated (from Counter housing) terminal at top of Counter		Insert	
	Counter Body Earthing		Insert	
	Earthing Conductor Material		Copper	
	Conductor Size	mm ²	Insert	
	Conductor Insulation		Insert	
3.16.10	Short Circuit Test of Counter		Yes	
3.16.10.1	Test Authority		Insert	
4	Drawings			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1	GA Drawing with All dimension & clearance clearly marked		Yes	
4.2	Sectional Drawing to show internal blocks, PRD etc.		Yes	
4.3	HV terminal Drawing		Yes	
4.4	Surge Counter Drawing		Yes	
4.5	Surge Counter installation Drawing		Yes	
4.6	Earthing Terminal Drawing		Yes	
4.7	Quality & FAT/Routine Test Plan Attached		Yes	
Overall compliance with the requirements (yes/no)				

Others

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

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

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

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

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

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

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 withstand capacity during indicated period: a) HV winding b) LV winding Pre-fault voltage	kA kA p.u.	40 40 1.05	
3.3.3	Asymmetrical short-circuit withstand capacity during indicated period: a) HV winding b) LV winding Pre-fault voltage	kA kA p.u.		
3.4	Guaranteed losses			
3.4.1	No-load losses with tap changer in nominal position: a) at rated voltage and rated frequency at 110 % rated voltage, at rated frequency	kW kW	Insert Insert	
	No-load losses with tap changer in plus (+) extreme position: at 110 % rated voltage, at rated frequency	kW	Insert	
	No-load losses with tap changer in minus (-) extreme position: at 110 % rated voltage, at rated frequency	kW	Insert	
	Average No-Load Loss (this value will be evaluated)	kW	Insert	
3.4.2	No-load losses capitalized value	BDT/kW	As per Tender Requirement	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C			
	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
	On-load losses at 75°C, at 110% rated voltage and rated frequency, with tap changer in plus (+) extreme position	kW	Insert	
	On-load losses at 75°C, at 110% rated voltage and rated frequency, with tap changer in minus (-) extreme position	kW	Insert	
	Average On-load losses (this value will be evaluated)	kW	Insert	
3.4.5	On-load losses capitalized value	BDT/kW	As per Tender Requirement	

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12.1	Top oil temperature under service conditions stated in Schedule of Technical Requirement: a) CMR ONAN rating	°C	≤ 55	
		°C	≤ 55	
3.12.2	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement:	°C	≤ 60	
3.12.3	Hottest spot rise in core, metallic parts and adjacent Parts in contact with oil at rated power	°C	≤ 65	
3.12.4	Hottest spot rise in copper (winding) at rated power	°C	≤ 75	
3.12.5	Winding insulation temperature capacity	°C	Insert	
3.12.6	Winding hot spot temperature on emergency overload not exceeding	°C	≤ 120 (may be fixed during final design at execution stage)	
3.12.7	Tank Surface temperature (amb+Top oil rise+Core surface temperature)		Insert	
3.12.8	Temperature gradient at rating specified	°C	Insert	
3.12.9	Temperature rise of metallic parts			
	Tank walls	°C	Insert	
	Tie plate	°C	Insert	
	Top clamp	°C	Insert	
	Bottom clamp	°C	Insert	
3.13	At the emergency cases it is allowed: h) 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 i) full rated power j) ¾ rated power ½ rated power		Insert Insert Insert	
3.14.1.2	After operation under 20 min k) full rated power l) ¾ rated power ½ rated power		Insert Insert Insert	
3.14.1.3	After operation under 120 min m) full rated power n) 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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.14.2.1	After operation under 15 min o) full rated power p) $\frac{3}{4}$ rated power $\frac{1}{2}$ rated power		Insert Insert Insert	
3.14.2.2	After operation under 20 min q) full rated power r) $\frac{3}{4}$ rated power $\frac{1}{2}$ rated power		Insert Insert Insert	
3.14.2.3	After operation under 120 min s) full rated power t) $\frac{3}{4}$ rated power $\frac{1}{2}$ rated power		Insert Insert Insert	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: u) with all cooling groups in operation (excluding stand-by cooling group) v) with one cooling group out of operation with two cooling groups out of operation		Insert Insert Insert	
4	Oil			
4.1	New		Yes	
4.2	Manufacturer & country		Insert	
4.3	Type Class		Insert Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Maximum dielectric strength	kV/cm	Insert	
4.8	Data sheet attached		Insert	
4.9	Corrosive Sulphur		No	
4.10	PCB content		Without PCB	
5	Bushing			
5.1	HV bushing			
5.1.1	Quantity		3	
5.1.2	Class	kV	245	
5.1.3	Manufacturer & country make		Insert	
5.1.4	Type		RIP with Composite Silicon Rubber Housing	
5.1.4.1	Single Flange or Double Flange		Insert	
5.1.4.2	Draw lead type or Solid Type		Insert	
5.1.4.3	Type: Oil to Oil or Oil to Air or Oil to SF6		Insert	
5.1.5	Rated current	A	≥ 2000	
5.1.6	Rated short circuit current (3 s)	kA rms	≥ 40	
5.1.7	Rated lightning impulse withstand voltage	kV peak	1050	
5.1.8	Rated switching impulse withstand voltage	kV peak	N/A	
5.1.9	Rated power frequency withstand voltage	kV rms	460	
5.1.10	Connectors			
5.1.10.1	Shape		Flat	
5.1.10.2	Dimension (L x W)	mm x mm	125x125	

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 composite silicon rubber		Insert	
5.2.19	De-rating Factor		Insert	
6	Design Data			
6.1	Maximum flux density in the legs			
	w) At rated voltage, frequency & normal ratio	T	Insert	
	x) At 105 % of the rated voltage	T	Insert	
	Volts/turn	V	Insert	
6.2	Maximum flux density in the yokes:			
	y) At rated voltage, frequency & normal ratio	T	Insert	
	z) At 105 % of the rated voltage	T	Insert	
	Volts/turn	V	Insert	
6.3	Maximum current density in windings at rated power and normal tap changer position:			
	aa) HV winding	A/mm ²	Insert	
	LV winding	A/mm ²	Insert	
6.3.1	Magnetising current at nominal ratio and			
	at 0.9 x nominal voltage	%	Insert	
	at 1.0 x nominal voltage	%	Insert	
	at 1.1 x nominal voltage	%	Insert	
	at 1.2 x nominal voltage	%	Insert	
6.3.2	Harmonic component of magnetizing current at rated voltage as percentage of fundamental			
	2 nd harmonic	%	Insert	
	3 rd harmonic	%	Insert	
	4 th harmonic	%	Insert	
	5 th harmonic	%	Insert	
	6 th harmonic	%	Insert	
	7 th harmonic	%	Insert	
		%		
6.4	Winding resistance at 75°C and middle tap changer position:			
	bb) HV winding	Ω	Insert	
	LV winding	Ω	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.5	For fault with zero impedance external to the transformer and infinite system			
	(a) Maximum axial force	kN	Insert	
	(b) Maximum tensile stress in winding	N/m ²	Insert	
	(c) Free buckling force	KN	Insert	
6.6	Designed safety margin	%	Insert	
6.7	ZnO block to limit distributed impulse [tap winding/other]		No	
6.8	X/R ratio		Insert	
6.9	Core construction			
6.9.1	Type of transformer		Core	
6.9.2	Method of joining of legs		Insert	
6.9.3	Method of joining of yokes		Insert	
6.9.4	Joining material		Insert	
6.9.5	Number of legs		Insert	
6.9.6	Type of core steel		Insert	
6.9.7	Steel Manufacturer		Insert	
6.9.8	Steel Grade	Grade	Insert	
6.9.9	Core Loss at W17/50	Watts/kg	< 0.85	
6.9.10	Irradiation method (Core graining method)		Laser beam or Plasma jet	
6.9.11	Insulation of			
	(A) Yoke bolts		Insert	
	(B) Side plates		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		Insert	
	(B) LV		Insert	
6.10.2	Insulation of			
	(a) HV windings		Thermally upgraded insulation paper	
	(b) LV windings		Thermally upgraded insulation paper	
6.10.3	Type of Winding connections (brazed or crimped or others)			
	Between windings		Insert	
	Between main & tap windings		Insert	
	Between windings & leads		Insert	
6.10.4	The individual winding sets clamped separately from each other and separately from the core		Yes	
6.10.5	HV winding		Cu – Interleaved / Cu-continuous/ disc – transposed cured in epoxy coating	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.10.5	LV winding		Cu – Interleaved / Cu-continuous/ disc – transposed/ Cu-transposed/ helix, cured in epoxy coating	
6.10.6	Type of Insulation of Tapping Connections		Insert	
7	Weights and dimensions			
7.1	Core and winding assembly	kg	Insert*	
7.2	Tank, conservator, cooler banks & cooling assembly & other accessories	kg	Insert*	
7.3	Total mass excluding oil	kg	Insert*	
7.4	Oil mass in tank & conservator	kg	Insert*	
7.5	Oil mass in coolers	kg	Insert*	
7.6	Total mass of Oil	kg	Insert*	
7.7	Total weight of transformer, with oil, equipped for service	kg	Insert*	
7.8	Maximum shipping weight (the heaviest item)	kg	Insert*	
7.9	Height from foundation to:			
	a) Highest point of HV bushing	mm	Insert*	
	b) Highest point of tank	mm	Insert*	
	c) Highest point of conservator	mm	Insert*	
7.10	d) Highest point of lifting hook for removal of core and oil assembly	mm	Insert*	
	Outer dimensions:			
	a) Length	mm	Insert*	
	b) Width	mm	Insert*	
7.11	Informative dimensional sketch		To be enclosed with bid	
7.12	Maximum shipping dimensions of tank:			
	a) Outside height	mm	Insert	
	b) Outside width	mm	Insert	
	c) Outside length	mm	Insert	
7.13	Transportation drawing		To be enclosed with bid	
8	Tap changer			
8.1	Manufacturer		Insert	
8.2	Type		Insert	
8.3	Insulation level	kV	Insert	
8.4	Rated current	A	≥ 800	
8.5	Number of steps		Insert	
8.6	Regulating coil		Insert	
8.7	Short-circuit withstand	kA rms	Insert	
8.8	BIL to ground through the regulating coil	kV peak	Insert	
8.9	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
8.10	Tap position indicator		Digital code matrix (BCD)	
8.11	Auxiliary supply		3x400 V / 230 V, 50 Hz	
9	Auxiliary power supply			
9.1	Motors		3x400 V / 50 Hz	
9.2	Heaters		230 V / 50 Hz	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
9.3	Control voltage		110 V DC	
10	Current transformer incorporated into the power transformer			
10.1	CT in HV bushings, for protection, WTI and/or Tap Changer		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
10.2	CT in LV bushings, for protection, WTI and/or Tap Changer		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
10.3	CT in neutral bushing, for protection		(Number, ratio, class & burden of CT cores shall be as per SLD & Schedule A of Volume 3. All CT parameters shall be finalized by calculation during the execution stage)	
11	Layout			
11.1	Primary winding bushings		Longitudinal axis	
11.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	
11.3	Conservator tank		To be defined in design stage	
11.4	Tap changer		To be defined in design stage	
11.5	Control cabinet		To be defined in design stage	
11.6	Coolers		To be defined in design stage	
11.7	Connection drawing, block diagram		To be enclosed with bid	
12	Cooling fan groups, Radiator banks & Valves			
12.1	No of radiator bank		Insert	
12.2	No of fins/plates in each radiator		Insert	
12.3	Number of cooling fan groups (for rated power)	Qty.	Minimum 02 (may be fixed during final design at execution stage)	
12.4	Number of coolers (fans) in each cooling group (for rated power)	Qty.	Insert	
12.5	Number of stand-by cooling fans in each cooling group (for rated power)	Qty.	Insert	
12.7	Rating of each cooler (fan)	kW	Insert	
12.8	Starting current of each fan motor	A	Insert	
12.9	Speed of air blowers/fans	rpm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
12.10	IP Class of Fan Motor		Insert	
12.11	Full vacuum withstand of complete cooler	mbar	Yes	
12.12	Thickness of radiator plates	mm	Insert	
12.13	Valve type/material: (A) 100mm and below (B) Above 100mm		Insert	
			Insert	
12.14	Gate /Ball Valve	Nos.	Insert	
12.15	Radiator Valve	Nos.	Insert	
12.16	Buchholz relay bypass valve	Nos.	Insert	
13	Oil Preservation system & Dehydrating breather			
13.1	Main Tank		Air Bag with dehydrating breather (maintenance-free) Refer: section-4, volume-2	
13.2	On-load Tap Changer		Dehydrating breather (maintenance-free) Refer: section-4, volume-2	
13.3	Type of dehydrating breather		Insert	
13.4	Dehumidifying agent	kg	Insert	
13.5	Type of Dehumidifying agent		Environment friendly	
14	Power transformer tank			
14.1	Type of design			
14.2	Thickness of transformer tank:			
	a) Sides	mm	Insert	
	b) Bottom	mm	Insert	
	c) Top	mm	Insert	
14.3	Material of the transformer tank		Insert	
14.4	Wheels			
14.4.1	Wheel number for each rail of two pair rails		Two pairs	
14.4.2	Axial inter space in transversal direction between two pairs of rails	mm	Insert	
14.4.3	Transversal distance between wheels in pair	mm	Insert	
14.4.4	Distance between wheels in longitudinal direction	mm	Insert	
14.5	Corrosion protection of the tank		Yes	
14.6	Vacuum withstand of the complete tank with cooler	mbar	1	
14.7	Over-pressure withstand of the complete transformer	bar	Insert	
14.8	Oil Sealing System (Type) a) Main Tank b) Other parts		Gasket/Welded Gasket	
14.9	Oil Sealing System (Gasket Material: Material used for gaskets for oil tight joints) a) Main Tank b) Bushings c) Other Parts d) Temperature Class / Grade		Insert Insert Insert Insert	
14.10	Maximum Operating Pressure a) At Top of Tank b) At Bottom of Tank	kN/m2 kN/m2	Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14.11	Permanent Deflection of Tank plates or Stiffeners:	mm	< IEC	
	a) At Maximum Operating Pressure			
	b) At Design Hydraulic Pressure for which the tank is Designed	mm	< IEC	
	c) At Full Vacuum	mm	< 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:		Insert	
	a) Maximum diagraph stress at highest working pressure		Insert	
	b) Diagraph construction details		Insert	
	c) Type of diagraph material		Insert	
15.7	Corrosion protection of conservator		Insert	
15.8	Oil level indicators with alarm for minimum oil level	pcs.	2	
16	Marshaling Kiosk			
16.1	Type of Mounting		Tank mounted	
16.2	IP Class		Insert	
16.3	Mounted on tank with/ without anti-vibration packing		Insert	
17	Operating Pressure of Pressure Relief Device			
17.1	Main Tank	kN/m ²	Insert	
17.2	OLTC	kN/m ²	Insert	
18	Noise level & interference			
18.1	Audible noise level (acc. To NEMA TR1), at 105 % of rated voltage, at maximum power and with complete cooling system in service	dB	Insert	
18.2	Radio Interference Voltage at 0.5 MHz as specified in IEC 60694	μV	2500 max	
19	Operating conditions			
19.1	At the altitude (above sea level)	m	≤ 1000	
19.2	Maximum ambient temperature	°C	+ 45	
19.3	Average daily temperature	°C	+ 35	
19.4	Average annual temperature	°C	+ 25	
19.5	Minimum ambient temperature	°C	– 5	
19.7	Parallel operation		Yes	
19.8	External cooling medium		Air	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	°C	+ 35	
19.11	Consideration for Restricted Air Circulation		Required	
20	Test & Short Circuit Withstand Requirement			
20.1	Brief description of transformer or parts thereof subjected to short-circuit test		Test Reference	
20.2	Similar Design Transformer (as per IEC 60076-5, Annex A) type test reference			
20.2.1	Testing Authority		STL Lab, insert Name	
20.2.2	certificate reference		Insert	
20.2.3	Contact address of test Lab		Insert	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	mm ² /s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	Bushing			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 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			
6.1	Total weight of transformer, ready for service	kg	Insert	

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

AUXILIARY POWER AND MULTICORE CONTROL CABLES

[illegible]

Schedule-E: Battery

GTP & requirement Form: 110V & 48V Battery

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

GTP & requirement Form: Charger

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Charger			
1	General			
1.1	Manufacturer			
1.2	Type designation			
1.3	Type		Thyristor controlled	
1.4	Country of origin		USA/Japan/Europe	
1.5	Standards		IEC	
1.6	Rated input voltage	V	3 x 400 / 230	
1.7	Rated input current (at rated output)	A	Insert	
1.8	Input voltage variation	%	±5	
1.9	Power factor	1	> 0,80	
1.10	Efficiency	%	> 85	
1.11	Degree of protection		IP42	
1.12	Noise level	dB	< 65 dB max	
1.13	Type of rectifiers		Thyristor controlled	
1.14	Number of modules (n+2)	pcs	Insert	
1.15	Module rated output current	A	Insert	
1.16	MCU protocol		IEC 61850	
1.21	Charging characteristic		Both constant current & constant voltage	
1.22	Rated frequency	Hz	50	
1.23	Insulation - HV, between input and output/ground	V AC, min	1000 V AC, 1 min	
1.24	Insulation resistance at 500 V DC, 1 min	MΩ	Insert	
1.26	Rated output voltage	V d.c.	110 (for 110 V DC) 48 (for 48 V DC)	
1.27	Rated output current	A	130 (for 110 V DC) 90 (for 48 V DC) (Based on BoQ & calculation)	
1.28	Cooling System		Self & natural air cooled	
1.29	Relative humidity	%	Up to 98%	
1.30	Ambient temperature	°C	40 (max.)	
1.31	Installation		Indoor	
2	AC Input			
2.1	Voltage	V	415	
2.2	Phase		3	
2.3	Frequency variation	Hz	47 to 51	
2.4	Allowable Input AC voltage variation At Charger input terminal	V	±15%	
2.5	Power factor	1	>0.8	
2.6	Efficiency (Full load)	%	>85%	
2.7	Charge Characteristics		Constant current /Constant voltage (During float charge)	
2.8	Current limitation	%	110%	
3	DC Output			
3.1	Voltage	V	110±5%	

Schedule-E: Charger

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

GTP & requirement Form: LVAC Distribution

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	AC Distribution Panel			
1.1	Manufacturer		Insert	
1.2	Manufacturer's type designation		Insert	
1.3	Rating of Busbar	Amps	Insert	
1.4	Fault Rating for 1 sec	kA	Insert	
1.5	Incomer Breaker Rating	Amps	Insert	
1.6	Voltage	Volts	Insert	
1.7	Thickness of sheet steel	mm	Insert	
2	Miniature Circuit Breakers			
2.1	Manufacturer		Insert	
2.2	Type		Insert	
2.3	Rating	Amps	Insert	
2.4	Fault Rating for 1 sec	kA	Insert	
Overall compliance with the requirements & detail specification described in Vol-2		Yes/No	Yes	

GTP & requirement Form: Automatic Power Factor Correction Panel

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

Schedule-E: Automatic PFC Panel

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

GTP of IP camera surveillance system

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

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

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

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

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

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

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

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

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

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

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

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

1.1.1 Control, Protection, Substation Automation & Metering

1.1.1.1 Line Distance Protection

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

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

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

1.1.1.2 Line Differential Protection

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

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

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

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

1.1.1.3 Transformer Differential Protection (3 Winding):

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

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

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

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

Over current and Earth fault protection:

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

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

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

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

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

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

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

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

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

1.1.1.5 Frequency Protection

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

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

1.1.1.6 Busbar and Breaker Failure Protection

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

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

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

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

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

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

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

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

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

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

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

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

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

1.1.1.10 Test Socket

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

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

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

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

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
	22.2 Voltage Circuit (with auxiliary power)	VA/phase	< 0.1	
	22.3 Voltage Circuit (with self power)	VA/phase	< 6VA	
23	Auxiliary supply range		Dual Power Supply: i. 80V to 240V AC/DC or higher range ii. Self Power with VT voltage (80V to 130V AC)	
24	Operating frequency		50Hz ($\pm 5\%$)	
25	Measuring mode		True 4 quadrant	
26	Accuracy class		0.2 for kWh, 0.5 for kVARh	
27	Losses at nominal load		To be mentioned	
28	Remote communication		Standard metering protocol, MODBUS; Communication facility to Network Control Center should be available	
29	Communication port		- The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard. - Following communication ports have to be available: - Optical 1107 Port (front mounted): supporting DLMS protocol - RS485: supporting MODBUS protocol - RS232: Optional - Ethernet: Optional	
30	Software requirement		- Should be able to configure and monitor with user-friendly PC-based tool. - Necessary software for configuration and parameterization has to be supplied free of cost and without any time-bound license - The parameterization software must run on Windows operating environment. - The software must be protected by software keys to control duplication and installation. - The software should have a customizable printing feature by task list. - The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days.	

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

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
			- Number of power interruption with date & time (minimum 100 events). - Latest power failure time & date - Date & time of meter tempering. (Voltage & Current missing, demand reset, time change). - Event logs - Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4) - Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence. The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 90 (ninety) days. - Load Profile data [kWh, KVarh (Q1+Q4) - Phase voltage - Phase amps	
37	Data logging and event recording		Should be available	
38	In built clock		Should be available	
39	Provision of GPS synchronization		Should be available	
40	Additional Features		i. Power Quality Measurement (At least 1 GB of memory, 192 channels of LDP, 24kHz waveform, 600 VSSI summary events, Wave View, Flicker, Power Harmonics and Interharmonics, Total Harmonic Distortion) ii. Necessary software for accessing the mentioned features should be provided without any time-bound license.	
41	Construction		The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal.	
42	Terminal		Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.	
43	Environment requirement			

SL. No.	Description	Unit	PGCB's requirements	Guaranteed
	43.1 Ingress protection		IP54 or better	
	43.2 Operating temperature		-10°C to +60°C	
	43.3 Storage temperature		-40°C to +80°C	
	43.4 Humidity range		0% to 95%, non-condensing	
44	Weight of the meter		To be mentioned	
45	Dimension of the meter		To be mentioned	
46	Outline, drawing and leaflets		To be provided	
47	Performance curves for balanced and unbalanced load		To be mentioned	
48	Year of manufacture		To be mentioned	
49	Minimum Battery Service life and shelf life	Years	10 (ten) & 15 (fifteen) respectively	
50	Meter service life	Years	15 (fifteen)	
51	Reference standard		Relevant ANSI/IEC standard	
52	Warranty	Days	540	
53	Type test certificate		Should be provided	

1.1.1.12

1.1.2

1.1.2.1 Overall Fault Clearance Times

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

	Total	ms	Insert	
5	230 kV Line Faults:			
	Distance protection maximum 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	

1.1.2.2 Multi-Phase Auto reclose

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

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

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

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

1.1.2.4 Front Panel Annunciation for Control Room (Optional)

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

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

1.1.2.5 SCADA Server

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

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

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

Substation Automation System

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

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

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

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

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

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

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

1.1.2.7 Operator Workstation

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

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

1.1.2.8 Printer

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

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

1.1.2.9 Engineering PC

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

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

1.1.2.10 Time Synchronization Device

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

1.1.2.11 Weather Station (Optional)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	

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

1.1.2.12 Ethernet Switch Process LAN

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

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

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

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

1.1.2.13 Ethernet Switch Control Room

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

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

1.1.2.14 Protection Monitoring Software

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

1.1.2.15 SCADA Software

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

Fibre Optic Cables & Terminal Equipment

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

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

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

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

1.1.2.16 Special Control Equipment and Tools

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

1.1.2.17 Automatic Voltage Regulation

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

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

1.1.2.18 Test Socket

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

1.1.3 Digital Fault and Disturbance Recorder (DFDR)

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

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

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

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

1.1.4 Telecommunication Equipment

Fibre Optic Multiplexer Equipment

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

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

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

Power Line Carrier Equipment (Not Applicable)

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

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

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

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

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

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

GTP 33kV XLPE Power Cable

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
2	Manufacturer		Insert	
3	Origin		Insert	
4	Type		Insert	
5	Rated system voltage	kV	33	
5.1	phase	kV	Insert	
5.2	line to line	kV	Insert	
6	Max. permissible system voltage	kV	36	
7	Rated frequency	Hz	50	
8	Max. operating current	A	Insert (Calculation is required)	
9	Nominal cross-sectional area	mm ²	800 mm2 Cu 185 mm2 Cu (Calculation is required)	
10	Impulse withstand voltage	kV	170	
11	Power frequency withstand voltage	kV	70	
12	Shape of conductor		Insert	
13	Nominal cross section of Cu-screen	mm ²	Insert	
14	Thickness of outer sheath	mm	Insert	
15	Insulation thickness	mm	8-9	
16	Min. bending radius	D	15	
17	Max. pulling force		Insert	
18	Max. DC resistance at 20°C	ohm/km	0.0366	
19	Max. AC resistance at 20°C	ohm/km	Insert	
20	Max. inductance in single configure	mH/km	Insert	
21	Operating capacitance	μF/km	Insert	
22	Charging current (phase)		Insert	
23	Charging load (phase)		Insert	
24	Earth fault current	kA	Insert	
25	Short circuit rating for 3 sec	kA	40 (Calculation is required)	
26	Current rating			
26.1	in soil	A	Insert	
26.2	in air	A	Insert	
27	standard		Insert	

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
Plant on turnkey basis**

SCHEDULE F

PROPOSED SUBCONTRACTORS

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

**Design, Supply, Installation, Testing and Commissioning of 230/33kV GIS
Substation at Char Fasson & 230kV GIS Bay Extension at Nutan Bidyut Power
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SCHEDULE F

PROPOSED SUBCONTRACTORS

The bidder shall propose a list of the Sub-contractors in the following table as per sub-clause 2.5.2, Subcontractors, Section-3, Evaluation and Qualification Criteria, Volume 1 of 3 of the Bidding Document.

Sl. No.	Name and Address of the Subcontractor

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

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

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SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

POWER GRID COMPANY OF BANGLADESH LIMITED

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SCHEDULE G

COEFFICIENT AND INDICES FOR PRICE ADJUSTMENT

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