

POWER GRID COMPANY OF BANGLADESH LIMITED



Bidding Document for

Design, Supply, Installation, Testing & Commissioning of 400/230kV, 400/520MVA Transformer with associated switchgear in existing Aminbazar 400/230/132kV grid substation

Volume 3 of 3

Issued on : January 24, 2023
Invitation for Bids No. : 27.21.0000.101.07.420.23.398
OCB No. : PGCB/400kVTx/Aminbazar SS
Country : People's Republic of Bangladesh

Employer:



Power Grid Company of Bangladesh (PGCB)

PGCB Head office Building, Jahurul Islam city, Avenue-3
Aftabnagar, Badda, Dhaka-1212, Bangladesh

Contents of the Bidding Documents

VOLUME 1

Part 1: Bidding Procedures

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

Part 2: Employer's Requirements

- Section 6: Employer's Requirements (ERQ)

Part 3: Conditions of Contract and Contract Forms

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

VOLUME 2

- Scope of Work
- Technical Specifications
- Drawings forming Part of Specifications

VOLUME 3

- Schedule A: Introduction & Preamble to the Price & Technical Schedules
- Schedule B: Bid Prices & Schedules
- Schedule C: Bar Chart Program of Key Activities-Delivery & Completion Time Schedule
- Schedule D: Manufacturers, Places of Manufacture and Testing
- Schedule E: Technical Particulars and Guarantees
- Schedule F: Departure from the Specifications
- Schedule G: Proposed Alternative Standards
- Schedule H: Proposed Contract and Site Organization
- Schedule I: Drawings and Documents to be submitted with the Bid
- Schedule J: Proposed Subcontractors

Table of Contents

Page

Schedule A: Introduction and Preamble to the Price and Technical Schedules

1. Scope of Supply of Plant and Services

1.1 Description of Overall Project

Providing access to affordable and reliable electricity to all citizens is a national goal of the Government of Bangladesh (GoB). In 1996, the GoB split the transmission segment and formed the Power Grid Company of Bangladesh (PGCB). PGCB is fully responsible for all transmission assets.

The Power Grid Company of Bangladesh Ltd (PGCB) is responsible for construction, operation and maintenance of the national power transmission grid.

The Bangladesh Power Development Board (BPDB) is planning to develop 1320 MW thermal power projects based on imported coal at Payra.

Power from the generation projects at Payra would be partly consumed in the nearby areas like Khulna, while the major portion of the power would be brought to the capital city Dhaka.

It is envisaged to transfer power from Payra. to Dhaka through the PAYRA-GOPALGANJ-AMINBAZAR 400 kV high-capacity transmission system.

It is planned to integrate the 400kV corridor from Payra to Aminbazar into the transmission system from the Roopuur nuclear power project for transfer of power to Aminbazar Substation in Dhaka area

PGCB plans to install 400/230/33kv ,400/520MVA ATR at aminbazar to transmit power towards 230kv network.

1.2 Description of this Package

The work covered by this specification is related to the Substation **Aminbazar** – installation of a new 400/230/33 kV transformer.

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.

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

The Contractor is responsible for ensuring that all and/or any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid Price whether they be described in the specification or not.

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 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 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 and any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the bid price whether they be described in the specification or not.

The scope also includes witnessing of factory acceptance tests by the Employer's Engineer (two Engineers in each visit, and actual working days for each visit, excluding travelling time) for:

- 400/520MVA power transformer 400/230/33 kV

1.3 Basic Scope of Supply of Plant and Services

The scope of work under this contract includes design, supply, delivery, installation, testing & commissioning on turnkey basis of:

- ONE(01) three phase, 400/230/33 kV, 400/520 MVA autotransformer,
 - 33/0.415KV,350KVA ,earthing transformer
 - 400kv Surge arrester
 - 230kv surge arrester
 - 230kv post insulator
 - necessary works for re-design, re-location, modification and re-connection of the existing equipment/switchgear for connection with the new equipment/switchgear
-

1.4 Detailed Description of the Scope of Supply

No.	Description	Quantity
A	420 kV switchgear, equipment connection and steel structures	
	The set of complete equipment for switchgear 420 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:	
A1	Surge arrester 420 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 336 kV, Uc = 268 kV, 10 kA nominal discharge current, 50 Hz	3 Nos.
A2	The lot of fittings including all necessary conductors, clamps and connectors required for completing 420 kV CVT, SA	1 lot
A3	Equipment supports steel structure including nut-bolts required for completing 420 kV SA on existing foundation	1 lot
B	245 kV switchgear, equipment connection and steel structures	
	The set of complete equipment for switchgear 245 kV shall be designed,	

No.	Description	Quantity
	supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:	
B1	Surge arrester 245 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 192 kV, Uc = 153 kV, 10 kA nominal discharge current, 50 Hz	3 Nos.
B2	Post insulator 245 kV, single phase, 10 kN, 50 kA / 1 sec, 50 Hz, 1,050 / 460 kV BIL	3 Nos.
B3	The lot of conductors 245 kV, for double busbars system and for connection of the 245 kV switchgear, 2,000 A, 50 kA / 1 sec, 50 Hz 1,050 / 460 kV BIL, three phase	One (1) lot
B4	The lot of fittings including all necessary conductors, clamps and connectors required for completing 245 kV switchgear.	One (1) lot
B5	Equipment supports steel structure including nut-bolts required for completing 245 kV switchgear on existing foundation.	One (1) lot
C	36 kV Switchgear, equipment connection and steel structures	
	The set of complete equipment for switchgear 36 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:	
C1	Current transformer 36 kV, single-phase, 3-core, single ratio, 800/1A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, post type current transformer.	3 Nos.
C2	Surge arrester 36 kV, single phase, gapless, metal oxide type, Uc = 30 kV, Ur = 24 kV, 10 kA nominal discharge current, 50 Hz, 170 / 70 kV BIL,	3 Nos.
C3	The lot of conductors 36 kV, for connection of the 36 kV switchgear,	One (1) lot

No.	Description	Quantity
C4	The lot of fittings including all necessary clamps and connectors required for completing 36 kV switchgear.	One (1) lot
C5	Modification of existing equipment support structure required for completing 36 kV switchgear.	One (1) lot
D	Transformers	
	The set of complete equipment 400/230/33 kV for transformation of energy shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:	
D1	The Auto-transformer 400/235/33 kV, 420/520 MVA, YNa0d1, ONAN/ONAF, with tertiary winding, three phase, oil immersed, hermetically closed, with on-load tap changer; with single phase, 3-core current transformers in all bushings. Characteristics of CTs will be defined during design	One(01) No.
D2	existing Nitrogen Injection Fire Protection System (NIFPS) shall be adapted for the new 400/235/33 kV autotransformer units	One (1) lot
E	Earthing/Auxiliary Transformers	
	The set of complete equipment 33/0.415 kV for transformation of energy for auxiliary power supply shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:	
E1	The auxiliary power transformer 33/0.415 kV, 350 kVA, ZNyn11, ONAN, oil immersed, three phase, with off-load tap changer; with single phase, 2-core current transformers in all bushings. Characteristics of CTs will be defined during design	One(01)set
F	Control, Protection, Substation Automation and Metering	
	The lot of complete equipment for control, protection, alarm, SAS and metering panels for the 400 kV & 230kV & 33 kV system as well as LV AC and LV DC system shall be modified, tested and commissioned under this contract for successful commissioning of the bay.	
F1	Existing Control, protection and SAS for ATR-1 , shall be re-connected and completing the testing ,commissioning	One(01)set

No.	Description	Quantity
F2	existing Control, protection and SAS for one (1) set of 33/0,4 kV Auxiliary Transformer circuits shall be reconnected, tesing and commissioning	One(01)set
F3	existing Control, protection and SAS for complete LV part of the Substation, AC & DC, reconnect, tesing ,commissioning	One (1) lot
F4	existng Substation Automation System for ATR-1 shall be complete with wiring ,testing ,commissioning	One (1) lot
F5	existing 400 kV busbars, in one and half breaker type busbar system, shall be tested & commisioning for ATR_1	One (1) lot
F6	existing Control, protection and SAS for two 230 kV busbars shall be complete with wiring ,testing and commissioning	One (1) lot
F7	eixsting tariff metering panel reconnection ,testing and commissioning For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.	One (1) lot
F8	existing Digital Fault and Disturbance Recorder (DFDR) system shall be complete with wiring , testing and commissioning	One (1) lot
F9	existing telecommunication system testing and commissioning for ATR_1	One (1) lot

No.	Description	Quantity
I	EXISTING Fire alarm & fire fighting system shall be complete for ATR_1 with wiring,testing,commissioning	One (1) lot
J	Earthing and Lightning Protection	
J1	existing earthing and Lightning Protection for ATR_1 shall be re-connncted and tested	One (1) lot
K	POWER Cable 36kV	
K1	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable. .	450 m
K2	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, cable end terminal end for single phase XLPE cable	One (1) lot

1.4.1.1 Scope of Work and Supply at Aminbazar 400 kV Substation

1.5 Type Test Requirements for Major Plant / Equipment

Please refer to Schedule-I of this Volume 3 of the tender document

1.6 Terminal Points

1.6.1 Transmission Line Circuit Connections not require

The slack spans including overhead earth wires between the 400 kV overhead line terminal towers and the substation gantry structures shall be supplied and terminated by the overhead line Contractors. All required insulators and hardwires shall also be supplied by the overhead line Contractors.

Eyebolts/U-bolts or other suitable fixtures for terminating the slack spans on the switchyard gantry shall be provided under this substation contract.

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

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

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

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

1.6.2 Substation Connections

The Contractor shall provide all equipment and shall provide all works and services inside the both Substation. All parts of new and existing substation shall be connected at the appropriate way.

- The 400/230/33 kV power transformers shall be connected with the appropriate 230 kV transformers bays via 230 kV available CSE.
 - Control & protection systems shall be RECONNECTED ,tested & commission by OEM engr. Or their certified Engr.
-

- Communication systems shall be connected, tested & commission
- Lightning protection systems shall be re-established

1.7 System Electrical Parameters

1.7.1 System Conditions

Equipment supplied under this contract shall be suitable for the following system conditions:

Description	Unit	Required		
Nominal system voltage between phases	kV	400	230	33
System frequency	Hz	50		
Rated voltage between phases	kV	420	245	36
Rated lightning impulse withstand voltage	kV	1425	1050	170
Rated switching impulse withstand voltage	kV	1050	-	-
Rated power frequency withstand voltage	kV, 1 min	-	460	70
Rated symmetrical short-circuit current	kA, 1 sec	63	50	25

1.7.2 System Earthing

The 400/230/33kV autotransformers are solidly earthed.

The 400 kV & 230 kV systems are solidly earthed at the 400/230/33 kV autotransformer neutrals but not earthed at the Grid supply points.

The 33 kV system is solidly earthed at some of the grid substations and resistance earthed at some other of the grid substations.

1.7.3 Minimum Substation Clearances

Air insulated connections shall have electrical clearances as listed in the following table:

Description	Unit	Required		
Nominal system voltage	kV	400	230	33
Minimum clearance between live metal parts and earth	mm	3500	2100	380
Minimum clearance between live metal	mm	4000	2400	430
Minimum safety clearance between ground and the nearest point not at earth potential of an insulator	mm	2500		
Minimum safety clearance between ground and the nearest live unscreened conductor (BS 7354: Safety Working Clearance)	mm	6400	4600	2800
Minimum insulator creepage distance (at rated voltage between phases)	mm/kV	25		

1.7.4 Low Voltage AC System

Description	Unit	Required
Rated service voltage (3 phase, 4 wire 50 Hz)	V	415 / 230
Tolerance on rated voltage	%	+15%, -15%
Switchgear symmetrical breaking capacity	kA	15 kA, 3 sec
System earthing	-	solid

1.7.5 Low Voltage DC System

For d.c. motor driven auxiliaries, relays, tripping, indicating lamps and controls.

Description	Unit	Required
Nominal DC voltage	V	110
Tolerance on rated voltage	%	+15%, -15%

For telecommunication & SCADA

Description	Unit	Required
Nominal DC voltage	V	48
Tolerance on rated voltage	%	+15%, -15%

1.8 Climatic Conditions

All plant and equipment supplied under the contract shall be entirely suitable for the climatic conditions prevailing at site.

The project area and vicinity is close to sea level and is in a tropical climate.

The ambient shade temperature variation is between 4 °C and 45 °C with periods of high humidity.

Between May and November, low-lying areas are subject to flooding. Flooding countermeasure shall be taken for the civil design, so as not to affect any substation equipment during the wet season. As per the recorded past maximum flood water levels in the project area, sufficient ground level height for land formation is required at the Contractor's responsibility. On certain sites, the flooding can be taken as an advantage in that the heavy loads may be floated on barges to close proximity of the sites.

The project area is a designated zone of moderate earthquake intensity. The seismic factor is 0.1 g. Atmospheric pollution is moderate and no special insulator design or washing is required. The area is subject to high winds of typhoon strength.

Description	Unit	Required
Maximum ambient shade temperature	°C	45
Minimum ambient shade temperature	°C	4
Maximum daily average temperature	°C	35
Maximum annual average temperature	°C	25
Maximum wind velocity	km/h	160
Minimum wind velocity for line rating purposes	km/h	3.2
Solar radiation	W/m ²	1000
Rainfall	mm/year	2500
Relative humidity, maximum	%	100
Relative humidity, average	%	80
Altitude	m	< 1000
Atmospheric pollution	-	medium
Icing		no ice or snow expected
Seismic factor	g	0.1
Soil type	-	alluvial
Soil temperature (at 1.1 m)	°C	30 °C at 1.1 meter depth
Soil thermal resistivity	°Cm/W	1.5
Isokeraunic level (thunderstorm days/year)	days/year	80

The information in this clause is given solely for the general assistance of Bidders and no responsibility for it will be accepted nor will any claim based on this clause be considered.

Schedule B: Bid Prices & Schedules

General

1. The Price Schedules are divided as follows:

Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad
Schedule No. 2: Plant and Mandatory Spare Parts Supplied from within the Employer's Country
Schedule No. 3: Design Services
Schedule No. 4: Installation and Other Services
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 previously mentioned, including overheads and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

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

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

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

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

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

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

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

Schedule B: Schedules of Rates and Prices

Schedule No. 1: Plant and Mandatory Spare Parts Supply from Abroad

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

Schedule No. 3: Design Services

Schedule No. 4: Installation and Other Services

Please see the separate Excel file for the above.

The Bidder shall fill, sign and stamp the attached price schedules and shall attach them to the bid.

(Price schedules are attached at the end of this document.)

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

Bidders shall fill, sign and stamp the attached time schedule and shall attach it to the bid.

The Bidder shall provide

- Filled general time schedule, provided below and as Appendix 4 to the Section 9: Contract Forms,
- Detail proposal for Mobilization Schedule, Section 4: Bidding Forms, item 5.3. and
- Detail proposal for the Construction Schedule, Section 4: Bidding Forms, item 5.4.

Please find the time schedule attached.

Time Schedule

Time Schedule (continued)

Schedule D: Manufacturers, Places of Manufacture and Testing

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

Manufacturers

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
Power Transformer					
1.1.	Power transformer 400/230/33 kV				
1.2.1:	HV Bushing				
1.2.2	MV Bushing				
1.2.3	LV Busing				
1.2.4	On Load Tap Changer				
1.2.5	Copper				
1.2.6	Core plates				
1.2.7	Tank				
1.2.8	Radiators				
1.2.9	Fan motors				
1.2.10	Transformer oil				
1.2.11	Oil valves				
1.2.12	Oil level indicator				
1.2.13	Membrane				
1.2.14	Pressure relief device				
1.2.15	Buholz relay				
1.2.16	Gas actuated relay				
1.2.17	Thermal image				
1.2.18	Oil temperature indicator				
1.2.19	Winding temperature indicator				
1.2.20					

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
Auxiliary Power Transformer					
2.1.	Auxiliary power transformer 33/0.4 kV				
High Voltage Equipment 400 kV					
3	Surge arresters 400 kV				
High Voltage Equipment 230 kV					
4.1	Surge arresters 230 kV				
4.2	Post insulators 230 kV				
33 kV Equipment					
5.1	Current transformers 33 kV				
5.2	Surge arresters 33 kV				

[illegible]

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
13.1	33kV Cables				
13.2	33kV Cable termination				
Name of Bidder:					
Signature of Bidder:					

Schedule E: Technical Particulars and Guarantees

1. General

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

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

They should be fully completed and submitted with the bid.

2. Technical Data Schedules

Please find the technical data schedules ATTACHED IN ANNEXURE _A

2.1

Schedule F: Departures from the Specifications

Bidders shall list all departures from the requirements of the specification in this schedule, whether they are commercial, financial, technical or of a contractual nature, and shall attach this list to the technical proposal.

Any item not listed in this schedule is deemed in full accordance with the requirements of the specification.

No other document or detail accompanying the tender will be considered when evaluating departures.

Bidders are not permitted to offer any alternative to this schedule.

Item	Volume	Clause	Detail of Departure from Specification

Schedule G: Proposed Alternative Standards to which Equipment shall be Provided

The Bidder shall list below all 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.

If no alternative standards are listed, it is deemed that the standards specified in the bidding document are fully complied with.

Specified Standard	Number	Alternative Standard Title

Schedule H: Proposed Contract and Site Organization

Personnel

The data on their experience should be supplied using the Form below for each candidate.

The Bidder must demonstrate that he has the personnel for the key positions that meet the following requirements:

No.	Position	Total Work Experience (years)	Work Experience In Similar Projects (years)
1	Contractor's Representative Project Director / Project Manager	15	10
2	Substation Design Engineer	12	8
3	Site Manager	10	5
4	HV Electrical Engineer	10	5
5	Protection Engineer	10	5
6	Control Engineer	10	5
7	Substation Civil Engineer	10	5
8	Health & Safety (Accident Prevention) Officer*	8	5
9	Environmental Specialist*	8	5
10	Social / Land Acquisition / Compensation Specialist*	8	5

* Workforce Management / Health & Safety (Accident Prevention) Officer, Environmental Specialist and Social / Community Liaison and Land Acquisition / Compensation Specialist shall be responsible inter alia for development of site - and works-specific CESMMP, including all sub-plans as indicated in Volume II (ERQ), Annex 1 and for the implementation of these plans, including monitoring and related reporting within the standard progress reporting of the project.

- All three specialists shall be full time position, during on-site construction.
- All three specialist shall be familiar with the application of the World Bank Group's General EHS Guidelines and the Sector EHS Guidelines for Electric Power Transmission and Distribution and with the other international standards as set out in Volume II (ERQ), Annex 1.
- CV's of the three specialists have to be provided with the bidding documents, including evidence for each expert for having worked with application of the required standards.
- Each of the three specialists for E&S Management should be provided with appropriate assistance in terms of additional support staff of appropriate qualification to ensure due implementation of the CESMMP.
- The numbers of support staff for each of the specialists/the final team set up for E&S Management of the Construction Phase shall be provided as part of the bidding document.

The Bidder shall provide details of the proposed personnel and their experience records in the relevant information forms included in Section 4 (Bidding Forms) of Volume 1 of the Bidding Document and below.

Schedule I: Drawings and Documents to be submitted with the Bid

The following drawings/documents shall be submitted with the bid:

1. Typical single line, layout and sectional drawings of substation showing details of construction and dimensions.
 2. Outline drawings of all switchgear equipment:
 - Showing installed dimensions and weights;
 - Showing transport dimensions and weights;
 3. Outline drawings of all power transformers and auxiliary transformers:
 - Showing installed dimensions and weights;
 - Showing transport dimensions and weights;
 4. Typical drawing of transformer remote control panel.
 5. The following Type test certificates of the equipment of similar or higher specifications (higher voltage & higher capacity) required by the bid shall be submitted as per relevant IEC.
 - **Power Transformer**
 - Temperature rise test.
 - Dielectric tests (Induced over voltage test, Lightning impulse voltage withstand test, Separate source voltage withstand test).
 - Short circuit withstand test (special test)
 - **Lightning Arrester(AIS)**
 - Power frequency voltage withstands (wet & dry) and lightning impulse voltage withstand tests on complete arrester housing.
 - Operating duty test.
 - Long duration current impulse withstand test.
 - Residual voltage test.
 - Pressure relief test.
 - Artificial pollution test.
 - Partial discharge test
 - **For Substation Automation System and Protection Relays**
 - Type test certificates from independent reputed testing laboratory for Protective relays as per IEC 61850.
 - **Power Cable**
 - Bending test followed by partial discharge test
 - Tan Delta measurement
 - Heating cycle voltage test
 - Impulse withstand test
 - **For Insulator Units (Disc & Post)**
 - Dry lightning impulse voltage withstand test;
-

Schedule J: Proposed Subcontractors

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

Subcontractors

The following Subcontractors are proposed for carrying out the facilities:

Item	Service	Subcontractor's Name and Address	Nationality
1.	Electrical Works Subcontractor		
2	Civil Works Subcontractor		
Name of Bidder:			
Signature of Bidder:			

Name of Bidder:

Signature of Bidder:

400/235/33 kV 400/520 MVA ONAN/ONAF Autotransformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Autotransformer three-phase, oil immersed, with tertiary winding, hermetically sealed, with on-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044 IEC 60076 IEC 60137 IEC 60214 IEC 60354 IEC 60529 IEC 60815 IEC 60947 NEMA TR-1 CENELEC EN 50216	
1.6	Quality control		ISO 9001	
1.7	Tertiary winding function		Stabilizing winding & auxiliary power supply	
1.8	Thermal insulation class		A	
2	Ratings and properties			
2.1	Rated power: • Primary / secondary winding • Tertiary - minimum	MVA MVA	520 / 520 ≥ 104	
2.2	Rated power by cooling ONAN / ONAF • Primary / secondary winding • Tertiary – minimum	MVA MVA	400 / 520 ≥ 80 / ≥ 104	
2.3	Rated voltage of windings: • HV winding • MV winding • LV - stabilizing winding	kV kV kV	400 235 33	
2.4	Tap changer:			
	• Manufacturer		Insert	
	• Country of origin		Insert	
	• Model designation		insert	
	• Type of tap changing		On-load	
	• Tap changer location		At High voltage side	
	• Type of voltage regulation	%	C.F.V.V.	
	• Tapping range	%	±10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	• Tapping step		1.25	
	• Rating		Rated power 520 MVA, all taps	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		YNa0d1	
2.7	Neutral point insulation		Li95	
2.8	Low voltage winding connection (LV)		Open delta, with four terminals brought out outside of the tank	
3	Special technical requirements			
3.1	Short circuit impedance corrected to reference temperature of 75°C at rated frequency and rated power			
3.1.1	HV - MV, on the basis of rated power with on-load tap changer in middle position	%	13 ±10 %	
3.1.2	HV - LV, on the basis of rated power with on-load tap changer in middle position	%	Insert	
3.1.3	MV - LV, on the basis of rated power 'x' MVA with on-load tap changer in middle position	%	Insert	
3.2	Zero-sequence impedance, with tap changer in middle position: • HV/MV • HV/LV • MV/LV	% % %	Insert Insert Insert	
3.3	Autotransformer capacity to withstand external short circuits			
3.3.1	Short-circuit duration	s	2	
3.3.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: • HV winding • MV winding • LV winding • Pre-fault voltage	kA kA kA p.u.	63 50 25 1.05	
3.4	Guaranteed losses			
3.4.1	a. No-load losses with tap changer in nominal tap position: at rated voltage and rated frequency	kW	Insert	
	b. No-load losses with tap changer in nominal tap position at 110% rated voltage and rated frequency	kW	Insert	
	c. No-load losses with tap changer in nominal tap position at 90% rated voltage, at rated frequency	kW	Insert	
	d. average no load loss (this value will be evaluated)	kW	(a+b+c)/3	

3.4.2	No-load losses capitalized value	BDT/kW	600,000	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
No.	Description	Unit	Minimum Requirements Data	Guaranteed
3.4.4	a. On-load losses at 75°C, with tap changer in nominal position and at rated current of that tap position	kW	Insert	
	b. On-load losses at 75°C, with tap position in plus (+) extreme tap position and at rated current of that position	kW	Insert	
	c. On-load losses at 75°C, with tap position in minus (-) extreme tap position and at rated current of that position	kW	Insert	
	d. average on load losses (this value will be evaluated)	kW	(a+b+c)/3	
3.4.5	On-load losses capitalized value	BDT/kW	300,000	
3.4.6	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.5	Ancillary equipment (fans, pumps, heaters, etc.)			
3.5.1	Load of ancillary equipment <u>(this value will be evaluated)</u>	kW	Insert	
3.5.2	Capitalized valued of ancillary equipment load	BDT/kW	300,000	
3.5.3	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	20	
3.6	Insulation level			
3.6.1	High voltage (HV)		LI 1425 SI1050	
3.6.2	Medium voltage (MV)		LI 1050 AC 460	
3.6.3	Neutral		LI 95 AC 38	
3.6.4	Low voltage (LV)		LI 170 AC 70	
3.7	The highest voltage for equipment (effective value)			
3.7.1	High voltage (HV)	kV	420	
3.7.2	Medium voltage (MV)	kV	245	
3.7.3	Neutral	kV	17.5	
3.7.4	Low voltage (LV)	kV	52	
3.8	Rated insulation level			
3.8.1	Induced voltage (ACSD, ACLD)	kV	In acc. to IEC 60076-3	
3.9	Efficiencies			
3.9.1	If $\cos\phi = 1.0$ and: <ul style="list-style-type: none"> 25 % load of the rated value 50 % load of the rated value 75 % load of the rated value 100 % load of the rated value 		Insert Insert Insert Insert	
3.9.2	If $\cos\phi = 0.8$ (inductive) and: <ul style="list-style-type: none"> 25 % load of the rated value 50 % load of the rated value 75 % load of the rated value 100 % load of the rated value 		Insert Insert Insert Insert	
3.10	Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position			
3.10.1	• $\cos\phi = 1.00$		Insert	
3.10.2	• $\cos\phi = 0.95$ (inductive)		Insert	
3.10.3	• $\cos\phi = 0.90$ (inductive)		Insert	

3.10.4	• $\cos\varphi = 0.80$ (inductive)		Insert	
3.11	No-load current at rated frequency			
3.11.1	At 0.90 Un		Insert	
3.11.2	At 1.00 Un		Insert	
3.11.3	At 1.05 Un		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.12.1	Top oil	K	≤ 50	
3.12.2	Winding	K	≤ 55	
3.12.3	Hottest spot	K	≤ 65	
3.13	At the emergency cases it is allowed: <ul style="list-style-type: none"> Continuous overload at the highestwinding temperature which exceeds by 2.5°C the guaranteed limit value Continuous voltage increase when the topoil temperature exceeds the guaranteed limit by 2.5°C at rated power (in % of the rated voltage) 	MVA %	Compliant to IEC 60076-7	
3.14	Guaranteed value of overloads in % of the rated power			
3.14.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.14.1.1	After operation under 15 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	
3.14.1.2	After operation under 20 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	
3.14.1.3	After operation under 120 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	
3.14.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.14.2.1	After operation under 15 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	
3.14.2.2	After operation under 15 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	
3.14.2.3	After operation under 15 min <ul style="list-style-type: none"> full rated power ¾ rated power ½ rated power 		Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: <ul style="list-style-type: none"> with all cooling groups in operation (excluding stand-by cooling group) with one cooling group out of operation with two cooling groups out of operation 		Insert Insert Insert	
4	Oil			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Maximum dielectric strength	kV/cm	Insert	
4.8	Data sheet attached		Insert	
4.9	Corrosive Sulphur		Non-Corrosive	
4.10	PCB content		Without PCB	
5	Bushing			
5.1	HV bushing			
5.1.1	Quantity		3	
5.1.2	Class	kV	420	
5.1.3	Manufacturer		Insert	
5.1.4	Type		Insert	
5.1.5	Rated current	A	≥ 1000	
5.1.6	Rated short circuit current (2 s)	kA rms	63	
5.1.7	Rated lightning impulse withstand voltage	kV peak	1425	
5.1.8	Rated switching impulse withstand voltage	kV peak	1050	
5.1.9	Rated power frequency withstand voltage	kV rms	Not applicable	
5.1.10	Connectors			
5.1.10.1	Shape	mm	Ø 50	
5.1.10.2	Length	mm	125	
5.1.10.3	Suitable for		Al wire	
5.1.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.1.12	Full vacuum withstand of complete bushing		YES	
5.2	Neutral bushing (identical as LV bushing)			
5.2.1	Quantity		1	
5.2.2	Class	kV	52	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Insert	
5.2.5	Rated current	A	≥ 2000	
5.2.6	Rated short-circuit current (2 s)	kA rms	50	
5.2.7	Rated lightning impulse withstand voltage	kV peak	insert	
5.2.8	Rated switching impulse withstand voltage	kV peak	-	
5.2.9	Rated power frequency withstand voltage	kV rms	insert	
5.2.10	Connectors			
5.2.10.1	Shape	mm	Flat	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.10.2	Length	mm	-	
5.2.10.3	Suitable for		Cu wire	
5.2.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2.12	Full vacuum withstand of complete bushing		YES	
5.3	MV bushings			
5.3.1	Quantity		3	
5.3.2	Class	kV	245	
5.3.3	Manufacturer		Insert	
5.3.4	Type		Insert	
5.3.5	Rated current	A	≥ 1600	
5.3.6	Rated short-circuit current (2 s)	kA rms	50	
5.3.7	Rated lightning impulse withstand voltage	kV peak	1050	
5.3.8	Rated switching impulse withstand voltage	kV peak	-	
5.3.9	Rated power frequency withstand voltage	kV rms	460	
5.3.10	Connectors			
5.3.10.1	Shape	mm	Ø 50	
5.3.10.2	Length	mm	125	
5.3.10.3	Suitable for		Al wire	
5.3.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.3.12	Full vacuum withstand of complete bushing		YES	
5.4	LV bushings			
5.4.1	Quantity		4	
5.4.2	Class	kV	36	
5.4.3	Manufacturer		Insert	
5.4.4	Type		Insert	
5.4.5	Rated current	A	≥ 2000	
5.4.6	Rated short-circuit current (2 s)	kA rms	25	
5.4.7	Rated lightning impulse withstand voltage	kV peak	170	
5.4.8	Rated switching impulse withstand voltage	kV peak	-	
5.4.9	Rated power frequency withstand voltage	kV rms	70	
5.4.10	Connectors			
5.4.10.1	Shape	mm	Flat	
5.4.10.2	Length	mm	-	
5.4.10.3	Adjusted for Cu wire		Cu wire	
5.4.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.4.12	Full vacuum withstand of complete bushing		YES	
6	Design Data			
6.1	Maximum flux density in the legs • At rated voltage • At 105 % of the rated voltage	T T	Insert Insert	
6.2	Maximum flux density in the yokes: • At rated voltage • At 105 % of the rated voltage	T T	Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.3	Maximum current density in windings at rated power and normal tap changer position: <ul style="list-style-type: none"> HV winding MV winding LV - stabilizing winding 	A/mm ² A/mm ² A/mm ²	Insert Insert Insert	
6.4	Winding resistance at 75°C and middle tap changer position: <ul style="list-style-type: none"> HV winding MV winding LV - stabilizing winding 	Ω Ω Ω	Insert Insert Insert	
6.5	Core construction			
6.5.1	Method of joining of legs		Insert	
6.5.2	Method of joining of yokes		Insert	
6.5.3	Joining material		Insert	
6.5.4	Number of legs		Insert	
6.5.5	Type of core steel		Insert	
6.5.6	Specific loss of core steel at 1.7 T inductance	W/kg	< 1.11	
6.6	Winding conductor			
6.6.1	HV winding		Cu - Interleaved & Continuous	
6.6.2	MV winding		Cu - Continuous	
6.6.3	LV - stabilizing winding		Cu - Helical	
6.7	Audible noise level (acc. to NEMA TR1), at 105 % of rated voltage, at maximum power and with complete cooling system in service	dB	Insert	
6.8	Radio Interference Voltage at 0.5 MHz as specified in IEC 60694	μV	2500 max	
7	Weights and dimensions			
7.1	Total weight of autotransformer, equipped for service	kg	less or equals to attached GA value*	
7.2	Core and oil assembly	kg	insert*	
7.3	Total mass excluding oil	kg	insert*	
7.4	Tank and accessories	kg	insert*	
7.5	Oil mass in tank	kg	insert*	
7.6	Oil mass in coolers	kg	insert*	
7.7	Oil mass total	kg	insert*	
7.8	Total mass	kg	insert*	
7.9	Maximum shipping weight (the heaviest item)	kg	insert*	
7.10	Height from foundation to: <ul style="list-style-type: none"> Highest point of HV bushing Highest point of tank Highest point of conservator Highest point of lifting hook for removal of core and oil assembly 	mm mm mm mm	As per GA* As per GA* As per GA* As per GA*	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.11	Outer dimensions: • Length • Width	mm mm	As per GA* As per GA*	
7.12	Informative dimensional sketch		To be enclosed with bid	
7.13	Maximum shipping dimensions of tank: • Outside height • Outside width • Outside length	mm mm mm	insert	
7.14	Transportation drawing		To be enclosed with bid	
8	Tap changer			
8.1	Manufacturer		Insert	
8.2	Type		Insert	
8.3	Insulation level	kV	Li 1050	
8.4	Rated current	A	≥ 1000	
8.5	Number of steps		17	
8.6	Regulating coil		At auto point	
8.7	Short-circuit withstand	kA rms	Insert	
8.8	BIL to ground through the regulating coil	kV peak	Insert	
8.9	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
8.10	Tap position indicator		Digital code matrix (BCD)	
8.11	Auxiliary supply		3x400 V / 230 V, 50 Hz	
9	Auxiliary power supply			
9.1	Motors		3x400 V / 50 Hz	
9.2	Heaters		230 V / 50 Hz	
9.3	Control voltage		110 V DC	
9.4	Oil pump		3x400 V / 50 Hz	
10	Current transformer incorporated into the power autotransformer			
10.1	CT in HV bushings, for protection, WTI and/or Tap Changer		In all phases, 3 cores characteristics shall be defined in design stage	
10.2	CT in MV bushings, for protection, WTI and/or Tap Changer		In all phases, 3 cores characteristics shall be defined in design stage	
10.3	CT in neutral bushing , for protection		In all phases, 3cores characteristics shall be defined in design stage	
10.4	CT in LV bushings, for protection		In all phases, 3 cores characteristics shall be defined in design stage	
11	Layout			
11.1	Primary winding bushings		Longitudinal axis	
11.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
11.3	Conservator tank		To be defined in design stage	
11.4	Tap changer		To be defined in design stage	
11.5	Control cabinet		To be defined in design stage	
11.6	Coolers		To be defined in design stage	
11.7	Connection drawing, block diagram		To be enclosed with bid	
12	Cooling groups			
12.1	Number of cooling groups (total)	Qty.	4	
12.2	Number of cooling groups (for rated power)	Qty.	3	
12.3	Number of stand-by cooling groups	Qty.	1	
12.4	Number of coolers in a cooling group	Qty.	Insert	
12.5	Number of spare fans	Qty.	Insert	
12.6	Rating of each cooler	kW	Insert	
12.7	Full vacuum withstand of complete cooler	mbar	Yes	
13	Dehydrating breather			
13.1	Type of dehydrating breather		Insert	
13.2	Dehumidifying agent	kg	Insert	
14	Autotransformer tank			
14.1	Type of design			
14.2	Thickness of transformer tank: • Sides • Bottom • Top	mm mm mm	Insert Insert Insert	
14.3	Material of the autotransformer tank		Insert	
14.4	Wheels			
14.4.1	Wheel number for each rail of two pair rails		Two pairs	
14.4.2	Axial inter space in transversal direction between two pairs of rails	mm	insert	
14.4.3	Transversal distance between wheels in pair	mm	insert	
14.4.4	Distance between wheels in longitudinal direction	mm	insert	
14.5	Corrosion protection of the tank		YES	
14.6	Vacuum withstand of the complete tank with cooler	mbar	insert	
14.7	Over-pressure withstand of the complete auto-transformer	bar	insert	
15	Conservator			
15.1	Type		With diaphragm	
15.2	Number of compartments	pcs.	2	
15.3	Total volume of conservator	m ³	Insert	
15.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: <ul style="list-style-type: none"> Maximum diagraph stress at highest working pressure Diagraph construction details Type of diagraph material 		Insert Insert Insert	
15.7	Corrosion protection of conservator		Insert	
15.8	Oil level indicators with alarm for minimum oil level	pcs.	2	
16	Operating conditions			
16.1	At the altitude (above sea level)	m	≤ 1000	
16.2	Maximum ambient temperature	°C	+ 45	
16.3	Average daily temperature	°C	+ 35	
16.4	Average annual temperature	°C	+ 30	
16.5	Minimum ambient temperature	°C	– 5	
16.6	Tertiary winding		Will be used	
16.7	Parallel operation		Yes	
	Overall compliance with the requirements (yes/no)			

Surge Arrester 36 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Surge Arresters - General			
1.1	Manufacturer			
1.2	Type		Outdoor	
1.3	Model designation			
1.4	Country of origin			
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		yes	
1.8	Short circuit testing authority		Insert authority	
2.	Surge Arresters - Characteristics			
2.1	Nominal system voltage	kV _{rms}	33	
2.2	Highest voltage for equipment U _n	kV _{rms}	36	
2.4	Rated voltage of surge arrester U _r	kV _{rms}	30	
2.5	Max. continuous operating voltage U _c	kV _{rms}	24	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current I _n (8/20 μs)	kA _{peak}	10	
2.10	High current impulse of an arrester (4/10 μs)	kA _{peak}	100	
3.	Surge Arresters - Design and Construction			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 μs)	A	≥ 850	
3.4	Maximum residual voltage U _{res}			
3.4.1	For switching impulse current 30/60 μs at 0,5 kA	kV _{peak}	≤ 65	
3.4.2	For switching impulse current 30/60 μs at 1 kA	kV _{peak}	≤ 67.5	
3.4.3	For switching impulse current 30/60 μs at 2 kA	kV _{peak}	≤ 70	
3.4.4	For lightning impulse current 8/20 μs at 5 kA	kV _{peak}	≤ 75	
3.4.5	For lightning impulse current 8/20 μs at 10 kA	kV _{peak}	≤ 80	
3.4.6	For lightning impulse current 8/20 μs at 20 kA	kV _{peak}	≤ 90	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 μs)	kV	≥ 235	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 105	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F _{dyn})	N	≥ 7500	
3.6.2	Specified long-term load SSL (F _{stat})	N	≥ 5000	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		yes (LSR)	
3.9	Insulating basement		yes	
3.10	Surge arrester height	mm	app 649	
3.11	Surge arrester weight	kg	11	

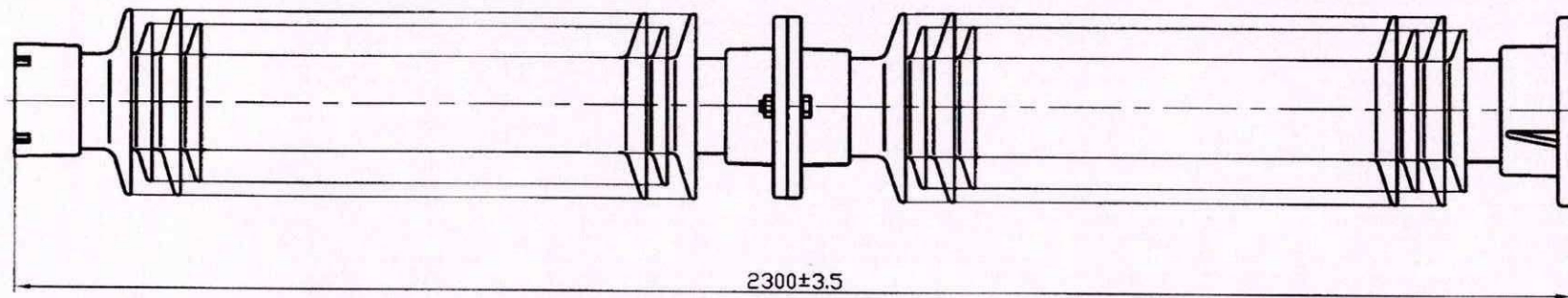
No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	NO	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	100*100	
3.14.3	Number of holes		4	
3.14.4	Distance between holes	Mm	50*50	
3.14.5	Material suitable for		Al terminal	
	Overall compliance with the requirements (yes/no)			

Post Insulator 245 kV

Post Insulator-245 kV				
No.	Description	Unit	Minimum Requirements Data	
1.	Post Insulators - General			
1.1	Manufacturer		Insert	Post insulator
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60168 IEC 60273 IEC 60672 IEC 60694	YES
1.6	Quality control		ISO 9001	YES
1.7	Design		Solid core, porcelain, outdoor	Solid core, porcelain, outdoor
2	Post Insulators - Characteristics			
2.1	Nominal system voltage	kV _{rms}	230	230
2.2	Highest voltage for equipment U _n	kV _{rms}	245	245
2.3	Rated lightning impulse withstand voltage	kV _{peak}	1050	1050
2.4	Rated short duration power frequency voltage	kV	460	460
2.5	Rated frequency f _r	Hz	50	50
2.6	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	Min. ≥ 25 mm/kV
2.7	Failing load bending (p0) (C10)	N	≥ 10000	≥ 10000
2.8	Failing load torsion	Nm	≥ 4000	≥ 4000
3	Post Insulators - Design and Construction			
3.1	Insulation material		Porcelain, brown	Porcelain, brown
3.2	Material quality acc. IEC 60672		Min. C130	Min. C130
3.3	Min. material density ρ _a	Mgm ⁻³	≥ 2.5	>2.5
3.4	Min. stretch strength of material σ _{tg}	MPa	≥ 140	>140
3.5	Insulator height	mm	Insert	2300
3.6	Max. diameter of insulating part	mm	Insert	263
3.7	Diameter of upper base	mm	Insert	160
3.8	Number of holes on upper base		Insert	4
3.9	Diameter distance between holes on upper base	mm	Insert	127
3.10	Hole type on upper base		Insert	M16
3.11	Diameter on lower base	mm	Insert	310
3.12	Number of holes on lower base		Insert	8
3.13	Diameter distance between holes on lower base	mm	Insert	275
3.14	Hole type on lower base		Insert	Φ 18
3.15	Insulator weight	kg	Insert	186
Overall compliance with the requirements (yes/no)				YES

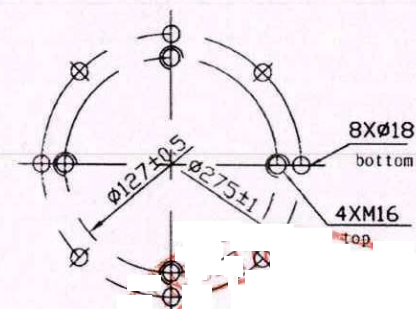


DRAWING



THE POSITION OF TOP AND BOTTOM MOUNTING HOLES

- Min. failing load
- Cantilever strength(kN)10
 - Torsion strength(kN.m) 7
- Min. creepage distance(mm) 6300
- Lightning impulse withstand voltage(kV)1050
- Power frequency wet withstand voltage(kV)460
- Material
- Porcelain: C130—IEC60672
 - Color of glaze: Brown
 - Fitting: Hot dip galvanized
- Tolerance
- Porcelain: IEC60168
 - Insulator: IEC60273
- Tests
- Acc. to IEC60168



Surge Arresters 245 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Surge Arresters - General			
1.1	Manufacturer			
1.2	Type		Outdoor	
1.3	Model designation			
1.4	Country of origin			
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		yes	
1.8	Short circuit testing authority		Insert authority	
2.	Surge Arresters - Characteristics			
2.1	Nominal system voltage	kV _{rms}	230	
2.2	Highest voltage for equipment U _n	kV _{rms}	245	
2.4	Rated voltage of surge arrester U _r	kV _{rms}	192	
2.5	Max. continuous operating voltage U _c	kV _{rms}	154	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current I _n (8/20 μs)	kA _{peak}	10	
2.10	High current impulse of an arrester (4/10 μs)	kA _{peak}	100	
3.	Surge Arresters - Design and Construction			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 μs)	A	≥ 850	
3.4	Maximum residual voltage U _{res}			
3.4.1	For switching impulse current 30/60 μs at 0,5 kA	kV _{peak}	≤ 375	
3.4.2	For switching impulse current 30/60 μs at 1 kA	kV _{peak}	≤ 385	
3.4.3	For switching impulse current 30/60 μs at 2 kA	kV _{peak}	≤ 405	
3.4.4	For lightning impulse current 8/20 μs at 5 kA	kV _{peak}	≤ 435	
3.4.5	For lightning impulse current 8/20 μs at 10 kA	kV _{peak}	≤ 465	
3.4.6	For lightning impulse current 8/20 μs at 20 kA	kV _{peak}	≤ 515	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 μs)	kV	≥ 925	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 425	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F _{dyn})	N	2000	
3.6.2	Specified long-term load SSL (F _{stat})	N	1400	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		yes (LSR)	
3.9	Insulating basement		yes	
3.10	Surge arrester height	mm	app 2232	
3.11	Surge arrester weight	kg	66	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	yes 700	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	100*100	
3.14.3	Number of holes		2x4	
3.14.4	Distance between holes	mm x mm	double 50*50	
3.14.5	Material suitable for		Al terminal	
	Overall compliance with the requirements (yes/no)			

Surge Arresters 420 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Surge Arresters - General			
1.1	Manufacturer			
1.2	Type		Outdoor	
1.3	Model designation			
1.4	Country of origin			
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		yes	
1.8	Short circuit testing authority		Insert authority	
2.	Surge Arresters - Characteristics			
2.1	Nominal system voltage	kV _{rms}	400	
2.2	Highest voltage for equipment U _n	kV _{rms}	420	
2.4	Rated voltage of surge arrester U _r	kV _{rms}	336	
2.5	Max. continuous operating voltage U _c	kV _{rms}	269	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current I _n (8/20 μs)	kA _{peak}	10	
2.10	High current impulse of an arrester (4/10 μs)	kA _{peak}	100	
3.	Surge Arresters - Design and Construction			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 μs)	A	≥ 1200	
3.4	Maximum residual voltage U _{res}			
3.4.1	For switching impulse current 30/60 μs at 0,5 kA	kV _{peak}	≤ 675	
3.4.2	For switching impulse current 30/60 μs at 1 kA	kV _{peak}	≤ 700	
3.4.3	For switching impulse current 30/60 μs at 2 kA	kV _{peak}	≤ 725	
3.4.4	For lightning impulse current 8/20 μs at 5 kA	kV _{peak}	≤ 775	
3.4.5	For lightning impulse current 8/20 μs at 10 kA	kV _{peak}	≤ 825	
3.4.6	For lightning impulse current 8/20 μs at 20 kA	kV _{peak}	≤ 900	
3.5.	Dielectric endurance of arrester housing)			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 μs)	kV	≥ 1500	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 750	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F _{dyn})	N	1100	
3.6.2	Specified long-term load SSL (F _{stat})	N	820	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8	Housing insulating material		yes (LSR)	
3.9	Insulating basement		yes	
3.10	Surge arrester height	mm	app 3639	
3.11	Surge arrester weight	kg	110	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	yes 1250	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	100*100	
3.14.3	Number of holes		2 x 4	
3.14.4	Distance between holes	mm x mm	double 50*50	
3.14.5	Material suitable for		Al terminal	
	Overall compliance with the requirements (yes/no)			

Auxiliary Transformers

33/0.415 kV 350 kVA Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	General			
1.1	Manufacturer		Insert	
1.2	Type		Earthing/Auxiliary transformer	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	Ratings and properties			
2.1	Rated power:	kVA	350	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage of windings: • MV winding • LV winding	kV V	33 415	
2.4	Tap changer: • Type of tap changing • Tapping range • Tapping step • Rating	% %	Off-load ±5 2.5 Rated power 350 kVA, all taps	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		ZNyn11	
3	Special technical requirements			
3.1	Power transformer capacity to withstand external short circuits			
	Short circuit impedance reference temperature of 75°C at rated frequency and rated power	%	5	
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: • MV winding • LV winding	kA kA	25 -	
3.2	Guaranteed losses			
3.2.1	No-load losses with tap changer in normal position, at rated voltage and rated frequency	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.2	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.2.3	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.3	Insulation level			
3.3.1	Medium voltage (MV)		LI 170 AC 70	
3.3.2	Low voltage (LV)		LI - AC 3	
3.4	The highest voltage for equipment (effective value)			
3.4.1	Medium voltage (MV)	kV	36	
3.4.2	Low voltage (LV)	kV	1.1	
3.5	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.5.1	Top oil	K	≤ 50	
3.5.2	Winding	K	≤ 55	
3.5.3	Hottest spot	K	≤ 65	
4	Oil			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	Maximum dielectric strength	kV/cm	Insert	
4.8	Data sheet attached		Insert	
4.9	Corrosive Sulphur		Non-Corrosive	
4.10	PCB content		Not Detectable	
5	Bushing			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36	
5.1.3	Manufacturer		Insert	
5.1.4	Type		Insert	
5.1.5	Rated current	A	≥ 100	
5.1.6	Rated short circuit current (3 s)	kA rms	25	
5.1.7	Rated lightning impulse withstand voltage	kV peak	170	
5.1.8	Rated switching impulse withstand voltage	kV peak	N.A.	
5.1.9	Rated power frequency withstand voltage	kV rms	70	
5.1.10	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.2	LV bushings (3 kV)			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Insert	
5.2.5	Rated current	A	≥ 400	
5.2.6	Rated short-circuit current (3 s)	kA rms	-	
5.2.7	Rated lightning impulse withstand voltage	kV peak	N.A.	
5.2.8	Rated switching impulse withstand voltage	kV peak	-	
5.2.9	Rated power frequency withstand voltage	kV rms	3	
5.2.10	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
6	Design data			
6.1	Maximum flux density, at rated voltage	TT	Insert	
6.2	Maximum current density in windings at rated power and normal tap changer position: <ul style="list-style-type: none"> MV winding LV winding 	A/mm ² A/mm ²	< 4 < 4	
6.4	Winding resistance at 75°C and middle tap changer position: <ul style="list-style-type: none"> MV winding LV winding 	Ω Ω	Insert Insert	
7	Weights and dimensions			
7.1	Total weight of transformer, equipped for service	kg	Insert	
7.10	Height from foundation to highest point of HV bushing	mm	Insert	
7.11	Outer dimensions: <ul style="list-style-type: none"> Height Length Width 	mm mm mm	Insert Insert Insert	
7.12	Informative dimensional sketch		To be enclosed with bid	
7.13	Maximum shipping dimensions of tank: <ul style="list-style-type: none"> Outside height Outside width Outside length 	mm mm mm	Insert Insert Insert	
7.14	Transportation drawing		To be enclosed with bid	
8	Dehydrating breather			
8.1	Type of dehydrating breather		Insert	
8.2	Dehumidifying agent	kg	Insert	
9	Conservator			
9.1	Type		With dehydrating breather	
9.2	Number of compartments	pcs.	1	
9.3	Total volume of conservator	m ³	Insert	
9.8	Oil level indicators with alarm for minimum oil level	pcs.	1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10	Current transformer incorporated into the auxiliary power transformer			
10.1	CT in all MV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	
10.2	CT in all LV bushings, for protection		In all bushings, 2 cores characteristics shall be defined in design stage	
10	Operating conditions			
10.1	At the altitude (above sea level)	m	≤ 1000	
10.2	Maximum ambient temperature	°C	+ 45	
10.3	Average daily temperature	°C	+ 35	
10.4	Average annual temperature	°C	+ 30	
10.5	Minimum ambient temperature	°C	– 5	
	Overall compliance with the requirements (yes/no)			

SPECIFICATIONS OF BUSBAR PROTECTION SYSTEM

Annexure-A1

GTP of Busbar Protection Central Unit-1 Relay:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Basic Information			
1.1	Number of central unit relays	Nos	1	
1.2	Manufacturer		ABB – Sweden / Switzerland	
1.3	Country of Origin (Place of Manufacturing)		EU/Switzerland	
1.4	Relay Type		CU04	
1.5	Relay Model		REB500	
1.6	Relay Software version		V7.50	
1.7	Relay Firmware version		Should be filled up by bidder	
1.8	Relay CPU	Nos	As required for 30 bay units	
1.9	Language		English	
1.10	Operating architecture		Distributed	
1.11	Operating frequency	Hz	50Hz, $\pm 5\%$	
1.12	Minimum number of Bay Units supported by single Central Unit	Nos	30	
1.13	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition (temp, humidity dust)	
2	Power Supply			
2.1	Relay auxiliary voltage	V DC	Minimum range of 48V to 250V; with protective fuse	
2.2	Maximum ripple		$\leq 15\%$	
2.3	Number power supply module	Nos.	2, Master-slave mode	
2.4	Failover time	ms	Insert	
2.5	Changeover switching time	ms	Insert	
3	Input and Output			
3.1	Binary Inputs of Central Unit			
	4.9.1	Minimum number of binary inputs	Nos.	12 (programmable)
	4.9.2	Operating range	V DC	Substation nominal DC voltage $\pm 15\%$
	4.9.3	Operating time	ms	<1
3.2	Binary Outputs of Central Unit			
	4.10.1	Minimum number of outputs	Nos.	9
	4.10.2	Operating time	ms	3
	4.10.3	Operating voltage	V	Up to 250 V AC/DC
	4.10.4	Continuous current capacity	A	8
	4.10.5	Short time current capacity	A	30A for at least 0.5s
	4.10.6	Binary output reset response		Programmable for latched and self-reset
3.3	Number of LEDs	Nos.	20 (programmable)	
3.4	Human Machine Interface			
	3.4.1	HMI Display		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer
	3.4.2	Navigation key		Yes
3.5	Bay Unit Relay Connection Module (Star Coupler Module)			
	3.5.1	Number of Module	Nos	Enter number as required
	3.5.2	Communication port for bay unit connection	Nos	30
4	Pre-configuration			
4.1	Type of Bus arrangement		As per SLD A1	
4.2	Number of OHL Bay	Nos	As per SLD A1	
4.3	Number of Trafo Bay	Nos	As per SLD A1	
4.4	Number of Buscoupler Bay	Nos	As per SLD A1	

SPECIFICATIONS OF BUSBAR PROTECTION SYSTEM

Annexure-A1

GTP of Busbar Protection Central Unit-1 Relay:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
4	Communication interface & Software			
4.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
4.2	GPS Time synchronization		Should be available	
4.3	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
4.4	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
4.5	Protection communication interface			
4.5.1	Communication medium		Optical fiber	
	Communication structure		Direct	
4.5.2	Communication protocol		Proprietary	
4.5.3	Core/sheath diameter		62.5/125 μ m (multi-mode)	
4.5.4	Maximum permissible attenuation	dB	5	
4.5.5	Minimum supported transmission length	m	1200	
5	Protection Functions			
5.1	Main protection function			
5.1.1	Required function		Highly reliable low-impedance based busbar differential protection	
5.1.2	Evaluation criteria		- Differential current with restrain feature - Directional current comparison method	
5.1.3	Evaluation method		Phase segregated	
5.1.4	Through-fault stability during CT saturation		Must be complied	
5.1.5	CT switching/Busbar selection		Must be done internally	
5.1.6	Minimum fault current pick-up setting	A	0.2 to 4 x I_N in step size of 0.01	
5.1.7	Differential restraining characteristics slope setting		0.5 to 0.8; in step size of 0.05	
5.1.8	Differential current alarms - Current setting - Time delay setting		5 to 50% of minimum pick-up in steps of 5% 2 to 10s in steps of 1s	
5.1.9	Isolator alarm time delay		0.5 to 90s	
5.1.10	Typical tripping time		20 to 30ms at $I_{Diff}/I_{Rest} \geq 5$	
5.1.11	Settable CT ratio per feeder		50 to 10,000/1A	
5.2	Check zone criterion			
5.2.1	Minimum fault current pick-up setting	A	0.2 to 4 x I_N in step size of 0.01	
5.2.2	Differential restraining characteristics slope setting		0 to 0.8; in step size of 0.05	
5.2.3	Settable CT ratio per feeder		50 to 10,000/1A	
5.3	Additional protection function 1			
5.3.1	Required function		Breaker failure protection	
5.3.2	Mechanical protection initiation for XFR feeder		Not required	
5.3.3	Current setting range		0.1 to 2 x I_N in step size of 0.1 x I_N	
5.3.4	Measurement accuracy		$\pm 5\%$	

GTP of Busbar Protection Central Unit-1 Relay:

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	5.3.5	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip	
	5.3.6	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms	
	5.3.7	Setting range of remote trip timer t2	ms	10 to 5,000ms in steps of 10ms	
	5.3.8	Remote trip pulse duration	ms	100 to 2,000ms in steps on 10ms	
5.4	Additional protection function 2				
	5.4.1	Required function		End-fault protection	
	5.4.2	Current setting range		0.1 to 2 x I _N in step size of 0.1 x I _N	
	5.4.3	Timer setting range	ms	100 to 10,000ms in steps of 100ms	
5.5	Additional protection function 3				
	5.5.1	Required function		Bay protection - OC/EF protection	
	5.5.2	Bay protection for bay		For feeder AT1 (ABB08), AT2 (ABB09), AT3 (ABB10), AT4 (ABB17) and BC1 (ABB11)	
5.6	Selective Tripping & Blocking options				
	5.6.1	Selective tripping		Should be provided based of statuses of switching devices	
	5.6.2	Selective blocking		Should be available for differential current alarm, switching object alarm, measurement abnormality, communication failure between Central Unit and Bay Unit	
	5.6.3	Forced blocking		Should be provided with selector switches installed in the panel for following options: BBP block, BFP block, EFP block, Output contacts block, All functions block	
6	Monitoring & Supervision functions				
6.1	Current measurement			For all feeders and all phases, Differential Current, Restraining current	
6.2	Switching object monitoring			Should be available	
6.3	Self-supervision system			Should be available for Central Unit and Bay Units	
6.4	Event records			Event recorder should keep at least 100 events in each bay unit and at least 1000 events in Central Unit	
6.5	Time stamp of event records			Date and time with 1ms accuracy	
6.6	Disturbance records			Should be available with wave shapes of all current measurements and at least 32 binary inputs and outputs for each bay unit.	
6.7	Sampling frequency of disturbance record		Hz	At least 2400	
7	Tripping and indication logics			Should be programmable	
8	Standards			Should conform IEC-60255 in all aspects	
9	Type test				
9.1	Certificate			Should be provided	
9.2	Insulation resistance tests			>100 MOhm @0.5kV	
9.3	Dielectric tests			2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
9.4	Impulse test			1.2/50 μS/0.5 Joule, 5kV AC	
10	Environmental requirements				
10.1	Temperature				
	10.1.1	Operation	°C	-10 to +55	
	10.1.2	Storage and Transport	°C	-40 to +85	
10.2	Climate tests				
	10.2.1	Cold		-25°C/16h	
	10.2.2	Dry heat		+70°C/16h	
	10.2.3	Damp heat		-25°C to +70°C, 1°C, 2 cycles	
	10.2.4	Damp heat (long time)		+40°C, 93% relative humidity/4 days	

SPECIFICATIONS OF BUSBAR PROTECTION SYSTEM

Annexure-A2

GTP of Busbar Protection Central Unit-2 Relay:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Basic Information			
1.1	Number of central unit relays	Nos	1	
1.2	Manufacturer		ABB – Sweden / Switzerland	
1.3	Country of Origin (Place of Manufacturing)		EU/Switzerland	
1.4	Relay Type		CU04	
1.5	Relay Model		REB500	
1.6	Relay Software version		V7.50	
1.7	Relay Firmware version		Should be filled up by bidder	
1.8	Relay CPU	Nos	As required for 30 bay units	
1.9	Language		English	
1.10	Operating architecture		Distributed	
1.11	Operating frequency	Hz	50Hz, $\pm 5\%$	
1.12	Minimum number of Bay Units supported by single Central Unit	Nos	30	
1.13	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition (temp, humidity dust)	
2	Power Supply			
2.1	Relay auxiliary voltage	V DC	Minimum range of 48V to 250V; with protective fuse	
2.2	Maximum ripple		$\leq 15\%$	
2.3	Number power supply module	Nos.	2, Master-slave mode	
2.4	Failover time	ms	Insert	
2.5	Changeover switching time	ms	Insert	
3	Input and Output			
3.1	Binary Inputs of Central Unit			
	4.9.1	Minimum number of binary inputs	Nos.	12 (programmable)
	4.9.2	Operating range	V DC	Substation nominal DC voltage $\pm 15\%$
	4.9.3	Operating time	ms	<1
3.2	Binary Outputs of Central Unit			
	4.10.1	Minimum number of outputs	Nos.	9
	4.10.2	Operating time	ms	3
	4.10.3	Operating voltage	V	Up to 250 V AC/DC
	4.10.4	Continuous current capacity	A	8
	4.10.5	Short time current capacity	A	30A for at least 0.5s
	4.10.6	Binary output reset response		Programmable for latched and self-reset
3.3	Number of LEDs	Nos.	20 (programmable)	
3.4	Human Machine Interface			
	3.4.1	HMI Display		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer
	3.4.2	Navigation key		Yes
3.5	Bay Unit Relay Connection Module (Star Coupler Module)			
	3.5.1	Number of Module	Nos	Enter number as required
	3.5.2	Communication port for bay unit connection	Nos	30
4	Pre-configuration			
4.1	Type of Bus arrangement		As per SLD A2	
4.2	Number of OHL Bay	Nos	As per SLD A2	
4.3	Number of Trafo Bay	Nos	As per SLD A2	
4.4	Number of Buscoupler Bay	Nos	As per SLD A2	

SPECIFICATIONS OF BUSBAR PROTECTION SYSTEM

Annexure-A2

GTP of Busbar Protection Central Unit-2 Relay:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
4	Communication interface & Software			
4.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
4.2	GPS Time synchronization		Should be available	
4.3	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
4.4	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
4.5	Protection communication interface			
4.5.1	Communication medium		Optical fiber	
	Communication structure		Direct	
4.5.2	Communication protocol		Proprietary	
4.5.3	Core/sheath diameter		62.5/125 μ m (multi-mode)	
4.5.4	Maximum permissible attenuation	dB	5	
4.5.5	Minimum supported transmission length	m	1200	
5	Protection Functions			
5.1	Main protection function			
5.1.1	Required function		Highly reliable low-impedance based busbar differential protection	
5.1.2	Evaluation criteria		- Differential current with restrain feature - Directional current comparison method	
5.1.3	Evaluation method		Phase segregated	
5.1.4	Through-fault stability during CT saturation		Must be complied	
5.1.5	CT switching/Busbar selection		Must be done internally	
5.1.6	Minimum fault current pick-up setting	A	0.2 to 4 x I_N in step size of 0.01	
5.1.7	Differential restraining characteristics slope setting		0.5 to 0.8; in step size of 0.05	
5.1.8	Differential current alarms - Current setting - Time delay setting		5 to 50% of minimum pick-up in steps of 5% 2 to 10s in steps of 1s	
5.1.9	Isolator alarm time delay		0.5 to 90s	
5.1.10	Typical tripping time		20 to 30ms at $I_{Diff}/I_{Rest} \geq 5$	
5.1.11	Settable CT ratio per feeder		50 to 10,000/1A	
5.2	Check zone criterion			
5.2.1	Minimum fault current pick-up setting	A	0.2 to 4 x I_N in step size of 0.01	
5.2.2	Differential restraining characteristics slope setting		0 to 0.8; in step size of 0.05	
5.2.3	Settable CT ratio per feeder		50 to 10,000/1A	
5.3	Additional protection function 1			
5.3.1	Required function		Breaker failure protection	
5.3.2	Mechanical protection initiation for XFR feeder		Not required	
5.3.3	Current setting range		0.1 to 2 x I_N in step size of 0.1 x I_N	
5.3.4	Measurement accuracy		$\pm 5\%$	

SPECIFICATIONS OF BUSBAR PROTECTION SYSTEM

Annexure-A2

GTP of Busbar Protection Central Unit-2 Relay:

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	5.3.5	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip	
	5.3.6	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms	
	5.3.7	Setting range of remote trip timer t2	ms	10 to 5,000ms in steps of 10ms	
	5.3.8	Remote trip pulse duration	ms	100 to 2,000ms in steps on 10ms	
5.4	Additional protection function 2				
	5.4.1	Required function		End-fault protection	
	5.4.2	Current setting range		0.1 to 2 x I _N in step size of 0.1 x I _N	
	5.4.3	Timer setting range	ms	100 to 10,000ms in steps of 100ms	
5.5	Additional protection function 3				
	5.5.1	Required function		Bay protection - OC/EF protection	
	5.5.2	Bay protection for bay		For feeder AT1 (ABB09), AT2 (ABB10), AT3 (ABB13), AT4 (ABB18) and BC1 (ABB03)	
5.6	Selective Tripping & Blocking options				
	5.6.1	Selective tripping		Should be provided based of statuses of switching devices	
	5.6.2	Selective blocking		Should be available for differential current alarm, switching object alarm, measurement abnormality, communication failure between Central Unit and Bay Unit	
	5.6.3	Forced blocking		Should be provided with selector switches installed in the panel for following options: BBP block, BFP block, EFP block, Output contacts block, All functions block	
6	Monitoring & Supervision functions				
6.1	Current measurement			For all feeders and all phases, Differential Current, Restraining current	
6.2	Switching object monitoring			Should be available	
6.3	Self-supervision system			Should be available for Central Unit and Bay Units	
6.4	Event records			Event recorder should keep at least 100 events in each bay unit and at least 1000 events in Central Unit	
6.5	Time stamp of event records			Date and time with 1ms accuracy	
6.6	Disturbance records			Should be available with wave shapes of all current measurements and at least 32 binary inputs and outputs for each bay unit.	
6.7	Sampling frequency of disturbance record		Hz	At least 2400	
7	Tripping and indication logics			Should be programmable	
8	Standards			Should conform IEC-60255 in all aspects	
9	Type test				
9.1	Certificate			Should be provided	
9.2	Insulation resistance tests			>100 MOhm @0.5kV	
9.3	Dielectric tests			2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
9.4	Impulse test			1.2/50 μS/0.5 Joule, 5kV AC	
10	Environmental requirements				
10.1	Temperature				
	10.1.1	Operation	°C	-10 to +55	
	10.1.2	Storage and Transport	°C	-40 to +85	
10.2	Climate tests				
	10.2.1	Cold		-25°C/16h	
	10.2.2	Dry heat		+70°C/16h	
	10.2.3	Damp heat		-25°C to +70°C, 1°C, 2 cycles	
	10.2.4	Damp heat (long time)		+40°C, 93% relative humidity/4 days	

GTP of Main-2 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Basic Information			
1.1	Number of bay unit relays	Nos	2	
1.2	Manufacturer		GE	
1.3	Country of Origin (Place of Manufacturing)		UK / USA	
1.4	Model		MiCOM P743	
1.5	Ordering Code		P74391JA6M0510K	
1.6	Software version		Should be filled up by bidder	
1.7	Firmware version		Should be filled up by bidder	
1.8	Language		English	
1.9	Operating frequency	Hz	50Hz, $\pm 5\%$	
1.10	Housing & mounting		Flush mounting housing	
2	Power Supply			
2.1	Auxiliary voltage	V DC	80V to 250V	
2.2	Maximum ripple		$\leq 15\%$	
2.3	Drop-off time due to power interruption	ms	>50	
3	Input and Output			
3.1	Binary Inputs			
	3.1.1	Minimum number of binary inputs	Nos.	12 (programmable)
	3.1.2	Minimum operating range	V DC	Substation nominal DC voltage $\pm 15\%$
	3.1.3	Operating time	ms	<1
3.2	Binary Outputs			
	3.2.1	Number of outputs	Nos.	>16
	3.2.2	Operating time	ms	<3
	3.2.3	Operating voltage	V	Up to 250 V AC/DC
	3.2.4	Continuous current capacity	A	>8
	3.2.5	Making Current	A	>15
	3.2.6	Breaking Current	A	>5
	3.2.7	Short time current capacity	A	>30, for at least 0.5s
	3.2.8	Binary output reset response		Programmable for latched and self-reset
3.3	Analog Inputs			
	3.3.1	No of CT Inputs	Nos.	4
	3.3.2	Nominal current	A	Operable in 1A and 5A (User settable)
	3.3.3	Continuous current capacity	A	4*Nominal current
	3.3.4	Thermal withstand capacity	A	100*Nominal current for at least 1s
	3.3.5	Burden per phase	VA	≤ 0.2
3.4	Number of LEDs	Nos.	8 (programmable)	
3.5	Human Machine Interfaces			
	3.5.1	HMI Display		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer
	3.5.2	Navigation key		Yes
4	External Device			
4.1	Lockout Relay	Nos	1 [ARTECHE/ BJ-8RP/Europe]	
4.2	Test socket	Nos	1 [ARTECHE/TSB-14/Europe TSB14-2222111111AAAB]	
4.3	Test plug	Nos	1 [ARTECHE/TSB-14/Europe TSB14-2222111111AAAB]	

GTP of Main-2 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
5	Communication interface & Software			
5.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
5.2	Process bus (IEC61850 9-2) compliance		No	
5.3	GPS Time synchronization		Mus be able to synchronize time with GPS by NTP/IRIG-B time protocol	
5.4	Rear communication port			
	5.4.1	Standard SAS protocol		Yes, IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)
	5.4.2	Number of ports	Nos	Should be filled up by bidder
	5.4.3	Supported protocol		All of PRP, HSR and RSTP
5.5	Front communication port		RJ45 plug connector or RS232 serial connector	
5.6	Protection communication interface			
	5.6.1	Communication medium		Optical fiber
	5.6.2	Communication structure		Direct
	5.6.3	Communication protocol		Proprietary
	5.6.4	Core/sheath diameter		62.5/125µm (multi-mode)
	5.6.5	Maximum permissible attenuation	dB	5
	5.6.6	Minimum supported transmission length	m	1200
6	Protection Functions			
6.1	Standalone function 1			
	6.1.1	Required function		Breaker failure protection
	6.1.2	Current setting range		0.1 to 2 x I _N in step size of 0.1 x I _N
	6.1.3	Measurement accuracy		±5%
	6.1.4	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip
	6.1.5	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms
	6.1.6	Setting range of remote trip timer (t2)	ms	10 to 5,000ms in steps of 10ms
	6.1.7	Trip pulse duration setting	ms	100 to 2,000ms in steps on 10ms
6.2	Standalone function 2			
	6.2.1	Required function		End-fault protection
	6.2.2	Current setting range		0.1 to 2 x I _N in step size of 0.1 x I _N
	6.2.3	Timer setting range	ms	100 to 10,000ms in steps of 100ms
	6.2.4	Trip pulse duration setting	ms	100 to 2,000ms in steps on 10ms
7	Monitoring & Supervision functions			
7.1	Current measurement		Continuous measurement	
7.2	Self-supervision system		Should be available	
7.3	Event records		Event recorder should keep at least 100 events in each bay unit	
7.4	Time stamp accuracy of event records		Less than 1ms	
7.5	Disturbance records		At least 5 records with wave shapes of all current measurements and at least 100 digital signals.	
7.6	Sampling frequency of disturbance record	Hz	At least 2400	
8	Tripping and indication logics			
9	Standards			
	Should conform IEC-60255 in all aspects			
10	Type test			
10.1	Certificate		Should be provided	

GTP of Main-2 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
10.2	Insulation resistance tests		>100 MOhm @0.5kV	
10.3	Dielectric tests		2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
10.4	Impulse test		1.2/50 μS/0.5 Joule, 5kV AC	
11	Environmental requirements			
11.1	Temperature			
	11.1.1	Operation	°C	-10 to +55
	11.1.2	Storage and Transport	°C	-40 to +85
11.2	Climate tests			
	11.2.1	Cold		-25°C/16h
	11.2.2	Dry heat		+70°C/16h
	11.2.3	Damp heat		-25°C to +70°C, 1°C, 2 cycles
	11.2.4	Damp heat (long time)		+40°C, 93% relative humidity/4 days

A. GTP of Main-1 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Basic Information			
1.1	Number of bay unit relays	Nos	2	
1.2	Manufacturer		SEL / USA	
1.3	Country of Origin (Place of Manufacturing)		USA	
1.4	Model		SEL401	
1.5	Ordering Code		0401011X3600XD7H57323XXXX	
1.6	Software version		Should be filled up by bidder	
1.7	Firmware version		Should be filled up by bidder	
1.8	Language		English	
1.9	Operating frequency	Hz	50Hz, $\pm 5\%$	
1.10	Housing & mounting		Flush mounting housing	
2	Power Supply			
2.1	Auxiliary voltage	V DC	80V to 250V	
2.2	Maximum ripple		$\leq 15\%$	
2.3	Drop-off time due to power interruption	ms	>50	
3	Input and Output			
3.1	Binary Inputs			
	3.1.1	Minimum number of binary inputs	Nos.	12 (programmable)
	3.1.2	Minimum operating range	V DC	Substation nominal DC voltage $\pm 15\%$
	3.1.3	Operating time	ms	<1
3.2	Binary Outputs			
	3.2.1	Number of outputs	Nos.	>16
	3.2.2	Operating time	ms	<3
	3.2.3	Operating voltage	V	Up to 250 V AC/DC
	3.2.4	Continuous current capacity	A	>8
	3.2.5	Making Current	A	>15
	3.2.6	Breaking Current	A	>5
	3.2.7	Short time current capacity	A	>30, for at least 0.5s
	3.2.8	Binary output reset response		Programmable for latched and self-reset
3.3	Analog Inputs			
	3.3.1	No of CT Inputs	Nos.	4
	3.3.2	Nominal current	A	Operable in 1A and 5A (User settable)
	3.3.3	Continuous current capacity	A	4*Nominal current
	3.3.4	Thermal withstand capacity	A	100*Nominal current for at least 1s
	3.3.5	Burden per phase	VA	≤ 0.2
3.4	Number of LEDs	Nos.	8 (programmable)	
3.5	Human Machine Interface			
	3.5.1	HMI Display		Front mounted, should be suitable to access all relevant measurements, alarms, tripping information and switching device information without external computer
	3.5.2	Navigation key		Yes
4	External Device			
4.1	Lockout Relay	Nos	1 [ARTECHE/ BJ-8RP/Europe]	
4.2	Test socket	Nos	1 [ARTECHE/TSB-14/Europe TSB14-2222111111AAAB]	
4.3	Supply of applicable test plug	Nos	1 [ARTECHE/TSB-14/Europe TSB14-2222111111AAAB]	

A. GTP of Main-1 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
5	Communication interface & Software			
5.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
5.2	Process bus (IEC61850 9-2) compliance		Must be able to communicate with SEL487B relay according to process bus (IEC61850 9-2) communication protocol in PRP communication structure	
5.3	GPS Time synchronization		Must be able to synchronize time with GPS by PTP time protocol	
5.4	Rear communication port			
	5.4.1	Standard SAS protocol		Yes, IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)
	5.4.2	Number of ports	Nos	Should be filled up by bidder
	5.4.3	Supported protocol		All of PRP, HSR and RSTP
5.5	Front communication port		RJ45 plug connector or RS232 serial connector	
5.6	Protection communication interface			
	5.6.1	Communication medium		Optical fiber
	5.6.2	Communication structure		PRP
	5.6.3	Communication protocol		Process bus (IEC61850 9-2)
	5.6.4	Core/sheath diameter		62.5/125 μ m (multi-mode)
	5.6.5	Maximum permissible attenuation	dB	5
	5.6.6	Minimum supported transmission length	m	1200
6	Protection Functions			
6.1	Standalone function 1			
	6.1.1	Required function		Breaker failure protection
	6.1.2	Current setting range		0.1 to 2 x I_N in step size of 0.1 x I_N
	6.1.3	Measurement accuracy		$\pm 5\%$
	6.1.4	Tripping logic		Should be available for minimum 2 (two) stages: re-trip and remote trip
	6.1.5	Setting range of re-trip timer (t1)	ms	10 to 5,000ms in steps of 10ms
	6.1.6	Setting range of remote trip timer (t2)	ms	10 to 5,000ms in steps of 10ms
	6.1.7	Trip pulse duration setting	ms	100 to 2,000ms in steps on 10ms
6.2	Standalone function 2			
	6.2.1	Required function		End-fault protection
	6.2.2	Current setting range		0.1 to 2 x I_N in step size of 0.1 x I_N
	6.2.3	Timer setting range	ms	100 to 10,000ms in steps of 100ms
	6.2.4	Trip pulse duration setting	ms	100 to 2,000ms in steps on 10ms
7	Monitoring & Supervision functions			
7.1	Current measurement		Continuous measurement	
7.2	Self-supervision system		Should be available	
7.3	Event records		Event recorder should keep at least 100 events in each bay unit	
7.4	Time stamp accuracy of event records		Less than 1ms	
7.5	Disturbance records		At least 5 records with wave shapes of all current measurements and at least 100 digital signals.	
7.6	Sampling frequency of disturbance record	Hz	At least 2400	
8	Tripping and indication logics			
			Should be programmable	

A. GTP of Main-1 Bay Unit of Busbar Protection System:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
9	Standards		Should conform IEC-60255 in all aspects	
10	Type test			
10.1	Certificate		Should be provided	
10.2	Insulation resistance tests		>100 MOhm @0.5kV	
10.3	Dielectric tests		2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
10.4	Impulse test		1.2/50 μS/0.5 Joule, 5kV AC	
11	Environmental requirements			
	Temperature			
11.1	11.1.1 Operation	°C	-10 to +55	
	11.1.2 Storage and Transport	°C	-40 to +85	
	Climate tests			
11.2	11.2.1 Cold		-25°C/16h	
	11.2.2 Dry heat		+70°C/16h	
	11.2.3 Damp heat		-25°C to +70°C, 1°C, 2 cycles	
	11.2.4 Damp heat (long time)		+40°C, 93% relative humidity/4 days	

SPECIFICATIONS OF BAY CONTROL UNIT

Annexure-A

GTP of Bay Control Unit:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
1	Basic Information			
1.1	Number of bay control unit relays	Nos	2	
1.2	Manufacturer		SEL / USA	
1.3	Country of Origin (Place of Manufacturing)		USA	
1.4	Model		SEL451	
1.5	Ordering Code		04515611XC4X3H74343X1	
1.6	Software version		Should be filled up by bidder	
1.7	Firmware version		Should be filled up by bidder	
1.8	Standard		IEC	
1.9	Language		English	
1.10	Operating frequency	Hz	50Hz, $\pm 5\%$	
1.11	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
2	Power Supply			
2.1	Auxiliary voltage	V DC	80V to 250V	
2.2	Maximum ripple		$\leq 15\%$	
2.3	Drop-off time due to power interruption	ms	>50	
3	Input and Output			
3.1	Binary Inputs			
	3.1.1	Minimum number of binary inputs	Nos.	>50 (programmable)
	3.1.2	Minimum operating range	V DC	Substation nominal DC voltage $\pm 15\%$
	3.1.3	Operating time	ms	<1
3.2	Binary Outputs			
	3.2.1	Number of outputs	Nos.	>20
	3.2.2	Operating time	ms	<3
	3.2.3	Operating voltage	V	Up to 250 V AC/DC
	3.2.4	Continuous current capacity	A	>8
	3.2.5	Making Current	A	>15
	3.2.6	Breaking Current	A	>5
	3.2.7	Short time current capacity	A	>30, for at least 0.5s
	3.2.8	Binary output reset response		Programmable for latched and self-reset
3.3	Analog CT Inputs			
	3.3.1	No of CT Inputs	Nos.	4
	3.3.2	Nominal current	A	Operable in 1A and 5A (User settable)
	3.3.3	Continuous current capacity	A	4*Nominal current
	3.3.4	Thermal withstand capacity	A	100*Nominal current for at least 1s
	3.3.5	Burden per phase	VA	≤ 0.2
3.4	Analog VT Inputs			
	3.4.1	No of PT Inputs	Nos.	4
	3.4.2	Nominal Voltage	A	100/110/120
	3.4.3	Continuous Voltage withstand capacity	A	1.5*Nominal voltage
	3.4.4	Thermal withstand capacity	A	2.5*Nominal voltage for at least 1s
	3.4.5	Burden per phase	VA	≤ 0.3
	3.4.6			
3.5	Number of LEDs	Nos.	>16 (programmable)	
3.6	Human Machine Interface			
	3.6.1	HMI Display		Yes, to access all relevant measurements, alarms, tripping information, switching device information and mimic control without external computer
	3.6.2	Navigation key		Yes

GTP of Bay Control Unit:

SL. No.	Description	Unit	PGCB's requirements	Bidder's Data
4	Communication Interface & Software			
4.1	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time-bounded license.	
4.2	GPS Time synchronization		Mus be able to synchronize time with GPS by NTP/IRIG-B time protocol	
4.3	Rear communication port			
	4.3.1	Standard SAS protocol		Yes, IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)
	4.3.2	Number of ports	Nos	>2
	4.3.3	Supported protocol		All of PRP, HSR and RSTP
4.4	Front communication port		RJ45 plug connector or RS232 serial connector	
5	Apparatus Control			
5.1	Apparatus control provision		Yes	
5.2	Switching object monitoring		Yes	
5.3	Interlocking logic		Yes	
5.4	Operation counter		Yes	
5.5	Number of controllable switching object	Nos	Should be filled up by bidder	
6	Synchronism & Energizing check			
6.1	Live – Live Synchrocheck		Yes	
6.2	Live – Dead Energizing Check		Yes	
6.3	Dead – Live Energizing Check		Yes	
6.4	Dead – Dead Energizing Check		Yes	
7	Monitoring & Supervision functions			
7.1	Voltage measurement		Continuous measurement	
7.2	Current measurement		Continuous measurement	
7.3	Frequency Estimation		Continuous measurement	
7.4	Active power measurement		Continuous measurement	
7.5	Reactive power measurement		Continuous measurement	
7.6	Active Energy measurement		Continuous measurement	
7.7	Reactive Energy measurement		Continuous measurement	
7.8	Self-supervision system		Should be available	
7.9	Event records		Event recorder should keep at least 1000 events	
7.10	Time stamp accuracy of event records		Less than 1ms	
7.11	Disturbance records		At least 50 records with wave shapes of all current and voltage measurements and at least 100 digital signals.	
7.12	Sampling frequency of disturbance record	Hz	At least 2400	
8	Indication logics			
9	Standards			
10	Type test			
10.1	Certificate		Should be provided	
10.2	Insulation resistance tests		>100 MOhm @0.5kV	
10.3	Dielectric tests		2kV AC or 3kV DC/1 min 1kV AC or 1.4kV DC/1 min (across open contacts)	
10.4	Impulse test		1.2/50 μS/0.5 Joule, 5kV AC	
11	Environmental requirements			
11.1	Temperature			
	11.1.1	Operation	°C	-10 to +55

SPECIFICATIONS OF BAY CONTROL UNIT**Annexure-A****GTP of Bay Control Unit:**

SL. No.	Description		Unit	PGCB's requirements	Bidder's Data
	11.1.2	Storage and Transport	°C	-40 to +85	
11.2	Climate tests				
	11.2.1	Cold		-25°C/16h	
	11.2.2	Dry heat		+70°C/16h	
	11.2.3	Damp heat		-25°C to +70°C, 1°C, 2 cycles	
	11.2.4	Damp heat (long time)		+40°C, 93% relative humidity/4 days	

Bay Assignment

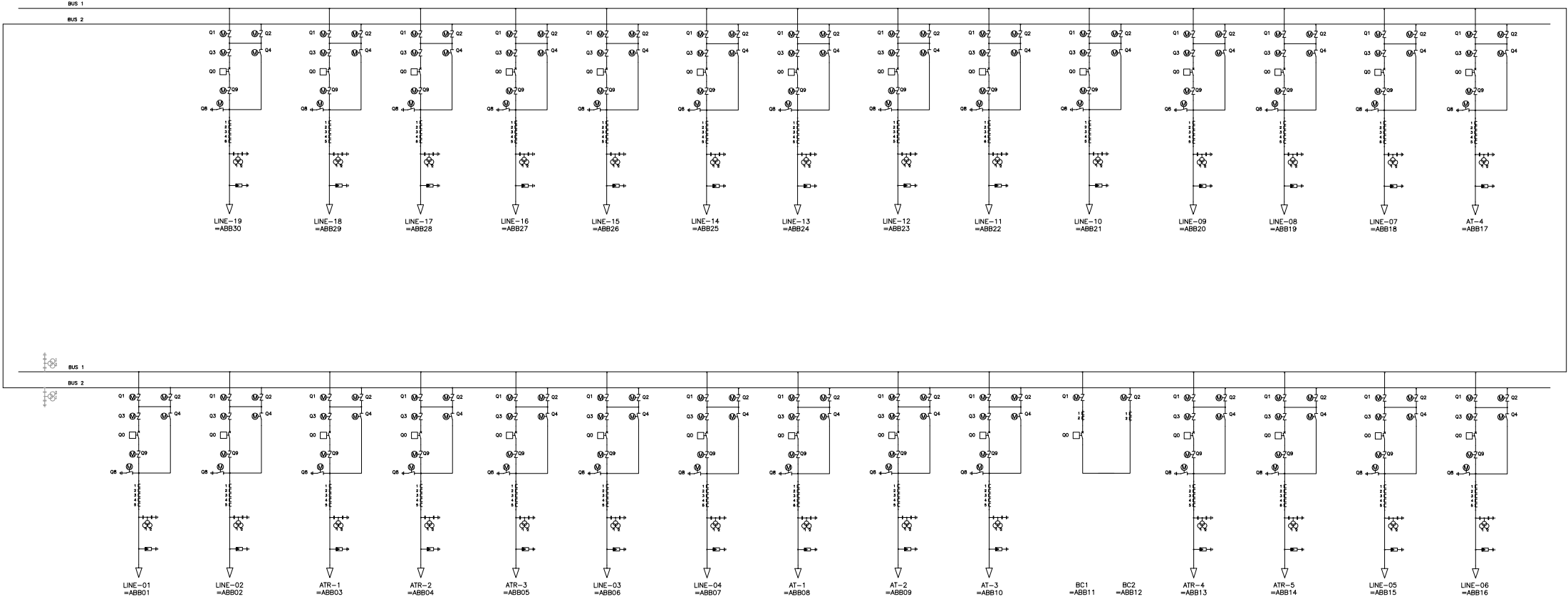
Annexure-A1A2

SLD A1	
LINE-01 =ABB01	LINE-06 =ABB16
LINE-02 =ABB02	AT-4 =ABB17
ATR-1 =ABB03	LINE-07 =ABB18
ATR-2 =ABB04	LINE-08 =ABB19
ATR-3 =ABB05	LINE-09 =ABB20
LINE-03 =ABB06	LINE-10 =ABB21
LINE-04 =ABB07	LINE-11 =ABB22
AT-1 =ABB08	LINE-12 =ABB23
AT-2 =ABB09	LINE-13 =ABB24
AT-3 =ABB10	LINE-14 =ABB25
BC1 =ABB11	LINE-15 =ABB26
BC2 =ABB12	LINE-16 =ABB27
ATR-4 =ABB13	LINE-17 =ABB28
ATR-5 =ABB14	LINE-18 =ABB29
LINE-05 =ABB15	LINE-19 =ABB30

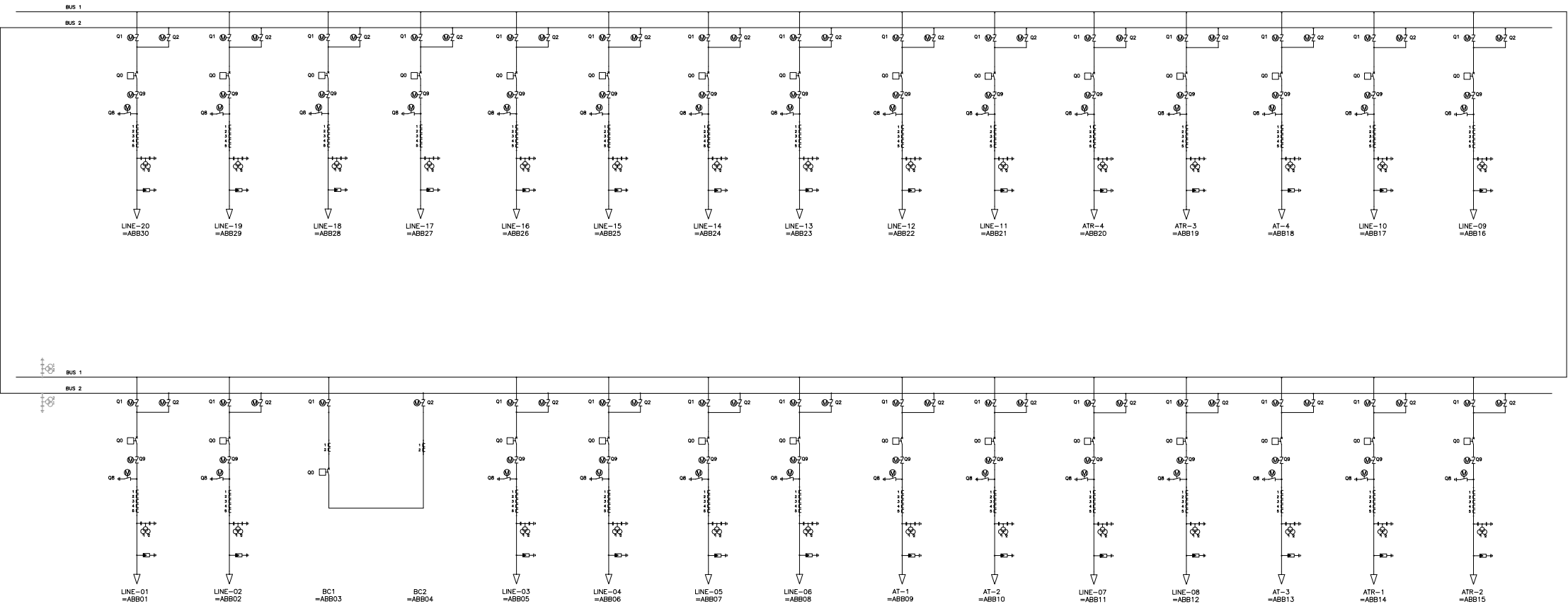
SLD A2	
LINE-01 =ABB01	LINE-09 =ABB16
LINE-02 =ABB02	LINE-10 =ABB17
BC1 =ABB03	AT-4 =ABB18
BC2 =ABB04	ATR-3 =ABB19
LINE-03 =ABB05	ATR-4 =ABB20
LINE-04 =ABB06	LINE-11 =ABB21
LINE-05 =ABB07	LINE-12 =ABB22
LINE-06 =ABB08	LINE-13 =ABB23
AT-1 =ABB09	LINE-14 =ABB24
AT-2 =ABB10	LINE-15 =ABB25
LINE-07 =ABB11	LINE-16 =ABB26
LINE-08 =ABB12	LINE-17 =ABB27
AT-3 =ABB13	LINE-18 =ABB28
ATR-1 =ABB14	LINE-19 =ABB29
ATR-2 =ABB15	LINE-20 =ABB30

Bay protection is required for highlighted bays

SLD A1



SLD A2



Schedule 1. supplied from abroad

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Foreign Currency Portion [USD]	CIP	Foreign Currency Portion [USD]	
1	2	3	4	5	6	7	8 = 5 x 7	9
A	420 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 420 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
A1	Surge arrester 420 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 336 kV, Uc = 268 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
A2	The lot of fittings including all necessary conductors, clamps and connectors required for completing 420 kV CVT, SA		lot	1				
A3	Equipment supports steel structure including nut-bolts required for completing 420 kV SA on existing foundation		lot	1				
B	245 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 245 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
B1	Surge arrester 245 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 192 kV, Uc = 153 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
B2	Post insulator 245 kV, single phase, 10 kN, 50 kA / 1 sec, 50 Hz, 1,050 / 460 kV BIL		nos	3				
B3	The lot of conductors 245 kV, for double busbars system and for connection of the 245 kV switchgear, 2,000 A, 50 kA / 1 sec, 50 Hz 1,050 / 460 kV BIL, three phase		lot	1				
B4	The lot of fittings including all necessary conductors, clamps and connectors required for completing 245 kV switchgear.		lot	1				
B5	Equipment supports steel structure including nut-bolts required for completing 245 kV switchgear on existing foundation.		lot	1				
C	36 kV Switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 36 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							

Schedule 1. supplied from abroad

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Foreign Currency Portion [USD]	CIP	Foreign Currency Portion [USD]	
1	2	3	4	5	6	7	8 = 5 x 7	9
C1	Current transformer 36 kV, single-phase, 3-core, single ratio, 800/1A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, post type current transformer.		nos	3				
C2	Surge arrester 36 kV, single phase, gapless, metal oxide type, Uc = 30 kV, Ur = 24 kV, 10 kA nominal discharge current, 50 Hz, 170 / 70 kV BIL,		nos	3				
C3	The lot of conductors 36 kV, for connection of the 36 kV switchgear, 630 A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, three phase.		lot	1				
C4	The lot of fittings including all necessary clamps and connectors required for completing 36 kV switchgear.		lot	1				
C5	Modification of existing equipment support structure required for completing 36 kV switchgear.		lot	1				
D	Transformers							
	The set of complete equipment 400/230/33 kV for transformation of energy shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
D1	The Auto-transformer 400/235/33 kV, 420/520 MVA, YNa0d1, ONAN/ONAF, with tertiary winding, three phase, oil immersed, hermetically closed, with on-load tap changer; with single phase, 3-core current transformers in all bushings. Characteristics of CTs will be AS per attached GTP, GA,		set	1				
D2	existing Nitrogen Injection Fire Protection System (NIFPS) shall be adapted for the new 400/235/33 kV autotransformer units AS per attached transformer GA and NIFPS drawing		lot	1				
E	Earthing/Auxiliary Transformers							
	The set of complete equipment 33/0.4 kV for transformation of energy for auxiliary power supply shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
E1	The auxiliary power transformer 33/0.4 kV, 350 kVA, ZNyn11, ONAN, oil immersed, three phase, with off-load tap changer; with single phase, 2-core current transformers in all bushings. MCCB shall be available for 0.415kv side adjacent to the Earthing Tr. Characteristics of CTs will be defined as per attached GTP and GA		set	1				

Schedule 1. supplied from abroad

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Foreign Currency Portion [USD]	CIP	Foreign Currency Portion [USD]	
1	2	3	4	5	6	7	8 = 5 x 7	9
F	Control, Protection, Substation Automation and Metering							
	The lot of complete equipment for control, protection, alarm, SAS and me-tering panels for the 400 kV & 230kV & 33 kV system as well as LV AC and LV DC system shall be modified, tested and commissioned under this contract for successful commissioning of the bay.							
F1	Existing Control, protection and SAS for ATR-1 , shall be re-connected and completing the testing ,commissioning		set	1				
F2	existing Control, protection and SAS for one (1) set of 33/0,4 kV Auxiliary Transformer circuits shall be reconnected, tesing and commissioning		set	1				
F3	existing Control, protection and SAS for complete LV part of the Substation, AC & DC, reconnect, tesing ,commissioning		lot	1				
F4	exisitng Substation Automation System for ATR-1 shall be complete with wiring ,testing ,commissioning		lot	1				
F5	existing 400 kV busbars, in one and half breaker type busbar system, shall be tested & commissioning for ATR_1		Lot	1				
F6	existing Control, protection and SAS for two 230 kV busbars shall be complete with wiring ,testing and commissioning		lot	1				
F7	eixsting tariff metering panel reconnection ,testing and commissioning For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.		lot	1				
F8	existing Digital Fault and Disturbance Recorder (DFDR) system shall be complete with wiring , testing and commissioning		lot	1				
F9	existing telecommunication system testing and commissioning for ATR_1		lot	1				

Schedule 1. supplied from abroad

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Foreign Currency Portion [USD]	CIP	Foreign Currency Portion [USD]	
1	2	3	4	5	6	7	8 = 5 x 7	9
I	EXISTING Fire alarm & fire fighting system shall be complete for ATR_1 with wiring,testing,commissioning		lot	1				
J	Earthing and Lightning Protection							
J1	existing earthing and Lightning Protection for ATR_1 shall be re-connncted and tested		lot	1				
K	power Cable 36kV							
K1	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		m	450				
K2	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, cable end terminal end for single phase XLPE cable		lot	1				
L	Mandatory Spare Parts							
i	Busbar protection bay unit SEL 401, Detailed specification in annexure _A		No.	2				
ii	Busbar protection bay unit P743, Detailed specification in annexure _A		No.	2				
iii	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A1		No.	1				
iv	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A2		No.	1				
iv	Bay control unit SEL 451 , Detailed specification in annexure _A		No.	2				

Schedule 2. supplied from employer's country

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
A	420 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 420 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
A1	Surge arrester 420 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 336 kV, Uc = 268 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
A2	The lot of fittings including all necessary conductors, clamps and connectors required for completing 420 kV CVT, SA		lot	1				
A3	Equipment supports steel structure including nut-bolts required for completing 420 kV SA on existing foundation		lot	1				
B	245 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 245 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
B1	Surge arrester 245 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 192 kV, Uc = 153 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
B2	Post insulator 245 kV, single phase, 10 kN, 50 kA / 1 sec, 50 Hz, 1,050 / 460 kV BIL		nos	3				
B3	The lot of conductors 245 kV, for double busbars system and for connection of the 245 kV switchgear, 2,000 A, 50 kA / 1 sec, 50 Hz 1,050 / 460 kV BIL, three phase		lot	1				
B4	The lot of fittings including all necessary conductors, clamps and connectors required for completing 245 kV switchgear.		lot	1				
B5	Equipment supports steel structure including nut-bolts required for completing 245 kV switchgear on existing foundation.		lot	1				
C	36 kV Switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 36 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							

Schedule 2. supplied from employer's country

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
C1	Current transformer 36 kV, single-phase, 3-core, single ratio, 800/1A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, post type current transformer.		nos	3				
C2	Surge arrester 36 kV, single phase, gapless, metal oxide type, Uc = 30 kV, Ur = 24 kV, 10 kA nominal discharge current, 50 Hz, 170 / 70 kV BIL,		nos	3				
C3	The lot of conductors 36 kV, for connection of the 36 kV switchgear, 630 A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, three phase.		lot	1				
C4	The lot of fittings including all necessary clamps and connectors required for completing 36 kV switchgear.		lot	1				
C5	Modification of existing equipment support structure required for completing 36 kV switchgear.		lot	1				
D	Transformers							
	The set of complete equipment 400/230/33 kV for transformation of energy shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
D1	The Auto-transformer 400/235/33 kV, 420/520 MVA, YNa0d1, ONAN/ONAF, with tertiary winding, three phase, oil immersed, hermetically closed, with on-load tap changer; with single phase, 3-core current transformers in all bushings. Characteristics of CTs will be AS per attached GTP, GA,		set	1				
D2	existing Nitrogen Injection Fire Protection System (NIFPS) shall be adapted for the new 400/235/33 kV autotransformer units AS per attached transformer GA and NIFPS drawing		lot	1				
E	Earthing/Auxiliary Transformers							
	The set of complete equipment 33/0.4 kV for transformation of energy for auxiliary power supply shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
E1	The auxiliary power transformer 33/0.4 kV, 350 kVA, ZNyn11, ONAN, oil immersed, three phase, with off-load tap changer; with single phase, 2-core current transformers in all bushings. MCCB shall be available for 0.415kv side adjacent to the Earthing Tr. Characteristics of CTs will be defined as per attached GTP and GA		set	1				

Schedule 2. supplied from employer's country

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT] 8 = 5 x 7	
1	2	3	4	5	6	7	8 = 5 x 7	9
F	Control, Protection, Substation Automation and Metering							
	The lot of complete equipment for control, protection, alarm, SAS and me-tering panels for the 400 kV & 230kV & 33 kV system as well as LV AC and LV DC system shall be modified, tested and commissioned under this contract for successful commissioning of the bay.							
F1	Existing Control, protection and SAS for ATR-1 , shall be re-connected and completing the testing ,commissioning		set	1				
F2	existing Control, protection and SAS for one (1) set of 33/0,4 kV Auxiliary Transformer circuits shall be reconnected, tesing and commissioning		set	1				
F3	existing Control, protection and SAS for complete LV part of the Substation, AC & DC, reconnect, tesing ,commissioning		lot	1				
F4	exisitng Substation Automation System for ATR-1 shall be complete with wiring ,testing ,commissioning		lot	1				
F5	existing 400 kV busbars, in one and half breaker type busbar system, shall be tested & commisioning for ATR_1		Lot	1				
F6	existing Control, protection and SAS for two 230 kV busbars shall be complete with wiring ,testing and commissioning		lot	1				
F7	eixsting tariff metering panel reconnection ,testing and commissioning For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.		lot	1				
F8	existing Digital Fault and Disturbance Recorder (DFDR) system shall be complete with wiring , testing and commissioning		lot	1				
F9	existing telecommunication system testing and commissioning for ATR_1		lot	1				
I	EXISTING Fire alarm & fire fighting system shall be complete for ATR_1 with wiring,testing,commissioning		lot	1				

Schedule 2. supplied from employer's country

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
J	Earthing and Lightning Protection							
J1	existing earthing and Lightning Protection for ATR_1 shall be re-connncted and tested		lot	1				
K	power Cable 36kV							
K1	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		m	450				
K2	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, cable end terminal end for single phase XLPE cable		lot	1				
L	Mandatory Spare Parts							
i	Busbar protection bay unit SEL 401, Detailed specification in annexure _A		No.	2				
ii	Busbar protection bay unit P743, Detailed specification in annexure _A		No.	2				
iii	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A1		No.	1				
iv	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A2		No.	1				
iv	Bay control unit SEL 451 , Detailed specification in annexure _A		No.	2				

Schedule No. 3. Design Services

Item	Description	Unit	Quantity	Unit Price ¹		Total Price ¹	
				Local Currency Portion [BDT]	Foreign Currency Portion [USD]	Local Currency Portion [BDT]	Foreign Currency Portion [USD]
1	2	3	4	5	6	7 = 4 x 5	8 = 4 x 6
1	420 kV ATR, switchgear, equipment connection and steel structures	Lump sum	1				
2	230 kV switchgear, equipment connection and steel structures	Lump sum	1				

1.

Name of Bidder:

Signature of Bidder:

schedule 4. installation and other services

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
A	420 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 420 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
A1	Surge arrester 420 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 336 kV, Uc = 268 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
A2	The lot of fittings including all necessary conductors, clamps and connectors required for completing 420 kV CVT, SA		lot	1				
A3	Equipment supports steel structure including nut-bolts required for completing 420 kV SA on existing foundation		lot	1				
B	245 kV switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 245 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
B1	Surge arrester 245 kV, single phase, heavy duty station class, gapless, metal oxide type, Ur = 192 kV, Uc = 153 kV, 10 kA nominal discharge current, 50 Hz		nos	3				
B2	Post insulator 245 kV, single phase, 10 kN, 50 kA / 1 sec, 50 Hz, 1,050 / 460 kV BIL		nos	3				
B3	The lot of conductors 245 kV, for double busbars system and for connection of the 245 kV switchgear, 2,000 A, 50 kA / 1 sec, 50 Hz 1,050 / 460 kV BIL, three phase		lot	1				
B4	The lot of fittings including all necessary conductors, clamps and connectors required for completing 245 kV switchgear.		lot	1				
B5	Equipment supports steel structure including nut-bolts required for completing 245 kV switchgear on existing foundation.		lot	1				
C	36 kV Switchgear, equipment connection and steel structures							
	The set of complete equipment for switchgear 36 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							

schedule 4. installation and other services

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
C1	Current transformer 36 kV, single-phase, 3-core, single ratio, 800/1A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, post type current transformer.		nos	3				
C2	Surge arrester 36 kV, single phase, gapless, metal oxide type, Uc = 30 kV, Ur = 24 kV, 10 kA nominal discharge current, 50 Hz, 170 / 70 kV BIL,		nos	3				
C3	The lot of conductors 36 kV, for connection of the 36 kV switchgear, 630 A, 25 kA / 1 sec, 50 Hz, 170 / 70 kV BIL, three phase.		lot	1				
C4	The lot of fittings including all necessary clamps and connectors required for completing 36 kV switchgear.		lot	1				
C5	Modification of existing equipment support structure required for completing 36 kV switchgear.		lot	1				
D	Transformers							
	The set of complete equipment 400/230/33 kV for transformation of energy shall be designed, supplied, delivered, installed, tested and commissioned,necessary modification of the existing transformer foundation (if required) under this contract, including the following:							
D1	The Auto-transformer 400/235/33 kV, 420/520 MVA, YNa0d1, ONAN/ONAF, with tertiary winding, three phase, oil immersed, hermetically closed, with on-load tap changer; with single phase, 3-core current transformers in all bushings. Characteristics of CTs will be AS per attached GTP,GA,		set	1				
D2	existing Nitrogen Injection Fire Protection System (NIFPS) shall be adapted for the new 400/235/33 kV autotransformer units AS per attached transformer GA and NIFPS drawing		lot	1				
E	Earthing/Auxiliary Transformers							
	The set of complete equipment 33/0.4 kV for transformation of energy for auxiliary power supply shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:							
E1	The auxiliary power transformer 33/0.4 kV, 350 kVA, ZNyn11, ONAN, oil immersed, three phase, with off-load tap changer; with single phase, 2-core current transformers in all bushings. MCCB shall be available for 0.415kv side adjacent to the Earthing Tr. Characteristics of CTs will be defined as per attached GTP and GA		set	1				

schedule 4. installation and other services

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
F	Control, Protection, Substation Automation and Metering							
	The lot of complete equipment for control, protection, alarm, SAS and me-tering panels for the 400 kV & 230kV & 33 kV system as well as LV AC and LV DC system shall be modified, tested and commissioned under this contract for successful commissioning of the bay.							
F1	Existing Control, protection and SAS for ATR-1 , shall be re-connected and completing the testing ,commissioning		set	1				
F2	existing Control, protection and SAS for one (1) set of 33/0,4 kV Auxiliary Transformer circuits shall be reconnected, tesing and commissioning		set	1				
F3	existing Control, protection and SAS for complete LV part of the Substation, AC & DC, reconnect, tesing ,commissioning		lot	1				
F4	exisitng Substation Automation System for ATR-1 shall be complete with wiring ,testing ,commissioning		lot	1				
F5	existing 400 kV busbars, in one and half breaker type busbar system, shall be tested & commisioning for ATR_1		Lot	1				
F6	existing Control, protection and SAS for two 230 kV busbars shall be complete with wiring ,testing and commissioning		lot	1				
F7	eixsting tariff metering panel reconnection ,testing and commissioning For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.		lot	1				
F8	existing Digital Fault and Disturbance Recorder (DFDR) system shall be complete with wiring , testing and commissioning		lot	1				
F9	existing telecommunication system testing and commissioning for ATR_1		lot	1				
I	EXISTING Fire alarm & fire fighting system shall be complete for ATR_1 with wiring,testing,commissioning		lot	1				

schedule 4. installation and other services

Item	Description	Country of origin	Unit	Quantity	Unit Price ¹		Total Price ¹	Taxes and Duties-Local Currency
					Currency Portion [BDT]	CIP	Currency Portion [BDT]	
1	2	3	4	5	6	7	8 = 5 x 7	9
J	Earthing and Lightning Protection							
J1	existing earthing and Lightning Protection for ATR_1 shall be re-connncted and tested		lot	1				
K	power Cable 36kV							
K1	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, single phase XLPE cable.		m	450				
K2	The lot of complete equipment shall be designed, supplied, delivered, in-stalled, tested and commissioned of 36 kV, 630A, 25kA / 1 sec, 50Hz, 170/70 kV BIL, cable end terminal end for single phase XLPE cable		lot	1				
L	Mandatory Spare Parts							
i	Busbar protection bay unit SEL 401, Detailed specification in annexure _A		No.	2				
ii	Busbar protection bay unit P743, Detailed specification in annexure _A		No.	2				
iii	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A1		No.	1				
iv	Busbar protection central unit ,REB 500 , Detailed specification in annexure _A2		No.	1				
iv	Bay control unit SEL 451 , Detailed specification in annexure _A		No.	2				