

POWER GRID COMPANY OF BANGLADESH LIMITED



BIDDING DOCUMENT

FOR

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV
AIS Substation at Pekua and associated single /double circuit
400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)**

[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]

[IFB NO: 27.21.0000.101.07.425.24.2920, May 28, 2024]

VOLUME 3A OF 3 (SUBSTATION PART)

BID FORMS, PRICES AND SCHEDULE

POWER GRID COMPANY OF BANGLADESH LIMITED

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SCHEDULE A

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, 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 scope of work comprises the following: -

DESCRIPTION OF WORKS

1. PEKUA 400/230/132kV AIS Substation

The scope of work under this turnkey Bid is design, supply, delivery, installation, testing & commissioning of a new Air Insulated Switchgear (AIS) substation. The configuration of the 400kV busbar shall be 1 and ½ busbar scheme and the 230KV & 132kV busbar shall be double Busbar scheme.

The scope of work also includes associated control, protection, fiber optic multiplexer equipment for communication & protection, substation automation, digital fault & disturbance recorder (DFDR), station power facilities, including towers and gantry structures, three storied Main Control Building, three (3) 400kV Switchyard Panel Rooms (SPR) and one (1)132kV SPRs to accommodate protection and control IED and associated equipment, local control kiosks, 33kV tertiary equipment, cable trenches, water supply & sewerage, fences, access road & internal roads, security guard stations, and all other necessary substation facilities and supply of mandatory spare parts and maintenance & special tools.

The scope of works shall also include four (4) Three-Phase Shunt Reactors with its size for each line and associated air-insulated switchgears including all necessary works.

400kV Air Insulated Switchgears (AIS)

New 400kV AIS switchyard for Four(4) 400kV line bays to connect Line in-out of existing 400kV Matarabari-Bashkhali 400kV double circuit overhead line (Matarabari 1 & 2 and Bashkhali 1 & 2); Four(4) shunt Reactor for Four(4) 400kV line bays (based on EMTP study); — Three 400kV transformer bays for three sets of 400/230/33kV, 400/520MVA, three phase auto transformers; space shall be kept for future extension of four (4) 400kV overhead line bays.

230kV Air Insulated Switchgears (AIS)

New Four 230kV line bays to connect Line in-out of existing 230kV Anwara-Cox's Bazar 230kV double circuit overhead line (Anwara 1 & 2 and Cox's Bazar 1 & 2); — Three 230kV transformer bays for LV side of two 400/230/33kV transformer; Two 230kV transformer bays for HV side of two 230/132/33kV transformer; one 230kV bus-coupler bay; space shall be kept for future extension of four (4) 230kV overhead line bays and one 230kV transformer bays for HV side of 230/132/33kV, 225/300MVA transformer.

132kV Air Insulated Switchgears (AIS)

New 132kV AIS switchyard for Four 132kV line bays to connect Line in-out of existing 132kV Matarabari-Chokoria 230kV double circuit overhead line (Matarabari 1 & 2 and Chokoria 1 & 2); Two 132kV transformer bays for LV side of two 230/132/33kV transformer; one 132kV bus-coupler bay; space for future extension of four overhead 132kV line bays and one 132kV transformer bays for LV side of 230/132/33kV transformer.

33kV Air Insulated Switches and Connection

New 33kV AIS switchyard and switches for station power service facilities;

- 400/230/33kV tertiary side switchyard and connection
- 230/132/33kV tertiary side switchyard and connection

Tertiary side connection between 33kV terminal to switches including necessary fittings, structures and conductors and XLPE for 400/230/33kV transformer bank.

Tertiary side connection between 33kV terminal to switches including necessary fittings, structures conductors and XLPE for 230/132/33 transformer bank.

400/230/33kV three phase 3 phase transformer

Three 400/230/33kV, 400/520MVA three phase 3 phase transformers,.

230/132/33kV three phase 3 phase transformer

Two 230/132/33kV, 225/300MVA three phase 3 phase transformers, and space for future extension of one 230/132/33kV, 225/300MVA three phase 3 phase transformer.

33/0.415kV earthing/auxiliary transformer

Two 33/0.415kV, 500kVA, outdoor type earthing/auxiliary transformers with no neutral earthing resistors to supply the substation auxiliary loads. The auxiliary transformer shall be connected to tertiary side of two new 400/230/33kV three phase 3 phase transformers.

Control, Protection, Substation Automation, Metering & DFDR

Associated local & Remote control panel, metering panel, protection equipment, synchronizing scheme and substation automation system (SAS) & DFDR for complete substation. Monitoring of status of Bus PT & Bus ES need to be included in the SAS. Necessary works to be performed so that Air temperature in the SPRs can be controlled and monitored through SAS. RTCC, LVAC, LVDC, Tariff metering panel shall be monitored by SAS.

Fibre Optic Multiplexer Equipment for Communication and Protection

Indoor type Fibre Optic Multiplexer Equipment for protection & communication.

DC and LVAC System

Complete set of DC and LVAC system with all necessary materials required for the plant being installed with spares for future use of 110V DC battery & battery charger, 48 V DC battery & battery charger, DC distribution board and LVAC distribution board.

Civil Works, Building and Foundation

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit; approach, entrance & internal roads; cable trenches, septic tank, surfacing, drainage, fences, guard house including earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for a new three storied Main Control Room Building, three new one storied local control houses in 400kV switchyard and one new one storied local control house in 132kV switchyard

Complete design, supply and construction of fire-fighting system for transformers including water pipe network and reservoir at normal pressure.

SCADA system for Telecontrol and Telemetry

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol &telemetry facilities required at the existing National Load Dispatch Center(NLDC) at Rampura for integration of complete new 400/230/132kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-101 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Mandatory Spares, Erection & Test Equipment

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment. Test equipment is to be supplied from Europe, USA, Japan or equivalent 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 Engineer.

Works and Equipment for Shunt Reactor Installation

Four 400kV three Phase Shunt Reactor ONAN (Size: 20MVAR and associated switchgears including all necessary works and services as specified in Section 16, Volume 2 of 3 of the Bidding Document.

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

SL	Description	No. of Engineer	Duration (Working Days)
1.	Transformers	02	10
2.	Circuit Breaker	02	05
3.	Shunt Reactor	02	07
4.	Disconnecter	02	05
5.	Instrument Transformer (1 for CT & 1 for PT)	02	05
6.	Lightning Arrester	02	05
7.	Control, protection & SAS	02	05
8.	DC system	01	03

- (b) **Local Training:** On-site instruction by the manufacturer's engineer on operations and maintenance of the (i) HV switchgears & transformers (ii) protection & Substation automation system (iii) fiber optic multiplexer & digital PABX for a period of two(2) weeks and for fifteen(15) PGCB engineers in each program.

The Contractor shall be responsible for bearing all costs for the trainees (for item (a)+(b)), including air fares, accommodation, meal, healthcare, transportation, visa fees etc. together with payment of a daily allowance of **US\$ 30** for each of the Employer's trainee. The Employer's engineer attending the Pre-shipment inspection (as mentioned in item no.-C) shall be provided with the same facilities except the payment of daily allowance which is to be **US\$ 100**.

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

SCHEDULE A

REQUIREMENTS

Section-I PEKUA 400/230/132kV AIS Substation

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

Item	Description
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1A	400 kV Air Insulated Switchgear (AIS)
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The 400kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and shall comprise the following:-

- | | |
|--|--|
| 1A1 | Three(3) sets of 400kV, 5000A, 63kA/1sec, 50Hz, 1425kVp BIL, live tank type, gang operated , SF6 gas circuit breakers with spring-stored energy operating mechanism .CSD (Control Switching Device) is required for line, shunt reactor & transformer switching which shall have to be considered for 400kV circuit breaker. |
| 1A2 | Eight (8) sets of 400kV, 5000A, 63kA/1sec , 50Hz, 1425kVp BIL, live tank type, single-pole operation , SF6 gas circuit breakers with spring-stored energy operating mechanism. PIR(Pre insertion resistor)is required for line switching which shall have to be considered for 400kV circuit breaker. |
| [For line switching: Pre insertion resistor (PIR) is also acceptable instead of control switching device. In this case of line & transformer switching with same breaker (i.e. Mid breaker), combination of PIR & CSD is required] | |
| 1A3 | Four(4) sets of 400kV, 5000A, 63kA/1sec , 50Hz, 1425kVp BIL,horizontal double break, post type, motor operated disconnectors with motor-operated earthing switch . |
| 1A4 | Twenty Five (25) sets of 400kV, 5000A, 63kA/1sec , 50Hz, 1425kVp BIL,horizontal double break, post type, motor operated disconnectors without earthing switch . |
| 1A5 | Two(2) sets of 400kV, 63kA/1sec , 50Hz, 1425kVp BIL, post type, motor operated busbar grounding switches. |
| 1A6 | Forty Five (45) nos. of single-phase, 6-core, 400kV, 5000A, 63kA/1sec , 50Hz, 1425kVp BIL,post type current transformer. |

- 1A7 Twenty seven (27) nos. of single-phase, 3-core, 400kV, 63kA/1sec, 50Hz, 1425kVp BIL,capacitor type voltage transformers.
- 1A8 Twenty seven (27) nos. of 390kV rated voltage, 303kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
- 1A9 Four (4) nos. of wave trap (single phase, 400kV, 5000A, 1mH).
- 1A10 One (1) lot of 400kV post type support insulators required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.
- 1A11 One(1) lot of rigid tubular bus [Aluminium of grade 63401 WP],flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 40kV busbar and switchgear connection as specified in the technical specifications and bid drawings.
- 1A12 One(1) lot of steel structures for gantry and equipment supports required for completing 400kV busbar and switchgear as specified in the technical specifications and bid drawings.

1B 245kV Air Insulated Switchgear (AIS)

The 245kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and shall comprise the following:-

- 1B1 Five (5) sets of 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for Transformer bay).
- 1B2 Four(4) sets of 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, live tank type, single-pole operation, SF6 gas circuit breakers with spring-stored energy operating mechanism (for T/L bay).
- 1B3 One (1) set of 245kV, 4000A, 50kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for bus coupler).
- 1B4 Fifteen (15) sets of 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL,double side break, post type, motor operated disconnectors without earthing switch (for Transformer bay).

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|------|--|
| 1B5 | Eight(8) sets of 245kV, 2000A, 50kA/1sec 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch (for T/L bay). |
| 1B6 | Two (2) sets of 245kV, 4000A, 50kA/1sec, 50Hz, 650kVp BIL,double side break, post type, motor operated disconnectors without earthing switch (for bus coupler). |
| 1B7 | Four(4) sets of 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with motor-operated earthing switch (for T/L bay). |
| 1B8 | Fifteen (15) nos. of single-phase, 4-core, 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, post type current transformer for Transformer bay |
| 1B9 | Twelve(12) nos. of single-phase, 4-core, 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, post type current transformerfor Line bay |
| 1B10 | Six(6) nos. of single-phase, 2-core, 245kV, 4000A, 50kA/1sec, 50Hz, 650kVp BIL, post type current transformer for bus coupler bay. |
| 1B11 | Thirty three(33) nos. of single-phase, 3-core, 245kV, 2000A, 50kA/1sec, 50Hz, 650kVp BIL, capacitor type voltage transformers. |
| 1B12 | Twenty seven (27) nos. of 198kV rated voltage, 160kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters. |
| 1B13 | One(1) lot of flexible conductors for bus and jumper, insulators, fittings including all necessary clamps and connectors required for completing 245kV busbar and switchgear connection as specified in the technical specifications and bid drawings. |
| 1B14 | One(1) lot of steel structures for gantry and equipment supports required for completing 145kV busbar and switchgear as specified in the technical specifications and bid drawings. |

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1C 145kV Air Insulated Switchgear (AIS)

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and shall comprise the following:-

- | | |
|------|---|
| 1C1 | Two (2) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for Transformer bay). |
| 1C2 | Four(4) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL, live tank type, single-pole operation, SF6 gas circuit breakers with spring-stored energy operating mechanism (for T/L bay). |
| 1C3 | One (1) set of 145kV, 3000A, 40kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for bus coupler). |
| 1C4 | Six(6) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL,double side break, post type, motor operated disconnectors without earthing switch (for Transformer bay). |
| 1C5 | Eight(8) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch (for T/L bay). |
| 1C6 | Two (2) sets of 145kV, 3000A, 40kA/1sec, 50Hz, 650kVp BIL,double side break, post type, motor operated disconnectors without earthing switch (for bus coupler). |
| 1C7 | Four(4) sets of 145kV, 1600A, 40kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with motor-operated earthing switch (for T/L bay). |
| 1C8 | Six(06) nos. of single-phase, 4-core, 1600/1A, 145kV, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer for Transformer bay |
| 1C9 | Twelve(12) nos. of single-phase, 4-core, 1600/1A,145kV, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer for Line bay |
| 1C10 | Six(6) nos. of single-phase, 2-core,145kV, 3000/1A, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer for bus coupler bay. |
| 1C11 | Twenty Four(24) nos. of single-phase, 3-core, 145kV, 40kA/1sec, 50Hz, 650kVp BIL, capacitor type voltage transformers. |
| 1C12 | Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50 ⁰ c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters. |

1C13 One(1) lot of flexible conductors for bus and jumper, insulators, fittings including all necessary clamps and connectors required for completing 145kV busbar and switchgear connection as specified in the technical specifications and bid drawings.

1C14 One(1) lot of steel structures for gantry and equipment supports required for completing 145kV busbar and switchgear as specified in the technical specifications and bid drawings.

1D 33kV Air Insulated Switches and Connectionfor Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and shall comprise the following:-

1D1 Two(2) sets of 33kV, 630A, 25kA/1sec, 50Hz, 170kVp BIL, vacuum circuit breakers with spring-stored energy operating mechanism.

1D2 Four(4) sets of 33kV, 630A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnectors.

1D3 Fifteen(15) nos. of single-phase, 2-core, 33kV, 25kA/1sec, 50Hz, 170kVp BIL, Inductive Voltage Transformer.

1D4 Fifteen(15) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

1D5 One(1) lot of Tertiary side connection between 33kV terminal to switches including necessary fittings, structures and conductors and XLPE for 400/230/33kV transformer.

1E Power Transformers & Earthing/Auxiliary Transformers

1E1 Three(3)sets of 400/230/33kV, 400/520MVA (ONAN/ONAF), three phase outdoor type power transformers, equipped with 33 kV tertiary winding (brought out to terminal bushings).

1E2 Two (2)sets of 230/132/33 kV, 225/300 MVA (ONAN/ONAF), three phase outdoor type power transformers, equipped with 33 kV tertiary winding (brought out to terminal bushings).

1E3 Two(2) sets 33/0.415 kV, 500kVA three phase outdoor type earthing/auxiliary Zig-Zag transformers without neutral earthing resisters, associated Bushing & outdoor neutral CTs and steel support structures including all necessary connections. The delta connected tertiary windings of two new 400/132/33kV3 phase transformers shall supply the two33/0.415 kV, auxiliary Zig-Zag transformer for the purpose of supplying the substation auxiliary power requirements.

1F Control, Protection, Monitoring, Substation Automation & Metering

400 kV Circuits

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

- 1F1 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuit bays.
- 1F2 Control, Protection & Monitoring and Substation Automation System including event recording function for three(3) sets of 400/230/33kV three phase, auto power transformer circuits including transformer tap changer control, fan control & AVR as per 4.15(N) of section 4 in volume 2 of 3.
- 1F3 One (1) set of Busbar protection for 400kV system
- 1F4 One (1) set of Independent standalone Digital Fault and Disturbance recorder (DFDR) to monitor complete substation including all 400kV shunt reactor bays.
- 1F5 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 400kV line and transformer feeder. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

245kV Circuits

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

- 1F6 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuits bays.
- 1F7 Control, Protection & Monitoring and Substation Automation System including event recording function for two(2) sets of 400/230/33 kV power transformer circuits including transformer tap changer control.

Control, Protection & Monitoring and Substation Automation System including event recording function for three(3) sets of 230/132/33kV three phase, auto power transformer circuits including transformer tap changer control, fan control & AVR as per 4.15(N) of section 4 in volume 2 of 3.

- 1F8 Control, Protection & Monitoring and Substation Automation System including event recording function for one(1) set of bus coupler circuit.
- 1F9 One (1) set of Busbar protection for 132kV system
- 1F10 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 132 kV line and transformer feeder. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

145 kV Circuits

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

- 1F6 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuits bays.
- 1F7 Control, Protection & Monitoring and Substation Automation System including event recording function for two(2) sets of 230/132/33 kV power transformer circuits including transformer tap changer control.
- 1F8 Control, Protection & Monitoring and Substation Automation System including event recording function for one(1) set of bus coupler circuit.
- 1F9 One (1) set of Busbar protection for 132kV system
- 1F10 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 132 kV line and transformer feeder. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

33kV Station Power System

1F11 One (1) lot of Control, Protection & Monitoring and Substation Automation System including event recording function for two 33kV circuits connected between tertiary side of 400/230/33kV Power transformers and two sets of 33/0.415 kV station Auxiliary Transformers.

1F12 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 33 kV transformer feeder. For each feeder minimum two meters (main & check) including one set software and communication cord. Substation Automation System shall include the metering for all the bays. Tariff Metering is to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

1G Multicore Cables

1G1 One(1) lot complete set of multicore low voltage XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided. Necessary Sizing calculation shall have to be submitted for approval during execution stage.

1H Earthing and Lightning Protection

1H1 One(1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

1H2 Two(2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

1I Batteries, Chargers and DC Distribution

1I1 110V substation alkaline batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied.

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

- a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 350Ah at the 5-hour rate of discharge for 400kV switchyard.

- b) Two (2) sets of 100% batteries complete, each capacity shall not be less than 300Ah at the 5-hour rate of discharge for 230kV switchyard (and for future 230kV Switchyard).
- c) Two (2) sets of 100% batteries complete, each capacity shall not be less than 300Ah at the 5-hour rate of discharge for 132kV switchyard (and for future 230kV Switchyard).

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per clause 8.4.3 of section 8 of Volume 2 of 3 of the bidding document. The battery with higher capability if required after calculation shall be supplied by the Contractor within the same Contract price.

- d) Two (2) sets of battery chargers complete, each float charge shall not be less than 120A rating for 400kV switchyard.
- e) Two (2) sets of battery chargers complete, each float charge shall not be less than 100A rating for 230kV switchyard.
- f) Two (2) sets of battery chargers complete, each float charge shall not be less than 100A rating for 132kV switchyard.

The charger rating shall be based on the load & boost charging rate and during execution stage after calculation if the higher charging charger is found to be required, it shall be supplied by the Contractor within the same Contract price.

- g) One(1) lot of DC distribution board. The DC distribution board shall be with overall spare switches for future use.

Two (2) sets of batteries and battery chargers shall be located in the 400kV #1 local control house and shall be used for first main and second main DC supplies for 400kV switchyard.

Two (2) sets of batteries and battery chargers shall be located in the 230kV #1 local control house. One set shall be used for DC supplies for 230kV switchyard and the other set shall be used for standby (emergency) DC supplies for 230kV switchyard.

Two (2) sets of batteries and battery chargers shall be located in the 132kV #1 local control house. One set shall be used for DC supplies for 132kV switchyard and the other set shall be used for standby (emergency) DC supplies for 132kV switchyard.

- (h) Two (2) sets of Inverter for SAS from 110V DC system having rating of 3kVA.

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

- 112 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 and protection. One set shall be used as standby supply.

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

- (a) Two(2) sets of 100% batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays as per clause 8.4.3 of section 8 of Volume 2 of 3 of the bidding document. The battery with higher capability if required after calculation shall be supplied by the Contractor within the same Contract price.

- (b) Two(2) sets of battery chargers of output 48V DC, 100A and input voltage three phase 50Hz, 415 V AC.

The charger rating shall be based on the load & boost charging rate and during execution stage after calculation if the higher charging charger is found to be required, it shall be supplied by the Contractor within the same Contract price.

- (c) One(1) lot 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 equipments hall be located in the Main Control Building.

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

1J LVAC Distribution

- 1J1 One(1) lot of LVAC switchboard for substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

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

- 1J2 One(1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVARmeters (accuracy class 0.2) for three 33/0.415 kV station auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check) shall have to supplied.

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weather-proof3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

1K Civil Works, Building and Foundation

- 1K1 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, septic tank, surfacing, drainage, fences, guard house, boundary wall, etc.

- 1K2 One(1) lot of complete design, supply and construction of all civil items and facilities required for the three storied main control building, one new storied local control houses in 400kV switchyard one new one storied local control house in the 132kV switchyard.

- 1K3 One (1) lot of complete design, supply and construction of firefighting system for transformers including water pipe network and reservoir at normal pressure. Necessary Sizing calculation shall have to be submitted for approval during execution stage.

1L Lighting, Small Power, Air Conditioning and Ventilation

- 1L1 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 system for the main control building and local control houses. Necessary Sizing calculation shall have to be submitted for approval during execution stage.

- 1L2 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light; sodium/mercury) for security, roadway, switchyard and emergency DC lighting system at strategic locations for equipment operation and inspection.Necessary Sizing calculation shall have to be submitted for approval during execution stage.

1M Fibre Optic Multiplexer Equipment for Communication and Protection

1M1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay (main and back-up) for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Hot-line telephone system

1M2 Underground optical fibre cables (48 cores for 400kV and 48 cores for 230kV and 24cores for 132kV switchyard) from terminal box gantry structure at each 400kV & 230KV & 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

1M3 PLC Equipment:

The equipment to be supplied, installed and commissioned shall be as per the SLD.
The scope of supply is summarised as follows:-

400kV

4 sets:- Indoor PLC equipment including tele-protection at PEKUA for (direction Matarbari 1 & 2 and Bashkhali 1 & 2) 400 kV line.

12 nos.:- line matching units for phase to phase circuit coupling for 400kV lines.

Additionally, if any Interfaces are required for system configuration at each remote end substation, then interface devices shall be installed in each existing system as a lot.

1N SCADA system for Telecontrol and Telemetry

1N1 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 Center(NLDC) at Rampura for integration of complete

new 400/132kV 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 60870-5-101 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Section-II Shunt Reactor & Associated works

Shunt Reactor and associated bay considering for 400KV lines The clause related to change of facilities (no. 39 of General Condition of Contracts-GCC) shall not be applicable for the works under this section-III.]

2A Works and Equipment for Shunt Reactor Installation

The works for shunt reactor shall comply with Section 16 of the Technical Specification and the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and shall comprise the following:-

- 2A1 Four (4) sets of 420 kV, Size: 25MVAR (only for Bid purpose, the final size shall be as per the EMTP study to be done by the Contractor) (ONAN), three phase outdoor type Shunt Reactor as specified in the technical specifications of this Section.
- 2A2 Four (4) sets of 420kV, 800A, 50kA/1sec, 50Hz, 1425kVp BIL, live tank type, gang operated, SF6 gas circuit breakers with spring-stored energy operating mechanism capable of reactor switching as specified in the technical specifications, Section 3, Volume 2 of 3 of the Bidding Document.
- 2A3 Four (4) sets of 420kV, 800A, 50kA/1sec, 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors without earthing switch as specified in the technical specifications, Section 3, Volume 2 of 3 of the Bidding Document.
- 2A4 Control, Protection, Monitoring & Substation Automation System including event recording function for four (4) sets of Shunt Reactor line circuits as specified in the technical specifications and bid drawings of Volume 2 of 3 of the Bidding Document
- 2A5 One (1) lot of rigid tubular bus [Aluminium of grade 63401 WP], flexible conductors, insulators, fittings including all necessary clamps and connectors required for completing 420kV busbar and switchgear connection for Shunt Reactor bay as specified in the technical specifications and bid drawings of Volume 2 of 3 of the Bidding Document

- 2A6 One (1) lot of steel structures for gantry, equipment supports and civil works required for completing 420kV busbar and switchgear for Shunt Reactor bay as specified in the technical specifications and bid drawings of Volume 2 of 3 of the Bidding Document.

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

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment is 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 storeas per instruction of the Engineer.

SCHEDULE B

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)

[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]

SCHEDULE B

BID PRICES

SB-1

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILLO Lines on turnkey basis(Package-1)

[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]

SCHEDULE B (PRICE SCHEDULES)

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows & added in Section 4 of Volume 1:

Schedule No. B1: Plant Supplied from outside the Employer's Country .

Schedule No. B2: Plant Supplied from within the Employer's Country.

Schedule No. B3: Design Services(Not applicable)

Schedule No. B4: Installation & other services.

Schedule No. B5: Summery of price schedule

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.

SCHEDULE B

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.

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.

SCHEDULE B

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

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)

[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]

SCHEDULE C

TIMES FOR DELIVERY AND COMPLETION

The individual dates are all contractually binding.

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

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

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

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

Site	A* Latest Access Permitted	B* Guaranteed Arrival of first shipment	C* Guaranteed Completion	D* Target Completion
Gopalganj 400/132kV S/s	7 days from the date of signing of the Contract	20		

* Time in months, after contract effective date.

Preliminary SLD, overall layout and control building drawings of the Technical Specification shall be provided within 2.0 months of the contract commencing date with final drawings following one month later.

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at
Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey
basis(Package-1)**

**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE D**

MANUFACTURERS, PLACES OF MANUFACTURE AND TESTING

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated.

Bidders are free to propose more than one for each item.

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
1	420 kV AIS SWITCHGEAR Steel Structure Circuit Breaker Disconnecter • Main part • PI Instrument Transformer • CT • CVT Surge Arrester Wave Trap			
2	245 kV AIS SWITCHGEAR Steel Structure Circuit Breaker Disconnecter			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
3	• Main part • PI			
	Instrument Transformer			
	Surge Arrester			
	145 kV AIS SWITCHGEAR			
	Steel Structure			
	Circuit Breaker			
	Disconnecter			
	• Main part • PI			
	Instrument Transformer			
	Surge Arrester			
4	33kV AIS SWITCHGEAR			
	Steel Structure			
	Circuit Breaker			
	Disconnecter			
	Instrument Transformer			
	CT			
	IVT			
	Surge Arrester			
	400/230/33 kV POWER TRANSFORMERS			
	Complete			
5	230/132/33 kV POWER TRANSFORMERS			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
6	Complete			
	33/0.415 kV EARTHING /AUXILIARY TRANSFORMERS			
	Complete PROTECTION METERING AND CONTROL			
	Panels			
	Instruments			
	Protective relays			
	Substation automation system			
7	Meters			
	Transducers			
8	DFDR			
9	Metering Panel			
10	Tariff meter			
11	FLEXIBLE CONDUCTOR, RIGID TUBULAR BUS			
	420kV			
	Rigid Tubular Bus			
	Flexible Conductor			
	Insulator			
11	Fittings and Clamps			
	245kV			
11	Flexible Conductor			

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
12	Insulator			
	Fittings and Clamps			
	145kV			
	Flexible Conductor			
	Insulator			
13	Fittings and Clamps			
	Fire Fighting system			
	DC EQUIPMENT			
14	Batteries			
	Chargers			
	Distribution Boards			
15	415 V AC DISTRIBUTION BOARD			
	Inverter System with panel			
16	MULTICORE CABLES			
	XLPE Insulated Cables			
	Cable trays			
17	EARTHING			
	Mesh conductor			
	Insulated copper Conductor			
18	Earthing rod			
	FIBRE OPTIC MULTIPLEXER EQUIPMENT			

Schedule D: Manufactures, place of manufacture and testing

Item	Description	Proposed Subcontractors/ Manufacturers	Place of Manufacture	Place of Testing and Inspection
19	POWER LINE CARRIER PLC Terminal unit Line traps Line Matching unit Co-Axial cable Tele-protection equipment			
20	SITE ERECTION AND COMMISSIONING BY CIVIL WORKS			
21	Design to be performed by:- Constructed by:-			

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)

**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE E**

TECHNICAL PARTICULARS AND GUARANTEES

General

400kV, 230KV, 132kV and 33kV AIR INSULATED SWITCHGEAR (AIS)

PART 1 - SWITCHGEAR

1.1 HV OUTDOOR CIRCUIT BREAKERS

Sl. No.	Description	Unit	Bidders Data			
			420kV	230kV	145kV	36kV
1	Manufacturer					
2	Type		Outdoor, SF ₆ insulated, live tank type			
	Model Reference (Manufacturer's designation)					
	Standard					
3	Number of Poles					
4	Rated Voltage		420	230	132	33
5	Rated frequency					
6	Rated normal current-feeder/transformer/bus coupler (As per schedule A scope of work)	A				
7	Rated breaking currents: Line charging Cable charging Small inductive	kA rms				
8	Rated short-circuit breaking current	kA,rms				
9	First pole to clear factor		1.3	1.3	1.5	1.5
10	Rated transient recovery voltage for terminal faults if other than standard	kV				
11	Rated characteristics for short-line faults					

Sl. No.	Description	Unit	Bidders Data			
			420kV	230kV	145kV	36kV
12	Rated short-circuit making current	kA	158	125	100	62.5
13	Rated operating sequence		O-0.3s-CO-3min-CO (Single phase & Three phase auto-reclosing)			
14	Rated duration of short-circuit	s	1	1	1	1
15	Rated out of phase breaking current	kA				
16	Rated opening time	ms				
17	Rated break time	ms				
18	Rated closing time	ms				
19	Maximum arcing time of any duty cycle to IEC 56	ms				
20	Is circuit-breaker re-strike free	Yes/No				
21	Test Authority					
22	Test Certificate ref.					
23	Rated short time withstand current	kA	63	50	40	25
24	Rated duration of short-circuit	s	1	1	1	1
25	Rated peak withstand current	kA				
26	Rated insulation levels:-					
26.1	Lightning impulse withstand to earth	kV pk	1425		650	
	(wave shape 1.2/50µs)					
26.2	Lightning impulse withstand across open contacts (wave shape 1.2/50µs)	kV pk	1425 (+240) kV		750	
26.3	Power frequency voltage withstand to earth	kV rms	520		275	
26.4	Power frequency voltage withstand across open contacts	kV rms	610		315	
27	Rated supply pressure of gas for interruption	MPa (g)				
28	Limits for correct operation max min	MPa (g) MPa (g)				
29	Frequency of operation	yr ⁻¹				
30	Operating mechanism Manufacturer					
31	Mechanism Type:		Spring	Spring	Spring	Spring
32	Trip free/or fixed trip					
33	Is lockout facility fitted?					

Sl. No.	Description	Unit	Bidders Data			
			420kV	230kV	145kV	36kV
34	Closing supply Volts Amps max/min	V A				
35	Rated supply voltage of shunt opening release	V				
36	Current required at rated supply voltage to open circuit-breaker	A				
37	Spring charging motor - Current - Voltage AC/DC	A V				
38	Number of auxiliary switch contacts - normally open - normally closed - adjustable		12 12 1	12 12 1	12 12 1	8 8 1
39	Other auxiliary loads: Voltage: Current:					
40	Degree of Protection for (a) auxiliary circuits (b) moving parts		IP55	IP55	IP55	IP55
41	Minimum clearances in air: (a) between phases (b) phases to earth (c) across interrupters (d) live parts to ground level	mm mm mm mm				
42	Minimum creepage (a) to earth (b) across interrupter terminals	mm mm				
43	Radio interference voltage	µV				
44	Guaranteed maximum gas leakage	% per annum				
45	Number of interrupters per pole					
46	Material of interrupter chamber					
47	Wall thickness of interrupter chamber	mm				
48	Material of contact surfaces primary arcing					
49	Length of each break	mm				
50	Length of stroke	mm				
51	Operating rod for moving contact(s) material dimensions, etc.					
52	Weight of circuit-breaker unit complete	kg				
53	Maximum shock load imposed on floor or foundations when opening under fault conditions (state whether tension or compression)	kg				

Sl. No.	Description	Unit	Bidders Data			
			420kV	230kV	145kV	36kV
54	Quantity of gas in complete three-phase circuit breaker					
55	Maximum pressure rise in circuit breakers due to the making or breaking of rated current					
56	Routine pressure test on circuit-breaker tanks or containers					
57	Pressure type test on circuit-breaker tanks or containers					
58	Interrupting gas pressure at 20°C Normal					
59	Limits of gas pressure at 20°C Maximum Minimum					
60	Period of time equipment has been in commercial operation					
61	Number of the same type of circuit breakers supplied to date					
62	Pre insertion Resistor (PIR) for 400kV	OHM				
63	Pre insertion time	ms				

1.2 DISCONNECTORS AND EARTHING SWITCHES

Sl. No.	Description	Unit	Bidders Data			
			420kV	245KV	145kV	36kV
1	Manufacturer					
2	Type Number					
3	Operating type					
	(a) horizontal/vertical break					
	(b) Pantograph					
	(c) Number of support insulation for pole					
	(d) Number of breaks per pole					
	(e) Material of contact surfaces					
	(f) Type of Contacts					
4	Rated normal current	A				
5	Rated short time withstand current	kA, rms				
6	Rated duration of short time current	s				
7	Rated peak withstand current	kA pk				
8	Rated insulation levels:					
8.1	Lightning impulse withstand to earth (waveshape: 1.2/50µs)	kV pk				

Sl. No.	Description	Unit	Bidders Data			
			420kV	245KV	145kV	36kV
8.2	Lightning impulse withstand across open contacts (waveshape: 1.2/50µs)	kV pk				
8.3	Power frequency voltage withstand to earth	kV rms				
8.4	Power frequency voltage withstand across open contacts	kV rms				
9	Contact Resistance					
10	Method of operation					
11	Type of operating mechanism manual/power					
12	Operating power					
13	Voltage/pressure rated max min	V/MPa(g) V/MPa(g) V/MPa(g)				
14	Auxiliary Consumption	A				
15	Operating time: open max min	ms ms				
16	Operating time: close max min	ms ms				
17	Manual operating torque	kNm				
18	Load switching capability Inductive Capacitive	A				
19	Mechanical Terminal Load	N				
20	Insulator Creepage	mm				
21	Radio interference voltage	mV				
22	Number of auxiliary switches - normally open - normally closed - adjustable					
23	Other auxiliary loads - voltage - current					
	Mechanical endurance:					
24	Number of operations carried out for mechanical operation test					
25	Degree of protection for 1) auxiliary circuits 2) moving parts					
26	Total weight of three pole disconnector complete	kg				
27	Type test certificate date/reference					

Sl. No.	Description	Unit	Bidders Data			
			420kV	245KV	145kV	36kV
28	Period of time equipment has been in commercial operation					
29	Number of the same type of disconnectors supplied to date					

1.3 CURRENT TRANSFORMERS

Sl. No.	Description	Unit	Bidders Data			
			420kV	245KV	145kV	36kV
1	Manufacturer/type					
2	Rated primary current	A rms				
3	Rated secondary current	A rms				
4	Rated frequency	Hz				
5	Highest voltage for equipment	kV				
6	Rated insulation level - primary winding	kV				
7	Lightning impulse withstand	kV pk				
8	(a) Power frequency withstand (dry) (b) Power frequency withstand (wet)	kV rms kV rms				
9	Insulator creepage (phase to earth)	mm				
10	Electrical dissipation factor at power frequency test voltage					
11	Radio influence voltage measured at $U/\sqrt{3}$ 1 MHz	μV				
12a 12b	Rated short term thermal current for 1s Rated short term thermal current for 3s	A rms A rms				
13	Rated dynamic current	kA pk				
14	Insulation class					
15	Number of secondary windings					
	Location of core					
	Core 1 Rated output Accuracy class * Accuracy limit factor Resistance ^a					
	Core 2 Rated output Accuracy class * Accuracy limit factor Resistance ^a					
	Core 3 Rated output Accuracy class * Accuracy limit factor Resistance ^a					
	Core 4 Rated output Accuracy class * Accuracy limit factor Resistance ^a					

	Class X winding: - Rated knee point emf - Exciting current - Resistance ^a *including instrument security factor where applicable	V A				
16	Is earth screen fitted between primary and secondary windings					
17	Maximum cantilever strength	Nm				
18	Type test certificate ref/date					

a. Preliminary value. Actual shall be as per Detail Engineering during execution

1.4 VOLTAGE TRANSFORMERS

Sl. No.	Description	Unit	Bidder's Data			
			420kV	245KV	145kV	36kV
1	Manufacturer	-				
2	Type No.	-				
3	Transformer type	-				
4	Rated primary voltage	kV rms				
5	Rated Impedance					
6	Rated secondary voltage for each secondary winding	kV rms				
7	Accuracy class for each winding Rated output for each winding	VA				
8	Rated voltage factor					
9	Type of Insulation					
10	Maximum temperature rise	°C				
11	Short-circuit withstand capability	kA rms				
12	Primary insulation					
12.1	Lightning impulse withstand dry	kV pk				
12.2	(a) Power frequency withstand wet (b) Power frequency withstand dry	kV rms kV rms				
13	Partial discharge magnitude	pC				
14	Total external creepage distance	mm				
15	Radio influence voltage measured at 1.1 Um/√3 at 1 MHz	μV				
16	Total installed weight	kg				
17	Capacitance					
17.1	High voltage capacitance (C1)	pF				
17.2	Intermediate - voltage capacitance (C2)	pF				
17.3	Total Capacitance (C _T)	pF				
18	Open circuit intermediate voltage	kV				
19	Rated open-circuit intermediate voltage	kV				
20	Reference range of frequency	+/- Hz				
21	Reference range of temperature	°C				

Sl. No.	Description	Unit	Bidder's Data			
			420kV	245KV	145kV	36kV
22	No. of Protective devices to limit overvoltage & location					

1.5 SURGE ARRESTERS

Sl. No.	Description	Unit	Bidder's Data			
			420kV	245KV	145kV	36kV
1	Manufacturer					
2	Model Number					
3	Type:					
4	Applicable Standard					
5	System Earthing					
6	Rated Frequency					
7	Rated system voltage					
8	Highest system voltage					
9	Continuous operating voltage	kV rms				
10	Rated voltage	kV rms				
11	Standard nominal discharge current	kA				
12	Reference current at ambient temperature	mA				
13	Reference voltage for above item no. 7	kV rms				
14	Currents at MCOV					
15	Residual Voltage					
16	Steep current impulse residual voltage	kV pk				
17	Protective Ratio					
18	Lightning impulse residual voltage at 5kA 10kA 20kA	kV pk kV pk kV pk				
19	Duty Class					
20	Discharge class					
21	Pressure relief class					
22	Minimum Energy Discharge Capability					

23	Temporary Over Voltage Capability at 0.1s 1s 10s 100s					
24	Nominal diameter of resistor blocks	mm				
25	Number of resistor blocks connected electrically in parallel					
26	Number of separately housed units per phase					
27	Overall height of arrester (without supporting structure)	m				
28	Overall height of arrester including grading ring if applicable	mm				
29	Clearances: phase to earth (from centre line) phase to phase (centre line to centre line)	mm mm				
30	Overall Weight of arrester (without supporting structure)	kg				
31	Maximum cantilever strength	Nm				
32	Maximum force due to wind (at maximum specified gust speed)	Nm				
33	Minimum creepage distance over insulator housing	mm				
34	Insulator shed profile - Reference Document					
35	Terminal palm details - Drawing No.					
36	Earthing terminal - Drawing No.					
37	Type & Description of surge monitoring device					
38	Type test certificate ref/date					
39	Number of the same type of surge arresters supplied to date					

PART 2 – TRANSFORMERS

2.1 400/230/33 kV, 400/520MVA, 3-PHASE POWER TRANSFORMER:

Sl. No.	Description	Unit	Bidder's data
1.1	Name of the Manufacturer		
1.2	Type/Model		
2.1	Continuous Rating - ONAN ONAF		
2.2	Voltage ratio at no-load HV/LV	kV	
3	Tap Changer		
3.1	HV Tap Changer (On load type) Tapping Range		
3.2	Size of tapping step		
3.3	No. of Steps		
4	Vector Group		
5	On-load voltage control equipment:		
	A) Type. B) Manufacturer C) Range D) Size of steps E) Rated Through Current F) Rated Short time withstand current & duration G) Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts H) Type test certificate reference	% % A kA/s	
6	Type of cooling		
7	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement	°C	
8	Top oil temperature under service conditions stated in Schedule of Technical Requirement (A) CMR (B) ONAN rating	°C °C	
9	Maximum hot spot temperature rise in core at rated power	°C	

Sl. No.	Description	Unit	Bidder's data
10	Maximum hot spot temperature rise in copper at rated power	°C	
11	Temperature gradient at rating specified	°C	
12	Flux density in iron at normal voltage and frequency and at normal ratio - (no load) (A) Cores (B) Yokes (C) Volts/turn	Tesla Tesla V	
13	Magnetising current (approx) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage at 1.1 x nominal voltage at 1.2 x nominal voltage	% % % %	
14	Harmonic component of magnetising current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	% %	
15*	No-load loss (excluding cooling plant losses) at rated voltage, ratio and frequency	kW	
16*	Copper loss (excluding cooling plant losses) at 75°C and at rated voltage, ratio (nominal tap),frequency	kW	
17*	Auxiliary loss (Total power input to fans for operation of total installed cooling capacity)	kW	
18	Total loss at 75°C and normal ratio (Sl. No.15+16+17)	kW	
19	Regulation at 75°C and normal ratio - (A) At unity power factor % (B) At 0.8 lagging power factor	% %	
20	(i) Impedance voltage at 75°C and CMR between HV & LV windings (A) At extreme minus tap normal tap extreme plus tap (B) Maximum Impedance over tapping range. Corresponding tap	% % % %	

Sl. No.	Description	Unit	Bidder's data
	(C) Minimum Impedance over tapping range. Corresponding tap	%	
	(ii) Impedance voltage at 75°C and CMR between HV & LV at normal tap.		
21	Equivalent circuit zero sequence impedance: HV-LV	%	
22	Maximum current density in windings at C.M.R. (A) HV winding (B) LV winding (C) SV winding	A/mm ² A/mm ² A/mm ²	
24	Noise level	dB	
25	Types of transformers (shell or core)		
26	Core steel (a) Type (b) Grade		
27	Types of winding - (A) HV (B) LV		
28	Insulation of (a) HV windings (b) LV windings		
29	Insulation of - (A) Yoke bolts (B) Side plates		
31	Safe working temperature of core plate insulation	°C	
32	Winding connections brazed or crimped		
33	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding	kN N/m ²	
34	Is facility provided for adjustment of axial pressure on windings	Yes/No	
35	Thickness of transformer tank (A) Sides (B) Bottom	mm mm	
36	Material used for gaskets for oil tight joints		
Radiators, Valves, Fans			
37	Thickness of radiator plates	mm	

Sl. No.	Description	Unit	Bidder's data		
38	Valve type/material: (A) 100mm and below (B) Above 100mm				
39	Equipment for ONAF + cooling state (A) – (A) Radiators on main tank				
40	Number of coolers/radiators or cooler banks per transformer				
41	Number of air blowers per transformer				
42	Speed of air blowers	rpm			
43	Rating of each air blower motor	kW			
44	Rated Current air each blower motor	A			
45	Starting current of each air blower motor	A			
Oil Volumes and Weights**					
46	Total oil required including cooler system	litres			
47	Volume of oil to fill transformer to above the top yoke	litres			
48	Total volume of conservator	litres			
49	Weight of active copper	tonnes			
50	Weight of active iron in core	tonnes			
51	Weight of core and winding assembly	tonnes			
52	Weight of each cooler bank complete with oil if mounted separately from transformer	tonnes			
53	Total weights of complete transformers, including attached coolers, voltage regulating equipment, all fittings and oil	tonnes			
54	Weight of transformer arranged for transport	tonnes			
55	Manufacture, type and class of oil to IEC 60296				
	Transformer Parts Subject To Short-Circuit Test				
56	Brief description of transformer or parts thereof subjected to short-circuit test				
	Transformer Bushing Insulators		420kV	145kV	36kV

Sl. No.	Description	Unit	Bidder's data		
57	Manufacturer				
58	Insulator material (solid, oil-paper etc)				
59	Maker's type reference and rated voltage				
60	Rated current				
61	BCT particulars				
	i) HV Side: Core 1,2 & Core 3: ii) LV Side: Core 1,2 & Core 3: iii) Neutral: Core 1:				
62	Manufacturer of porcelain	mm			
63	Length of insulator (overall)	kg			
64	Weight of insulator	pF			
65	Electrostatic capacity of complete bushings				
66	Dry lightning impulse voltage withstand (1.2/50 wave)	kV			
67	50Hz wet withstand voltage without arcing horns	kV			
68	Total creepage distance of outdoor shedding	mm			
69	Protected creepage distance of shedding	mm			

* Guaranteed values subject to deduction from Contract Price

**These values are required for Foundation design & shipping purpose only. During detail design, these values may vary from Bid value due to attaining desired electrical output.

2.2 400/230/33 kV, 390/520MVA, 3-PHASE POWER TRANSFORMER:

Sl. No.	Description	Unit	Bidder's data
1.1	Name of the Manufacturer		
1.2	Type/Model		

Sl. No.	Description	Unit	Bidder's data
2.1	Continuous Rating - ONAN ONAF		
2.2	Voltage ratio at no-load HV/LV	kV	
3	Tap Changer		
3.1	HV Tap Changer (On load type) Tapping Range		
3.2	Size of tapping step		
3.3	No. of Steps		
4	Vector Group		
5	On-load voltage control equipment:		
	I) Type. J) Manufacturer K) Range L) Size of steps M) Rated Through Current N) Rated Short time withstand current & duration O) Power frequency withstand test voltage (BS.4571) - between first and last contacts of the selector switch - between any two adjacent contacts of the selector - between open diverter switch contacts P) Type test certificate reference	% % A kA/s	
6	Type of cooling		
7	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement	°C	
8	Top oil temperature under service conditions stated in Schedule of Technical Requirement (A) CMR (B) ONAN rating	°C °C	
9	Maximum hot spot temperature rise in core at rated power	°C	
10	Maximum hot spot temperature rise in copper at rated power	°C	
11	Temperature gradient at rating specified	°C	
12	Flux density in iron at normal voltage and frequency and at normal		

Sl. No.	Description	Unit	Bidder's data
	ratio - (no load) (A) Cores (B) Yokes (C) Volts/turn	Tesla Tesla V	
13	Magnetising current (approx) at nominal ratio and at 0.9 x nominal voltage at 1.0 x nominal voltage at 1.1 x nominal voltage at 1.2 x nominal voltage	% % % %	
14	Harmonic component of magnetising current at rated voltage as percentage of fundamental (A) Fifth harmonic (B) Seven harmonic	% %	
15*	No-load loss (excluding cooling plant losses) at rated voltage, ratio and frequency	kW	
16*	Copper loss (excluding cooling plant losses) at 75°C and at rated voltage, ratio (nominal tap),frequency	kW	
17*	Auxiliary loss (Total power input to fans for operation of total installed cooling capacity)	kW	
18	Total loss at 75°C and normal ratio (Sl. No.15+16+17)	kW	
19	Regulation at 75°C and normal ratio - (A) At unity power factor % (B) At 0.8 lagging power factor	% %	
20	(i) Impedance voltage at 75°C and CMR between HV & LV windings (A) At extreme minus tap normal tap extreme plus tap (B) Maximum Impedance over tapping range. Corresponding tap (C) Minimum Impedance over tapping range. Corresponding tap (iii) Impedance voltage at 75°C and CMR between HV & LV at normal tap.	% % % % % %	
21	Equivalent circuit zero sequence impedance: HV-LV	%	
22	Maximum current density in windings at C.M.R. (A) HV winding	A/mm ²	

Sl. No.	Description	Unit	Bidder's data
	(B) LV winding (C) SV winding	A/mm ² A/mm ²	
24	Noise level	dB	
25	Types of transformers (shell or core)		
26	Core steel (a) Type (b) Grade		
27	Types of winding - (A) HV (B) LV		
28	Insulation of (a) HV windings (b) LV windings		
29	Insulation of - (A) Yoke bolts (B) Side plates		
31	Safe working temperature of core plate insulation	°C	
32	Winding connections brazed or crimped		
33	For fault with zero impedance external to the transformer and infinite system (a) Maximum axial force (b) Maximum tensile stress in winding	kN N/m ²	
34	Is facility provided for adjustment of axial pressure on windings	Yes/No	
35	Thickness of transformer tank (A) Sides (B) Bottom	mm mm	
36	Material used for gaskets for oil tight joints		
	Radiators, Valves, Fans		
37	Thickness of radiator plates	mm	
38	Valve type/material: (A) 100mm and below (B) Above 100mm		
39	Equipment for ONAF + cooling state (A) – (A) Radiators on main tank		
40	Number of coolers/radiators or cooler banks per transformer		
	Number of air blowers per		

Sl. No.	Description	Unit	Bidder's data		
41	transformer				
42	Speed of air blowers	rpm			
43	Rating of each air blower motor	kW			
44	Rated Current air each blower motor	A			
45	Starting current of each air blower motor	A			
Oil Volumes and Weights**					
46	Total oil required including cooler system	litres			
47	Volume of oil to fill transformer to above the top yoke	litres			
48	Total volume of conservator	litres			
49	Weight of active copper	tonnes			
50	Weight of active iron in core	tonnes			
51	Weight of core and winding assembly	tonnes			
52	Weight of each cooler bank complete with oil if mounted separately from transformer	tonnes			
53	Total weights of complete transformers, including attached coolers, voltage regulating equipment, all fittings and oil	tonnes			
54	Weight of transformer arranged for transport	tonnes			
55	Manufacture, type and class of oil to IEC 60296				
	Transformer Parts Subject To Short-Circuit Test				
56	Brief description of transformer or parts thereof subjected to short-circuit test				
	Transformer Bushing Insulators		420kV	145kV	36kV
57	Manufacturer				
58	Insulator material (solid, oil-paper etc)				
59	Maker's type reference and rated voltage				
60	Rated current				
61	BCT particulars				
	iii) HV Side:				

Sl. No.	Description	Unit	Bidder's data		
	Core 1,2 & Core 3: iv) LV Side: Core 1,2 & Core 3: iii) Neutral: Core 1:				
62	Manufacturer of porcelain	mm			
63	Length of insulator (overall)	kg			
64	Weight of insulator	pF			
65	Electrostatic capacity of complete bushings				
66	Dry lightning impulse voltage withstand (1.2/50 wave)	kV			
67	50Hz wet withstand voltage without arcing horns	kV			
68	Total creepage distance of outdoor shedding	mm			
69	Protected creepage distance of shedding	mm			

2.3 33/0.415 kV EARTHING/AUXILIARY TRANSFORMERS

Sl. No.	Description	Unit	Bidder's Data
1	Rated short time (10 second) current at neutral	A	
2	Current density in the interconnected star winding at rated short time current	A/mm ²	
3	Current density in the interconnected star winding -at CMR and -10 second fault rating simultaneously	A/mm ² A/mm ²	
4	Maximum flux density in core iron at normal voltage and frequency	Tesla	
5	CMR of lower voltage star winding	kVA	
6	No load losses	kW	
7	Load losses at 75°C at CMR of lower voltage winding	kW	
8	Impedance voltage at CMR of lower voltage winding between HV and LV winding	%	

9	Total range of variation of off load ratio ratio Size of step	plus % minus %	
10	Resistance of higher voltage winding at 75°C	ohms per phase	
11	Zero phase sequence impedance at 75°C with LV windings open circuited	ohms per phase	
12	Total oil required	litres	
13	Weight of complete transformer (including oil)	tonnes	
14	Height from base to bottom of neutral bushing insulator	mm	

PART-3

3.1 XLPE POWER CABLES

(Schedule to be completed if manufacture not to BS.6346)

Sl. No.	Description	Unit	Bidder's Data
			33 kV
1	Manufacturer		
2	Type		
3	Rated system voltage	kV	
4	Max. permissible system voltage	kV	
5	Rated frequency	Hz	
6	Max. operating current	A	
7	No. of cable		
8	Nominal cross sectional area	mm ²	
9	Impulse withstand voltage	kV	
10	Power frequency withstand voltage	kV	
11	Shape of conductor		
12	Nominal cross section of Cu-screen	mm ²	
13	Thickness of outer sheath	mm	
14	Insulation thickness	mm	
15	Min. bending radius	D	
16	Max. pulling force		
17	Max. DC resistance at 20°C	ohm/km	
18	Max. AC resistance at 20°C	ohm/km	

Sl. No.	Description	Unit	Bidder's Data
			33 kV
1	Manufacturer		
19	Max. reactance in single configure	mH/km	
20	Operating capacitance	μF/km	
21	Charging current (phase)	A	
22	Charging load (phase)	A	
23	Earth fault current	kA	
24	Short circuit rating for 1 sec	kA	
25	Three phase symmetrical fault current for 1 sec	kA	
26	Current rating	kA	
	- in soil	A	
	- in air	A	
27	standard		

3.2 AUXILIARY POWER AND MULTICORE CONTROL CABLES

Item		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of core																
Core section	mm ²															
Core diameter	mm															
Conductor insulation	mm															
Type of filler																
Type of tape																
Sheath thickness	mm															
Sheath outer diameter	mm															
Armour wires	no.															
Armour wires diameter	mm															
Outer covering	type															
Outer covering thickness																
Completed cable:																
diameter	mm															
weight per metre	kg															
maximum drum length	m															
Minimum installed bending radius	mm															
Maximum conductor temperature	°C															

PART 4 - DC EQUIPMENT

4.1 110 V BATTERIES AND CHARGERS

Sl. No	Description	Unit	Bidder's Data		
	Battery		For 400kV System	For 230kV System	For 132kV System
1	Manufacturer				
2	Type				
3	Electrolyte				
4	Nominal voltage	V			
5	Capacity at 5 hour rate	Ah			
6	Number of cells				
7	Float voltage per cell	V			
8	Boost voltage per cell	V			
9	Battery voltage at end of the duty cycle	V			
10	Normal charging rate	A			
11	Maximum charging rate	A			
12	Ampere-hour efficiency at five hour rate	%			
13	Ampere-hour efficiency at one hour rate	%			
14	Dimensions of cells	mm			
15	Dimensions of battery complete	mm			
16	Weight of cell complete with electrolyte	kg			
17	Internal resistance per cell when fully charged	ohms			
18	Material of battery case				
	Charger				
19	Manufacturer				
20	Type				
21	AC input voltage and range	V			
22	DC output of charger	kW,A			
23	Type of DC voltage control				
24	Range of DC voltage	V			
25	Output current sharing facility (for parallel operation of chargers)				
26	Regulation	%			
	Charger Cubicle Complete				
27	Manufacturer				
28	Overall dimensions	mm			
29	Total weight	Kg			
	DC Switchboard				
30	Manufacturer				
31	Type				
32	Busbars:				
	- maximum current rating	A			
	- dimensions	mm			
33	Boost charge contactors:				
	- manufacturer				
	- maximum current rating				

Sl. No	Description	Unit	Bidder's Data		
	- coil rating				
	- method of interlocking				
34	Alarm relays:				
	- manufacturer				
	- type and reference				
	- power consumption:				
	a) quiescent	A			
	b) operating	mA			
35	Number and rating of distribution circuits				
36	Overall dimensions	mm			
37	Total weight	kg			

4.2 48 V BATTERIES AND CHARGERS

Sl. No	Description	Unit	Bidder's Data
	Battery		
1	Manufacturer		
2	Type		
3	Electrolyte		
4	Nominal voltage	V	
5	Capacity at 5 hour rate	Ah	
6	Number of cells		
7	Float voltage per cell	V	
8	Boost voltage per cell	V	
9	Battery voltage at end of the duty cycle	V	
10	Normal charging rate	A	
11	Maximum charging rate	A	
12	Ampere-hour efficiency at ten hour rate	%	
13	Ampere-hour efficiency at one hour rate	%	
14	Dimensions of cells	mm	
15	Dimensions of battery complete	mm	
16	Weight of cell complete with electrolyte	kg	
17	Internal resistance per cell when fully charged	ohms	
18	Material of battery case		
	Charger		
19	Manufacturer		
20	Type		
21	AC input voltage and range	kVA	
22	DC output of charger	kW	
23	Type of DC voltage control		
24	Range of DC voltage	V	
25	Output current sharing facility (for parallel operation of chargers)		
26	Regulation	%	
	Charger Cubicle Complete		

Sl. No	Description	Unit	Bidder's Data
27	Manufacturer		
28	Overall dimensions	mm	
29	Total weight	Kg	
	DC Switchboard		
30	Manufacturer		
31	Type		
32	Busbars:		
	- maximum current rating	A	
	- dimensions	mm	
33	Boost charge contactors:		
	- manufacturer		
	- maximum current rating		
	- coil rating		
	- method of interlocking		
34	Alarm relays:		
	- manufacturer		
	- type and reference		
	- power consumption: c) quiescent d) operated	A mA	
35	Number and rating of distribution circuits		
36	Overall dimensions	mm	
37	Total weight	kg	

PART 5 - LV AC EQUIPMENT

Sl.No.	Description		Bidder's Data
5.1	Distribution Board		
1	Manufacturer		
2	Manufacturer's type designation		
3	Rating	Amps	
4	Fault Rating for 1 sec	kA	
5	Voltage	Volts	
5.2	Miniature Circuit Breakers		
1	Manufacturer		
2	Type		
3	Rating	Amps	
4	Fault Rating for 1 sec	kA	

PART 6

Digital Fault and Disturbance Recorder [DFDR]

SL. No.	Description	UNITS	BIDDER'S DATA
(A)	GENERAL		
1	Manufacturer's name & address		
2	Type		
3	Power Supply -power Supply for printer	VDC VAC	
(B)	ANALOGUE INPUTS		
1	Number of Channel For Gopalagnj : -Expandability		
2	Nominal Current	Amp	
3	Nominal voltage - Current	Vac/Vdc mA/Amp	
4	Frequency response		
5	Cut-off frequency		
	(a) Bandwidth	dB	
	(b) Attenuation at	dB	
	(c) Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	
	(d) Simultaneously programmable sampling rate for all feeders/inputs -Locally Changeable -Remotely Changeable	Yes/No Yes/No	
	(e) Possible sampling rates	Samples/sec Samples/sec Samples/sec	
6	DC coupled inputs	Yes/No	
7	Resolution	bits	
8	Accuracy	%	
9	Burden 1. Current Circuit at IN 2. Voltage Circuit	VA VA	
10	Over load 1. Current 2. Voltage circuit	% In % Vn	
(C)	DIGITAL INPUTS		
1	Number of Channel -Expandability (Without and time skew)		
2	Selectable input level	Vdc	
3	Type		
4	Resolution	ms	
(D)	MEMORY		
1	Size	MB	
2	Type		
3	Pre-fault time (fast scanning rate)	sec	
4	Post-fault (fast scanning rate)	sec	
5	Pre and Post-fault time (slow scanning rate)	sec	
6	In-Built hard disk (auto-maintained)	GB	
(E)	SENSORS/ TRIGGERING CRITERIA		

SL. No.	Description	UNITS	BIDDER'S DATA
	All sensors/triggers are preferable Programmable and Virtually recordable	Yes/No	
1.	Logical combination sensor	Yes/No	
2.	Three phase over or under Voltage / Current	Yes/No	
3.	Mono phase over or under Voltage / Current	Yes/No	
4.	*du/dt, dp/dt, dq/dt, [Single/3 Phases], df/dt. etc.	Yes/No	
5.	RMS [Voltage / Current]	Yes/No	
6.	Zero Sequence	Yes/No	
7.	Negative, Positive Sequence	Yes/No	
8.	Frequency	Yes/No	
9.	DC Step	Yes/No	
10.	Pending / Swing	Yes/No	
11.	Digital level and edge	Yes/No	
12.	Sensor trigger	Yes/No	
13.	Event Trigger	Yes/No	
14.	Manual Trigger	Yes/No	
15.	Remote Trigger	Yes/No	
(F)	CLOCK SYSTEM		
1.	Internal Clock	Yes/No	
2.	Accuracy		
3.	External Synchronization	Yes/No	
4.	Time resolution between 2 synchronized pulses		
(G)	OUTPUT ALARM RELAY CONTACT		
1.	Max. operation Voltage DC/AC	Vac / Vdc	
2.	Make and carry for 0.5 sec	A	
3.	Carry Continuously	A	
4.	Break (DC) – resistive	W	
(H)	INTERFACE FOR DATA COMMUNICATION		
1.	Full definition compression	Yes/No	
2.	Maximum transmission rate	bits / Sec	
3.	Standard serial port (EIA-232-D)	Yes / No	
4.	Printer Port	Yes/No	
5.	Dedicated serial port for modem	Yes/No	
(I)	PRINTER DATA		
1.	Printer amplitude (scaling peak to peak)		
2.	Time Scal (mm / s)		
3.	Printer resolution	mm	
4.	Auto printing	Yes/No	
(J)	Fault Priority transmission	Yes/No	
(K)	Fault location (distance calculation)	Yes/No	
(L)	Test certificates from internationally recognized Laboratories	Yes/No	
(M)	COMMUNICATION AND REMOTE ANALYZING UNIT		
	1. Processor Pentium	(MHz) Yes/No	
	2. Co-Processor pentium	Yes/No	
	3. Main memory capacity	(Mb) Yes/No	

SL. No.	Description	UNITS	BIDDER'S DATA
	4. Color graphics board S-VGA	Yes/No	
	5. Screen S-VGA	Yes/No	
	6. Hard disk unit	Yes/No	
	7. Printer	Yes/No	
	8. Modem	Yes/No	
*Note: du/dt=Change of voltage, dp/dt=Change of active power, dq/dt=change of reactive power, df/dt=Change of frequency.			

PART 7 - SUBSTATION AUTOMATION SYSTEM

Sl. No.	Description	Unit	Bidder's Data
1	General Requirement:		
	Standards to be complied with Substation Automation system		
	Test Ca. Damp heat steady state		
	Test Db and guidance; Damp heat cyclic		
	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		
	Temperature range (min/max)	°C	
	Relative humidity	%	
	Intelligent Electronic Devices (IED's)		
	- serial communication interface included?		
	- Protection & Control IED's connected same bus?		
	- self monitoring		
	- display of measured values		
	- remote parameterization		
	- disturbance record upload and analysis		
	Availability Calculation shall be furnished for each equipments as well as for the entire system		
	Main system, HMI, Gateway, IEC have dual communication port		
	SNTP server provide GPS time synchronization to HMI, Gateway, IED		
	System topology		
2	Detailed Requirements:		
	Manufacturer of Substation Automation System		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	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)	Yrs	
	Design life of substation Automation System	Yrs	
	Manufacturers quality assurance system		

Sl. No.	Description	Unit	Bidder's Data
	Dimensions of cubicle: - Width - Depth - Height - Floor load	mm mm mm N/m ²	
3	Station Level Equipment:		
	Station Controller		
	MTBF (Mean time between Failures)		
	MTTR (Mean time to repair)		
	Station computer dual connection to Ethernet		
	Dual wide screen monitor	inch	
	Dual Station Computers Provided in redundant hot Standby		
	Hot standby take over time		
	Annunciator for Station PC system software		
	Number of years of proven field experience of offered software	Yrs	
	Operating System		
	All standard picture as per spec included in HMI		
	Process Status Display & Command Procedures		
	Event processing as per spec		
	Alarm processing as per spec		
	Reports as per spec		
	Trend Display as per spec		
	Graphical Fault I information receiving function		
	Disturbance & Fault recording and analysis with graphical format		
	User Authority levels as per spec		
	System supervision & monitoring as per spec		
	Automatic sequence control as per spec		
4	Gateway to National Load dispatch Center		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered unit	Yrs	
	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	Yrs	
	Redundant communication channel		
	Redundant CPU		
	Redundant DC/DC Supply		
	MTBF (Mean time between Failures)		
	MTTR (Mean time to repair)		
	Dual connection to Ethernet		

Sl. No.	Description	Unit	Bidder's Data
5	Station Bus:		
	Type of bus/protocol		
	Physical Medium		
	Dual connection		
	Transfer rate/bus speed		
6	Interbay Bus		
	Type of bus/protocol		
	Physical Medium		
	Transfer rate/bus speed		
7	Printer server		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	MTBF		
8	Event Printer		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Print speed		
	Paper feed/width		
	Character set		
	MTBF		
9	Hard Copy colour Printer		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Print speed		
	Colours		
	Resolution		
	Character set		
	MTBF		
10	Master Clock GPS (Global Positioning System) Receiver:		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Stability		
	MTBF		
11	Bay control Unit – HV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered unit	Yrs	
	Separate Bay controller unit provided for each bay & feeder		
	Type of bay controller offered HV/MV		
	Select Before Operate with Open Execute & Close Execute		
	Single bit dependence		
	Interlocking, bay & Station wide		

Sl. No.	Description	Unit	Bidder's Data
	Dual connection to Ethernet sw		
	Synchrocheck function: - Maximum Voltage difference - Maximum Frequency difference - Maximum Phase difference		
	Double command blocking		
	Independent settable parameter groups		
	Local Display Unit		
	Sequence of event recorder: - Events - Time resolution		
	Disturbance recorder function		
	Disturbance record transfer function		
	Comtrade file generation		
	Comprehensive self-supervision		
	Battery free backup of events and disturbance records		
	Insulation tests		
	Fast disturbance tests		
	MTBF		
	MTTR		
	Temperature range: IED's - Operation - Transport and storage	°C °C	
	Relative humidity: - Operating max./min. - Transport and storage	% %	
12	Back up control mimic -HV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Control functionality: Control of breaker as well as all isolators/earthing switch (Control functionality should not be affected if bay controller fails)		
	Key-Locked		
	Interlock override function		
	Separate backup control mimic provided for each bay & feeder		
13	Bay Control Unit - MV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered unit	Yrs	
	Separate Bay controller unit provided for each bay & feeder		
	Control functionality implementation in software:		
	Select before Operate with Open Execute & Close Execute		
	Interlocking, Bay & Station Wide		
	Dual connection to Ethernet sw		

Sl. No.	Description	Unit	Bidder's Data
	Synchrocheck function - Maximum Voltage difference - Maximum Frequency difference - Maximum Phase difference		
	Local Display Unit		
	Sequence of event recorder - Events - Time resolution	ms	
	Disturbance recorder function		
	Disturbance record transfer function		
	Comtrade file generation		
	Comprehensive self-supervision		
	Insulation tests		
	Fast disturbance tests		
	MTBF		
	MTTR		
	Temperature range: IED's - Operation - Transport and storage	°C °C	
	Relative humidity: - Operating max./min. - Transport and storage	% %	
14	Back up control mimic - MV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Control functionality: Control of breaker as well as all isolators/earthing switches Separate backup control mimic provided for each bay & feeder		
15	Bay Control Unit - LV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Number of years of proven field experience of offered unit	Yrs	
	Separate Bay controller unit provided for each bay & feeder		
	Control functionality implementation in software:		
	Select before Operate with Open Execute & Close Execute		
	Interlocking, Bay & Station Wide		
	Dual connection to Ethernet sw		

Sl. No.	Description	Unit	Bidder's Data
	Synchrocheck function - Maximum Voltage difference - Maximum Frequency difference - Maximum Phase difference		
	Local Display Unit		
	Sequence of event recorder - Events - Time resolution	ms	
	Disturbance recorder function		
	Disturbance record transfer function		
	Comtrade file generation		
	Comprehensive self-supervision		
	Insulation tests		
	Fast disturbance tests		
	MTBF		
	MTTR		
	Temperature range: IED's - Operation - Transport and storage	°C °C	
	Relative humidity: - Operating max./min. - Transport and storage	% %	
16	Back up control mimic - LV		
	Manufacturer		
	Name and type of product in supplier's catalogue		
	Origin of manufacturer		
	Control functionality: Control of breaker as well as all isolators/earthing switches Separate backup control mimic provided for each bay & feeder		
17	System Performance:		
	Exchange of display (First reaction)	s	
	Presentation of a binary change in the process display	s	
	Presentation of an analogue change in the process display	s	
	From order to process output	s	
	From order to updated of display	S	
18	Deviations		
	Please state all deviations from specification		

PART 8 - FIBRE OPTIC MULTIPLEXER EQUIPMENT

SL. No.	Description	Unit	Bidder's Data
1	GENERAL:		
	Manufacturer		
	Model No.		
	Type		
	Type of multiplexer		
	Complying to ITU-T rec.		
	Transmission Capacity	Mbit/s	
	Access capacity on 64 kbit/s	channels	
	Access capacity on 2 Mbit/s	channels	
	Redundant central processor		
	Digital cross connect function		
2	Available AGGREGATES:		
	Optical aggregates (ITU-T G.957)		
3	Available TRUNK INTERFACES:		
	HDB3, 2 Mbit/s interfaces per module	No.	
	Complying to ITU-T rec.		
	HDSL, 2Mbit/s interface: no of copper wires	No. ch	
	- Capacity on 2Mbit/s or on 1Mbit/s - Capacity selectable	ch / pair of wire	
4	Available USER INTERFACES		
5	Voice interfaces for trunk lines:		
	1 + 1 com path protection, available for all		
	Analogue, 4wire with E&M: Input level	dBr	
	Output level	dBr	
	Analogue, 2wire with E&M: Input level	dBr	
	Output level	dBr	
	Digital, 2Mbit/s CAS or PRI		
6	Voice interfaces for remote Subscriber:		
	2wire, subscriber side	dBr	
	2wire, PABX side	dBr	
7	Integrated teleprotection		
8	Interface for Commands:		
	Number of independent commands	No.	
	Transmission time max.	ms	
	Signal voltage	Vpeak	
	1 + 1 com path protection		
9	Interface(s) for Differential Protection:		
	Electrical interface: G.703	kbit/s	
	Optical Interface	kbit/s	
10	Data: channels per module		
	1 + 1 com path protection, available for all		
	V.24/V.28 (RS-232): up to 38.4kbit/s	No.	
	V.11/X.24 (RS-422): 64kbit/s	No.	
	V.35: 64kbit/s	No.	
	V.36 (RS-449): 64kbit/s	No.	
	G.703: 64kbit/s	No.	
	Ethernet: 10/100 BaseT	No.	
	WAN capacity	Mbit/s	
	Protocols	Mbit/s	
11	Integrated alarm gathering module:		
	Number of external alarms per module	No.	
	Auxiliary power supply for ext. contacts		

SL. No.	Description	Unit	Bidder's Data
12	Network Management System		
	Type/Name of configuration tool		
	For fault / configuration management		
	For local / remote operation		
	Data communication network (DCN)		
13	Ambient Conditions:		
	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	
	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	
	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	
14	Power Supply		
	Operation	VDC	
	Fully redundant power supply		

Bidder shall provide all necessary information which deem to be necessary to complete the project in all respects.

PART 9 – DIGITAL PABX EQUIPMENT

SL. No.	Description	Unit	Bidder's Data
1.0	GENERAL:		
1.1	Manufacturer		
1.2	Type		
1.3	Complying to ITU-T rec.		
1.4	Analogue Trunk Connectivity		
1.5	Digital Trunk Connectivity(E1/T1)		
1.6	10/100 BaseT Ethernet Connection		
1.7	No of Subscribers	No.	
2.0	Trunk Connectivity		
2.1	Analogue Trunk		
2.1.1	- Loop Start/Ground Start(Via peripheral)		
2.1.2	- E&M		
2.1.3	- DID(Direct Inward Dial)		
2.2	Digital Trunk		
2.2.1	- T1		
2.2.2	- E1		
2.2.3	- ISDN Connectivity using BRI/PRI		
2.3	IP Trunk		
2.3.1	- 10/100 Mbps Ethernet(IEEE 802.3)		
2.3.2	- TCP/IP, H.323, T.38(Switching)		
2.3.3	- Voice Compressor : G.711, G729		
2.3.4	- QoS(Quality of Signal) : 802.1		
2.3.5	- SIP(Session Initiation Protocol): RFC 3261		
3.0	Main Features		
3.1	- Ring Back		
3.2	- Call Forwarding, park, waiting, pick-up		
3.3	- Call/Message waiting lamp		
3.4	- Hands Free operation		
3.5	- Speed Calling, Stored number redial		
3.6	- Account Code		
3.7	- Automatic Attendant, Auto Answer		
3.8	- Automatic Route Selection		
3.9	- Call-by-call Service, Call Duration Display		
3.10	- Call Transfer, Direct Outward Dialing		
3.11	- Hunt Group, Music on Hold		

SL. No.	Description	Unit	Bidder's Data
3.12	- Night Service, Off-hook Alarm, Redial		
4.0	Network Management System		
4.1	Type/Name of configuration tool		
4.2	For fault / configuration management		
4.3	For local / remote operation		
4.4	Data communication network (DCN)		
5.0	Ambient Conditions:		
5.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	
5.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	
5.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	

PART 10 – PROTECTION

10.1 Line Distance Protection (Main 1)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Phase switched		
4	Zone switched		
5	Number of zones		
6	Shape of impedance characteristic: Zone 1/Zone 2/Zone 3		
7	Reverse looking element (blocking signal initiation)		
8	Sensitivity:		
8.1	Minimum operation current: Earth faults/Phase faults	A	
8.2	Minimum necessary voltage for fault at Zone 1 reach point (if applicable): Earth faults/Phase faults	V	
8.3	Minimum Zone 1 ohmic impedance to which relay can be set	ohms	
8.4	Maximum Zone 1 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.5	Minimum Zone 2 ohmic impedance to which relay can be set	ohms	
8.6	Maximum Zone 2 ohmic impedance to which relay can be set and maintain accuracy	ohms	
8.7	Maximum Zone 3 ohmic reach: Forward reach/Reverse reach	ohms	
9	Arc forward and reverse reach setting independent of each other?	Yes/No	
10	Can resistance and reactance reaches be set independent of each other	Yes/No	
11	Directional sensitivity	V	
12	Current transformer requirements		
13	Voltage transformer requirements		
14	Back up Zone time ranges: Zone 2/ Zone 3	sec.	
15	Method used to clear close-in faults: which occur when line is already energized in service which exist upon line energisation		
16	Has distance protection previously been used in the type of blocking scheme offered for this contract? If yes: number of scheme in service/year first in service	Yes/No	
17	Approximate number of years distance relay in service (A complete reference list should be submitted stating client, system voltage and year of going into service).		
18	Zone 1 operating times on fault position:		
	Earth faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Phase to phase faults: 0, 50, 90% of relay setting	ms (min./max.)	
	Three phase faults: 0, 50, 90% of relay setting	ms (min./max.)	

10.2 Line Directional Earth Fault Protection (Main 1 BU)

SL. No.	Description	Unit	Bidder's Data
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1	Manufacturer		
2	Type designations		
3	Current setting range: Forward element/Reverse element	A	
4	Minimum polarizing quantity required for correct directional decision:		
	Voltage: Forward element/Reverse element	V	
	Current: Forward element/Reverse element	V	
5	Characteristic angle	Degree	
6	Time ranges: Blocking scheme/Back up	sec	
7	Has protection previously been used in the blocking scheme offered for this contract?	Yes/No	
8	Current transformer requirements		

10.3 Line Distance Protection (Main 2)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Range of operating coil settings	% of CT rating	
4	Range of bias coil settings	% of CT rating	
5	Recommended operating coil setting	% of CT rating	
6	Recommended bias coil settings	% of CT rating	
7	Number of bias coils		
8	Minimum sensitivity: Earth faults/Phase faults	% of CT rating	
9	Maximum through fault at which the protective equipment is stable with recommended settings: Earth faults/Phase faults	% of CT rating	
10	Inter trip: Operating time/Reset time	ms	
11	Permissive inter trip:		
	Time delay setting	ms	
	Operating time after delay setting	ms	
	Reset time	ms	
12	Maximum time delay between initiation of fault and emerging of breaker trip circuit		
13	Current transformer requirement		

10.4 Busbar Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Operating principle, e.g. high impedance		
4	Minimum relay setting	A	
5	Sensitivity of scheme (allowing for CT magnetizing current, etc.)		
6	Maximum through fault current at which protection is stable	A	
7	Current transformer requirements		
8	Estimated magnetizing current at relay setting	A	
9	Operating time at twice relay minimum setting	ms	
10	Operating time at ten times relay minimum setting	ms	

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Operating principle, e.g. high impedance		
4	Minimum relay setting	A	
5	Sensitivity of scheme (allowing for CT magnetizing current, etc.)		
6	Maximum through fault current at which protection is stable	A	
7	Current transformer requirements		
8	Estimated magnetizing current at relay setting	A	
9	Operating time at twice relay minimum setting	ms	
10	Operating time at ten times relay minimum setting	ms	

10.5 10.5 3 winding Transformer Biased Differential Protection (87)

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Range of operating coil settings	% of CT rating	
4	Range of bias coil settings	% of CT rating	
5	Recommended operating coil setting	% of CT rating	
6	Recommended bias coil setting	% of CT rating	
7	Number of bias coils		
8	Minimum sensitivity: Earth faults/Phase faults	% of CT rating	
9	Maximum through fault at which the protective equipment is stable with recommended settings: Earth faults/Phase faults	% of CT rating	
10	Maximum time delay between initiation of fault and emerging of breaker trip circuit	ms	
11	Current transformer requirements		

10.6 3 winding Transformer Restricted Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Operating principle, e.g. high impedance		
4	Minimum relay setting	A	
5	Sensitivity of scheme (allowing for CT magnetizing current, etc.)		
6	Maximum through fault current at which protection is stable	A	
7	Current transformer requirements		
8	Estimated magnetizing current at relay setting	A	
9	Operating time at twice relay minimum setting	ms	
10	Operating time at ten times relay minimum setting	ms	

10.7 3 winding Inversed Time Overcurrent and Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
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1	Manufacturer		
2	Type designations		
3	Inversed time element		
	Range of current settings: Overcurrent/Earth Fault	A	
	Range of operating times at highest timing setting at ten times current setting	sec.	
	Range of operating times at highest timing setting at twice current setting	sec.	
4	High set instantaneous element range of settings: Overcurrent/Earth Fault	A	
5	Transient overreach at X/R=10		
6	Operating time with Maximum offset current at five times current setting	ms	
7	Burden of relay on minimum inverse time element current setting at a current ten times setting: Overcurrent/Earth fault	VA	

10.8 3 winding Directional Overcurrent and Earth Fault Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Current setting range: Forward element/Reverse element	A	
4	Minimum polarizing quantity required for correct directional decision:		
	Voltage: Forward element/Reverse element	V	
	Current: Forward element/Reverse element	V	
5	Characteristic angle	degrees	
6	Current transformer requirements		

10.9 Breaker Failure Protection

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Setting of current elements: Phase faults/Earth faults	A	
4	Timer setting range	sec.	
5	Burden of relay at minimum current setting at ten times CT secondary rated current during: Phase faults/Earth faults	VA	
6	Operating time/Reset time	ms	

10.10 Tripping Relays

SL. No.	Description	Unit	Bidder's Data
1	Manufacturer		
2	Type designations		
3	Nominal operating voltage	V	
4	Minimum operating voltage	V	
5	Operation indicator		
6	Operating time at nominal voltage	ms	
7	Contact rating:		

SL. No.	Description	Unit	Bidder's Data
	Make and carry continuously	VA	
	Make and carry for 3 sec.	VA	
	Break: resistive	W	
	inductive	VA	

10.11 Overall Fault Clearance Times

SL. No.	Description	Unit	Bidder's Data
1	400 kV Busbar Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
2	132 kV Busbar Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
3	230 kV Busbar Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
4.1	3winding Transformer Faults:		
	Main protection relay operating time	ms	
	Auxiliary and tripping relay time	ms	
	Circuit breaker time	ms	
	Total	ms	
5	400 kV Line Faults		
5.1	Fault Clearance		
	Distance protection maximum operating time	ms	
	Permissive scheme time delay	ms	
	Auxiliary relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
5.2	230 kV Line Faults		
	Fault Clearance		
	Distance protection maximum operating time	ms	
	Permissive scheme time delay	ms	
	Auxiliary relay time (where used)	ms	
	Circuit breaker time	ms	
	Total	ms	
5.3	132 kV Line Faults		
	Fault Clearance		
	Distance protection maximum operating time	ms	
	Permissive scheme time delay	ms	
	Auxiliary relay time (where used)	ms	
	Circuit breaker time	ms	
	Total		

PART 11– SHUNT REACTOR

SL	Description	Unit	Bidders Data
1.	Name of manufacturer		
2.	Model		
3.	Service conditions: - External cooling medium - Altitude not exceeding - Air temperature not exceeding Average air temperature in any one year not exceeding: - In any one day - Average in one year	- - m °C °C °C	
4.	Rated voltage	kV	
5.	Rated lightning impulse withstand voltage - HV - Neutral	kV	
6.	Rated switching impulse withstand voltage - HV - Neutral	kV	
7.	Rated power Frequency withstand voltage - HV - Neutral	kV	
8.	Rated Capacity		
9.	Vector Group		
10.	Method of Earthing		
11.	Maximum temperature Rise - windings - Top oil - Hot spot of Core	°C	
12.	Total Losses at rated voltage & frequency - Core Loss - Copper Loss - Total	kW	
13.	Cooling		
14.	Rated Power at Rated voltage & frequency	MVar	
15.	Rated Current	A	
16.	Rated reactance/phase	Ω	
17.	Zero sequence reactance	Ω	
18.	Mutual Reactance	Ω	
19.	Linearity Range of magnetic circuit percent to rated voltage	%	
20.	Reactance during saturation percent to rated reactance	%	
21.	Harmonics - Even - Total	%	
22.	Core Design	Gapped/Air Core	
23.	No. of Core	No's	
24.	Material & type of Core		
25.	Type of winding		
26.	Winding Connection brazed or crimped		

SL	Description	Unit	Bidders Data
27.	Type of Insulation - HV side - Neutral side	Non/Uniform	
28.	Flux Density at Rated voltage & frequency - Core - Yokes	T	
29.	Volts per turn		
30.	Efficiency	%	
31.	Regulation - At unity power factor - At 0.8 lagging power factor	%	
32.	Bushing Current Transformer -Ratio -Class -Burden	-- -- VA	
33.	Maximum Sound Pressure level	dB	
34.	Oil Type		
35.	Weight of Active part	kg	
36.	Weight of Oil*	kg	
37.	Total weight*	kg	
38.	Heaviest part for shipment	kg	

*These values are required for Foundation design & shipping purpose only. During detail design, these values may vary from Bid value due to attaining desired electrical output.

PART 12– OTHERS

Sl. No.	Description	Unit	420kV	145kV	36kV
1	Structural Steel				
	Type and standard specification				
	Manufacturer and country				
	Minimum yield strength	Kg/ mm ²			
	Ultimate tensile strength	Kg/ mm ²			
2	Copper Conductors for Earthing system				
	Type and standard specification				
	Manufacturer and country				
	Conductor material				
	Size of conductors (Solid copper rods)	mm ²			
	Size of conductors (Flat copper bars) (Width×Thickness×Bundles)	mm			
	Rated current	A			
	Short time withstand current	kA rms			
	Peak withstand current	kA pk			
3	High Voltage Bus Work				
3.1	Switchyard Conductor				
3.1.1	Tubular Conductors for Busbar				
	Type and standard specification				
	Manufacturer and country				
	Inner diameter	mm			
	Outer diameter	mm			

Sl. No.	Description	Unit	420kV	145kV	36kV
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Weight	kg/m			
	Moment of inertia	kg-m ²			
3.1.2	Busbar conductor for Baybus connetion				
	Type and standard specification				
	Manufacturer and country				
	Conductor type				
	Conductor size				
	Standing - No. of Al wires - Dia. Of each wire	mm			
	Overall conductor dia.	mm			
	Cross-sectional area	mm ²			
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Rated ultimate tensile strength	kN			
	Mass, nominal	kg/m			
	No. of conductors per bundle				
	Bundle configuration				
	Bundle spacing				
3.1.3	Flexible Bus Conductor				
	Type and standard specification				
	Manufacturer and country				
	Conductor type				
	Conductor size				
	Standing - No. of Al wires - Dia. Of each wire	mm			
	Overall conductor dia.	mm			
	Cross-sectional area	mm ²			
	Rated continuous current (site rating)	A rms			
	Temperature rise at rated current	°C			
	Rated short time current	kA rms			
	Peak withstand current	kA pk			
	Rated ultimate tensile strength	kN			
	Mass, nominal	kg/m			
	No. of conductors per bundle				
	Bundle configuration				
	Bundle spacing				
3.1.3	Shield Wire				
	Type and standard specification				

Sl. No.	Description	Unit	420kV	145kV	36kV
	Manufacturer and country				
	Dia. of galvanized steel wire	mm			
	Stranding - No. of Al wires - Dia. Of each wire	mm			
	Grade of wire				
	Weight of wire	kg/km			
	Minimum breaking strength of wire	kN			
3.2	Insulators				
3.2.1	Station Post Type (for rigid Busbar)				
	Type and standard specification				
	Manufacturer and country				
	Insulator unit, length/height	mm			
	No. of units in each insulator				
	Power frequency flashover voltage - Dry - Wet	kV kV			
	Impulse flashover voltage - Positive - Negative	kV kV			
	Power frequency withstand voltage - 1 min. dry - 10 sec. wet	kV kV			
	Power frequency puncture voltage	kV			
	Switching impulse withstand voltage, wet	kV pk			
	Lightning impulse withstand voltage	kV pk			
	Radio interference voltage - Test voltage to ground - Max. RIV at $1.1xU_r/3$ line to ground voltage, when tested as per IEC 60694	kV rms micro V			
	Leakage distance	mm			
	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			
3.2.2	String Type				
	Type and standard specification				
	Manufacturer and country				
	Insulator unit, length	mm			
	No. of units in each insulator				
	No. of insulator strings per conductor (at each end)				
	Dia. of disc	mm			

Sl. No.	Description	Unit	420kV	145kV	36kV
	Disc spacing	mm			
	Power frequency flashover voltage				
	- Dry	kV			
	- Wet	kV			
	Impulse flashover voltage				
	- Positive	kV			
	- Negative	kV			
	Power frequency withstand voltage				
	- 1 min. dry	kV			
	- 10 sec. wet	kV			
	Power frequency puncture voltage	kV			
	Switching impulse withstand voltage, wet	kV pk			
	Lightning impulse withstand voltage	kV pk			
	Dry arcing distance	mm			
	Radio interference voltage				
	- Test voltage to ground	kV rms			
	- Max. RIV at 1.1xUr//3 line to ground voltage, when tested as per IEC 60694	micro V			
	Leakage distance	mm			
	Mechanical values, failing load (min.)				
	- Tensile strength	N			
	- Torsional strength	N-m			
	- Compressional strength	N			
	- Combined electrical and mechanical strength	N			
	- Impact strength	N-m			
3.3	Clamps and Fittings				
	Type and standard specification				
	Manufacturer and country				
	Maximum working stresses				
	All accessories for installation (bolts, nuts, etc.)				

PART -13

12.0 POWER LINE CARRIER EQUIPMENT

12.1	Line Trap	400kV	
1.	Manufacturer/model		
2.	Type		
3.	Rated continuous current		
4.	Coil inductance		
5.	Air temperature operating range		
6.	Weight of trap		
7.	Type of protective device		
8.	Temperature rise at normal rating		
9.	Dynamic short circuit rating		
10.	Temperature rise at short circuit rating		
11.	Working tension of strain (mounted units)		
12.	Bandwidth blocked band		
13.	Minimum impedance in working bandwidth		
14.	Compatibility with IEC Recommendation 353		
15.	Mounting details		
16.	MTBF		
17.	Design Life		
18.	Equipment technical description		
12.2	HF Coupling Unit	400kV	
1.	Manufacturer/model		
2.	Type		
3.	Working temperature range		
4.	Available bandwidth		
5.	Tuning range		
6.	Composite loss over tuning range		
7.	Line side impedance range for phase/phase coupling		
8.	Equipment side impedance		

9.	Drain coil current carrying - continuous - for 1 second - for 3 seconds		
10.	Isolation transformer voltage withstand for 1 minute		
11.	Main arrester voltage		
12.	Earth switch interlock with door		
13.	Compatibility with IEC Recommendation 481		
12.3	High Frequency Cable	400 kV	
1.	Manufacturer		
2.	Type		
3.	Coaxial or quad		
4.	Surge impedance		
5.	Voltage withstand: - between conductors - between cores and armouring		
	Attenuation per km: - at 50 kHz - at 400 kHz		
12.4	Digital PLC Terminal		
1.	Manufacturer/model		
2.	Type		
3.	Compliance with relevant parts of IEC 495		
4.	DC voltage working range		
5.	Service conditions (temperature and RH)		
6.	Power consumption		
7.	Design life		
8.	Carrier frequency range		
9.	Gross bandwidth		
10.	Teleprotection equipment mounted within the PLC units		
11.	Technical description of the equipment		
12.	Type of coupling (phase/phase or inter circuit)		
13.	Return loss within the carrier frequency band		
14.	Transmission rate of the digital signal		
15.	Output impedance		

16.	Dynamic range of receiver for digital signal	
17.	Means of RF frequency selection	
18.	frequency spacing for parallel connections • between two digital PLCs • between a digital and an analogue PLC	
19.	Output power (before hybrid at coaxial cable)	
20.	Channel terminal power at output to coupling equipment	
21.	Type of digital modulation available/proposed	
22.	Calculations to justify operation of the PLC over the transmission lines	
23.	Any limitations in parallelling of terminals (to digital or analogue PLCs)	
24.	Required minimum SNR for minimum BER	
25.	Switching off of parallel PLCs, not to cause interference with working PLCs	
26.	Spurious emissions	
	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	
28.	Voltage withstand	
29.	Capacity options available for various services equipped within the digital bit stream	
30.	Capacity allocation proposed for this project	
31.	Speech channel 2W/4W interface	
32.	Speech channel impedance/levels	
33.	"Long line" telephone facility	
34.	Speech channel interfaces available (E&M etc.)	
35.	Service telephone	
36.	Type of speech codec	
37.	Compatibility with analogue speech bands	
38.	Method of telephone signalling	
39.	Frequency response of speech channel (Ref 800 Hz)	
40.	Data channel interface	
41.	Synchronous/asynchronous data channel availability	
42.	Data signalling transmission rates which can be accommodated	
43.	FSK Interface	
44.	VFT signal levels (2W and 4W)	

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

28.	No. of alarm contacts	
29.	19"/ETSI rack mounting practice	
	Teleprotection Equipment (Continued)	
30.	Information to be submitted with the Tender (a) Technical description (b) MTBF calculations (c) Performance graphs/details	
12.6	PAX Telephone Equipment and Subscriber Equipment	
(a)	Exchange equipment	
1.	Type reference	
2.	Manufacturer	
3.	Dimensions of cubicle	
4.	Rack width	
5.	Literature reference for typical layout of cubicle	
6.	Operating temperature range	
7.	Operating relative humidity	
8.	Power requirements	
9.	Mean time between failures	
10.	Maximum number of local extensions	
11.	Maximum number of remote extensions	
12.	Maximum number of trunk lines	
13.	Maximum number of connecting circuits	
14.	Method of signalling - Local extensions 2W - Remote extensions 4W - Trunk lines 4W	
15.	Frequency of audible tones - Dial tone Hz - Busy tone Hz - Ring tone Hz - Ring current Hz - Ring current Hz	
16.	Ring voltage	
17.	Type of processor	
18.	Type of memory	
(b)	Subscriber telephone	
1.	Type reference	

2.	Manufacturer	
3.	Type of dial (rotary/pushbutton)	
4.	Operating voltage	
5.	Outdoor bell	
6.	Type reference	
7.	Manufacturer	
8.	Operating voltage	

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey basis(Package-1)

**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE F**

DEPARTURES FROM THE SPECIFICATION

Bidders are to list all departures from the requirements of the specification in this schedule.

All departures whether they be commercial, financial, technical or of a contractual nature are to be included and shall be submitted with the Technical proposal

Any item that does not have a departure listed in this schedule will be deemed to be in full accordance with the requirements of the specification.

No other document or detail accompanying the tender will be considered in evaluating departures. Bidders are not permitted to offer any alternative to this schedule.

Item	Volume	Clause	Detail of Departure from Specification

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at
Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey
basis(Package-1)**

**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE G**

PROPOSED ALTERNATIVE STANDARDS TO WHICH EQUIPMENT SHALL BE PROVIDED

The bidder shall list below all the alternative engineering and design Standards, which he proposes to use in his design, manufacture and testing of equipment to be supplied. Should these standards differ from the specified standard in any respect, the bidder shall detail the differences between the proposed and specified standard.

Compliance with any standard equal or superior to those specified will be considered acceptable.

In the absence of any listed alternative standard, it is deemed that the standards specified in the Tender documents are fully complied with.

Specified Standard	Alternative Standard	
	Number	Title

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at
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**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE H**

PROPOSED CONTRACT & SITE ORGANISATION

Personnel

Bidders should provide the names of suitably qualified personnel to meet the requirements specified in Section 3 (Evaluation and Qualification Criteria) of Volume 1 of 3 of the Bidding Document. The data on their experience should be supplied using the Form below for each candidate.

Form PER – 1: Proposed Personnel

1.	Title of position*
	Name
2.	Title of position*
	Name
3.	Title of position*
	Name
4.	Title of position*
	Name

*As listed in Section 3 (Evaluation and Qualification Criteria).

Schedule H: Proposed contract & site organization and site resources

Form PER – 2: Resume of Proposed Personnel

Position		
Personnel information	Name	Date of birth
	Professional qualifications	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	E-mail
	Job title	Years with present employer

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

[illegible]

Schedule I: Drawings and Documents

POWER GRID COMPANY OF BANGLADESH LIMITED

**BIDDING DOCUMENT
FOR**

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at
Pekua and associated single /double circuit 400kV/230kV/132kV LILO Lines on turnkey
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**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE I**

DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER

DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER SHALL BE AS PER SECTION 6
OF VOLUME 1 OF 3.

Schedule J: Proposed Subcontractor

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT FOR

**Design, Supply, Installation, Testing & Commissioning of 400/230/132 kV AIS Substation at
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**[Contract No.: PGCB/ADB/400kV/PEKUA/PTSIREP/PACKAGE-1]
SCHEDULE J**

PROPOSED SUBCONTRACTORS

The bidder shall propose a list of the Sub-contractors in the following table as per sub-clause 2.7, Item 2, Civil 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 _____