

ATTACHEMENT 10

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 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 works under this turnkey contract is: design, supply, manufacture, quality assurance, inspection and testing, delivery, new packing for export, insurance, shipment & transport to the site, complete construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning, defect liability for all equipment, including all civil works of new 400/230/132KV AIS substations.

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

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

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

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

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

Generally, land development of new substation shall be made for the total substation area and perimeter wall shall be made for the total substation area.

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

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

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

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

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

All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price.

The bid price shall include supply and delivery of mandatory spare parts.

The bid price shall include all other miscellaneous works required.

The programme of works shall be as shown in Schedule C - Times for Delivery and Completion. Within one month of acceptance of the bid, the Contractor shall submit a programme chart detailing times required for the design, supply, delivery, installation, testing and commissioning for the complete work.

The "Schedule of Requirements" for equipment, materials and services and the guaranteed technical particulars of equipment and materials will be stated in Schedule A of this bidding

document shall be read in conjunction with the detailed technical specifications of equipment and materials described in Volume 2 of the bidding documents.

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

The 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, a new three storied Main Control Room Building, two(2) nos one storied switchyard panel room in 400kV switchyard and one nos one storied switchyard panel room in 132kV switchyard 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.

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 ; — 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 three 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 Matarbari-Chokoria 230kV double circuit overhead line (Matarbari 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 auto transformers.

230/132/33kV three phase 3 phase transformer

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

33/0.415kV earthing/auxiliary transformer

Two 33/0.415kV, 500kVA, outdoor type earthing/auxiliary transformers to supply the substation auxiliary loads. The auxiliary transformer shall be connected to tertiary side of two new 400/230/33kV three 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 & other 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

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

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, two(2) nos one storied switchyard panel room in 400kV switchyard and one nos one storied switchyard panel room 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 Spare parts including Maintenance Equipment

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment. 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.

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	Min. Duration (Working Days, excluding travel time)
1.	Transformers	02	10
2.	Circuit Breaker	02	05
3.	Disconnecter	02	05
4.	Instrument Transformer (PT)	02	05
5.	Instrument Transformer (CT)	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 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 including air fares, accommodation, meal, healthcare, transportation, visa fees etc. together with payment of a daily allowance of **US\$ 100** for each of the Employer's engineer attending the Pre shipment inspection (as mentioned in item no.-a) including travel time. If required the minimum duration of the Pre shipment inspection may extend as the requirement of the completion of the factory acceptance tests.

For on-site instruction training, (item no (b)), the contractor shall not be responsible for any costs for trainees except meal and the aforementioned onsite trainings shall have to be arranged at any Substation's respective local Grid Circle or GMD area with the consultation of Superintending Engineer, Grid Circle, PGCB. In "Schedule B4.2: Installation and Other Services" of the Price Schedule, cost of Employer's Factory Acceptance Tests Witness, and Local O&M Training are given as provisional sum. These costs are fixed

ceiling and will be included in total price. But the payment shall be at actual upon submission of relevant document.

For Transformer & HV substation training, the trainer shall be experience of at least 400kV Class, 520MVA Substation & transformer design experience for at least 5 years. For other training, the trainer shall be experience of related field experience for at least 5 years. The CV of proposed trainers shall be submitted to employer & taken approval during execution. If the proposed trainer does not meet the minimum requirements mentioned here, the Employer shall preserve the right to ask the contractor to change the trainer as per requirement.

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	420 kV Air Insulated Switchgear (AIS)
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The 420kV 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	Four(4) sets of 420kV, 4000A , 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 & transformer switching which shall have to be considered for 400kV circuit breaker.
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1A2	Nine (9) sets of 420kV, 4000A , 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.
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[For line switching: 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 420kV, 4000A , 63kA/1sec , 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors with motor-operated earthing switch .
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1A4	Twenty seven (27) sets of 420kV, 4000A , 63kA/1sec , 50Hz, 1425kVp BIL, horizontal double break, post type, motor operated disconnectors without earthing switch .
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1A5	Two(2) sets of 420kV, 63kA/1sec , 50Hz, 1425kVp BIL, post type, motor operated busbar grounding switches.
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- 1A6 Fifty seven (57) nos. of single-phase, 6-core, 420kV, **4000A**, 63kA/1sec , 50Hz, 1425kVp BIL,post type current transformer. **400kV, 63kA/1s single phase, 6-core, current transformer with cores as follows:**
Bus side CT
 4000-2000/1A, Class 5P20, 30-60VA for Main 1 Protection
 4000-2000/1A, Class 5P20, 30-60VA for Main 2 Protection,
 4000-2000/1A, Class 0.2S,15VA(min burden) for Metering 1
 4000-2000/1A, Class 5P20, 30-60VA
 4000-2000/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
 4000-2000/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
Mid breaker CT
 4000-2000/1A, Class 5P20, 30-60VA for Main 1 Protection
 4000-2000/1A, Class 5P20, 30-60VA for Main 2 Protection,
 4000-2000/1A, Class 0.2S,15VA(min burden) for Metering 1
 4000-2000/1A, Class 5P20, 30-60VA
 4000-2000/1A, Class 5P20, 30-60VA
 4000-2000/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
 [Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]
- 1A7 Twenty seven (27) nos. of single-phase, 3-core, **420/√3 / 110/√3 / 110/√3 / 110/√3 kV/V/V/V, 5P20/5P20/0.2, 20-50/20-50/10-20VA** 420kV, 63kA/1sec, 50Hz, 1425kVp BIL,capacitor type voltage transformers.
 [Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]
- 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, 420kV, **4000A**, 1mH).
- 1A10 One (1) lot of 400kV post type support insulators required for completing 420kV 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 420kV 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 420kV 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, 3150A , 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).
- 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, 3150A , 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, 5-core, 245kV, 50kA/1s, 50Hz, 650kVp BIL, post type current transformer for Transformer bay: **245kV, 50kA/1s single phase, 6-core, current transformer with cores as follows:**
2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection
2400-1600-800/1A, Class 5P20, 30-60VA for Main 2 Protection,
2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 1
2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 2, BCU
2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure

[Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]

- 1B9 Twelve(12) nos. of single-phase, 5-core, 245kV, 50kA/1sec, 50Hz, 650kVp BIL, post type current transformer for Line bay **245kV, 50kA/1s single phase, 6-core, current transformer with cores as follows:**

**2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection
2400-1600-800/1A, Class 5P20, 30-60VA for Main 2 Protection,
2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 1
2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 2, BCU
2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
[Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]**

- 1B10 Three(3) nos. of single-phase, 4-core, 245kV, 50kA/1sec, 50Hz, 650kVp BIL, post type current transformer for bus coupler bay: **245kV,50kA/1s, single phase, 4-core, current transformer with cores as follows:**

- **3000-1500/1A, class 0.2S, 15VA(min burden) for measuring, BCU**
- **3000-1500/1A, class PX, 30-60VA for Busbar Differential Protection**
- **3000-1500/1A, class PX, 30-60VA for Busbar Differential Protection**
- **3000-1500/1A, class 5P20, 30-60VA for Protection**

[Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]

- 1B11 Thirty three (33) nos. of single-phase, 3-core, **230/√3 / 110/√3 / 110/√3 / 110/√3 kV/V/V/V, 5P20/5P20/0.2, 20-50/20-50/10-20VA** 245kV, 50kA/1sec, 50Hz, 1050kVp BIL, capacitor type voltage transformers.

[Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]

- 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 245kV 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, 3150A, 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, 3150A, 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, 5-core, 145kV, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer for Transformer bay **145kV, 40kA/1sec single phase, 5-core, current transformer with cores as follows:**

2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection

2400-1600-800/1A, Class 5P20, 30-60VA for Main 2 Protection,

2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 1
 2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 2, BCU
 2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
 [Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]

- 1C9 Twelve(12) nos. of single-phase, , 5-core, 145kV, 40kA/1sec, 50Hz, 650kVp BIL , post type current transformer for Line bay **145kV, 40kA/1sec single phase, 5-core, current transformer with cores as follows:**
 2400-1600-800/1A, Class 5P20, 30-60VA for Main 1 Protection
 2400-1600-800/1A, Class 5P20, 30-60VA for Main 2 Protection,
 2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 1
 2400-1600-800/1A, Class 0.2S,15VA(min burden) for Metering 2, BCU
 2400-1600-800/1A, PX, 30VA for Busbar Differential Protection and Breaker Failure
 [Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]

- 1C10 Three(3) nos. of single-phase,145kV, 40kA/1sec, 50Hz, 650kVp BIL, post type current transformer for bus coupler bay. **145kV, 40kA/1sec single phase, 4 -core, current transformer with cores as follows:**
 - 3000-1500/1A, class 0.2S, 15VA(min burden) for measuring, BCU
 - 3000-1500/1A, class PX, 30-60VA for Busbar Differential Protection
 - 3000-1500/1A, class PX, 30-60VA for Busbar Differential Protection
 - 3000-1500/1A, class 5P20, 30-60VA for Protection

[Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]

- 1C11 Twenty Four(24) nos. of single-phase, 3-core, **132/√3 / 110/√3 / 110/√3 110/√3 kV/V/V/V, 5P20/5P20/0.2, 20-50/20-50/10-20VA** 145kV, 40kA/1sec, 50Hz, 650kVp BIL,inductive type voltage transformers.
 [Actual Burden shall be finalized at execution time based on sizing calculation.
 Accuracy & VA shall have to be defined for all ratio]

1C12 Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50°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 36kV Air Insulated Switches and Connection for Auxiliary Transformers

The 36kV 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 36kV, 800A, 31.5 kA/1sec, 50Hz, 170kVp BIL, vacuum circuit breakers with spring-stored energy operating mechanism.

1D2 Four(4) sets of 36kV, 800A, 31.5 kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, motor operated disconnectors.

1D3 Fifteen(15) nos. of single-phase, 2-core, $33/\sqrt{3}$ / $110/\sqrt{3}$ / $110/\sqrt{3}$ kV/V/V, 5P20/0.2, 20-50/10-20VA 36kV, 31.5kA/1sec, 50Hz, 170kVp BIL, inductive type voltage transformers.
[Actual Burden shall be finalized at execution time based on sizing calculation. Accuracy & VA shall have to be defined for all ratio]

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 36kV terminal to switches including necessary fittings, structures and conductors and XLPE for 400/230/33kV transformer.

1D6 Three(3) sets of 36kV, 630A, 31.5 kA/1sec, 50Hz, 170kVp BIL, post type current transformer.
-100/1A, Class 0.2S, 10VA(min burden) for Metering 1 & Metering 2
-800/1, class 5P20, 30VA for protection
-800/1, class 5P20, 30VA for protection
-800/1, class 5P20, 30VA for protection

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 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 two 33/0.415 kV, auxiliary Zig-Zag transformer for the purpose of supplying the substation auxiliary power requirements.

1E4 One(1) sets Complete water spray fire fighting system for all 400/230/33 kV three phase outdoor type power transformer

1E5 One(1) sets Complete water spray fire fighting system for all 230/132/33 kV three phase outdoor type power transformer

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

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

1F1 One(1) lot of Complete station SAS panels including all required equipment & accessories for the whole Substation. SAS system shall include BCU for 400kV, 230kV, 132 kV level and auxiliaries.: as per Protection SLD, Two (02) sets of Industrial Server PC (latest generation) cum Operator workstation (Main & Redundant) with SAS & Engineering Software, Firewall, 55" or Large LED Monitor, One(01) lot of Ethernet Switch, One (01) set of GPS system, Two (02) sets of Printer, A4 Laser (One black & White, Other Color), One (01) nos of Engineering PC: (core i7-latest generation, 1TB (RAID 1) SSD, 16GB RAM, 27" display for SAS & SCADA), panels, Cables (Fiber Optic, Ethernet, Copper etc.), One (01) set of Common alarm unit with hooter/buzzer for annunciation etc & other accessories. Any other accessories shall be provided to complete the whole SCADA system as required.

400 kV Circuits

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

1F2 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuit bays. The control panels shall be supplied considering complete diameter..

- 1F3 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. The control panels shall be supplied considering complete diameter.
- 1F4 Two (2) set of Busbar protection for 400kV system
- 1F5 One (1) set of Independent standalone Digital Fault and Disturbance recorder (DFDR) with travelling wave fault locator to monitor all bays.
- 1F6 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, Canada, 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 :-

- 1F7 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuits bays.
- 1F8 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.
- 1F9 Control, Protection & Monitoring and Substation Automation System including event recording function for one(1) set of bus coupler circuit.
- 1F10 Two (2) sets of Busbar protection for 230kV system
- 1F11 One (1) set of Independent standalone Digital Fault and Disturbance recorder (DFDR) to monitor all bays.

- 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 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, Canada, 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 :-

- 1F13 Control, Protection & Monitoring and Substation Automation System including event recording function for Four (4) sets of overhead line circuits bays.
- 1F14 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.
- 1F15 Control, Protection & Monitoring and Substation Automation System including event recording function for one(1) set of bus coupler circuit.
- 1F16 One (1) set of Busbar protection for 132kV system
- 1F17 One (1) set of Independent standalone Digital Fault and Disturbance recorder (DFDR) to monitor all bays.
- 1F18 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, Canada, USA or Japan origin. Printed catalogue, operation and service manual are to be provided.

33kV Station Power System

- 1F19 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.

1F20 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 BPDB approved make. Printed catalogue, operation and service manual are to be provided.

1G **Multicore Cables**

1G1 One(1) lot complete setof 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 for outdoor switchyard equipment & Control Room with necessary connectors and clamps, with design to suit the work under this contract arrangement. Calculation and GPR shall have to show using software like CYMGRD.

1H2 One (1) lot of design, supply and installation of lightning protection screen for outdoor switchyard equipment & Control Room with necessary connectors and clamps, with design to suit the work under this project. Supporting calculation shall have to be shown in Rolling Sphere method.

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) 400KV System:

i)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.

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering international standards for 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.

ii)Two (2) sets of battery chargers complete, each charge shall not be less than 130A rating and input voltage three phase 50Hz, 415V AC.for 400kV switchyard.

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. 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.

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

All DC status excluding (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.) control & protection shall be incorporated in substation automation system.

b) 230KV System:

i)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.

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering international standards for 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.

ii)Two (2) sets of battery chargers complete, each charge shall not be less than 100A rating and input voltage three phase 50Hz, 415V AC.for 230kV switchyard.

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. 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.

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

All DC status excluding (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.) control & protection shall be incorporated in substation automation system.

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

c) 132KV System:

i)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.

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering international standards for 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.

ii)Two (2) sets of battery chargers complete, each charge shall not be less than 100A rating and input voltage three phase 50Hz, 415V AC.for 132kV switchyard.

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. 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.

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

All DC status excluding (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.) control & protection shall be incorporated in substation automation system.

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

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

i)Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge for for communication and protection.

During execution stage the battery capacity shall be confirmed with calculation by the contractor considering international standards for 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.

ii)Two (2) sets of battery chargers complete, each charge shall not be less than 100A rating and input voltage three phase 50Hz, 415V AC..

One set shall be used for DC supplies and the other set shall be used for standby (emergency) DC supplies. 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.

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

All DC status excluding (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.) control & protection 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 MVArh meters (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. [Tariff meter shall be BPDB approved make.](#)

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-proof 3-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 Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.

1K2 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 , gravel laying, sentry post, ansar barac etc.

1K3 One(1) lot of complete design, supply and construction of all civil items and facilities required for a new three storied Main Control Room Building, two(2) nos one storied switchyard panel room in 400kV switchyard and one nos one storied switchyard panel room in 132kV switchyard

1K4 Testing of pile Foundation , Compression & uplift on random basis.

1K5 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 with software 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 with software 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 400/230/132kV 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.

Section-II **Mandatory Spare parts including Maintenance Equipment**

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, & erection as per quantity mentioned in Schedule B of price schedule. The materials shall have to be handed over to the designated store as per instruction of the Engineer. Spare shall be supplied from main item make.