Financial Cooperation with Bangladesh

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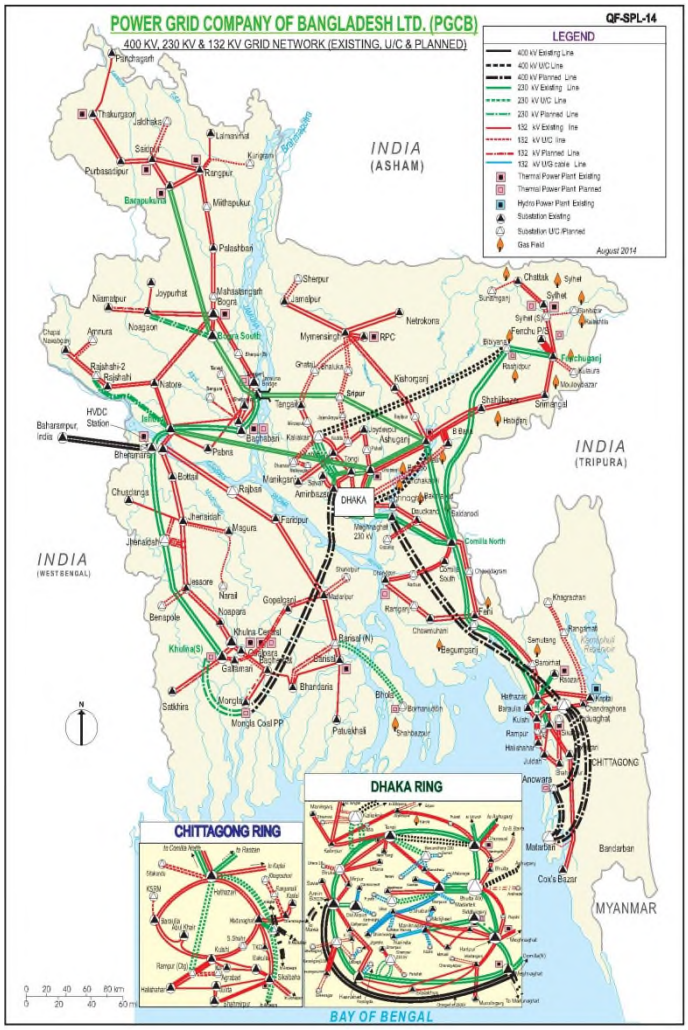
Transmission System Improvement Western Zone



Tender Documents for Design, Supply, Installation, Testing & Commissioning of 230/132 kV and 132/33 kV Substations, Northern Zone, on Turnkey Basis

Contract No. PGCB/KfW/2012.66.436/NZSS

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Employer:

Power Grid Company of Bangladesh (PGCB)
IEB Bhaban (4th Floor), IEB
Ramna, Dhaka-1000, Bangladesh

Consultant:

GOPA-International Energy Consultants GmbH
Justus-von-Liebig-Str. 1, 61352 Bad Homburg, Germany
Phone: +49 (6172) 1791-800; Fax: +49 (6172) 944 95 20
eMail: info@gopa-intec.de; www.gopa-intec.de

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1.1 Brief Description of the 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.

Bangladesh is facing chronic power shortages that could undermine its economic sustainability. Inadequate, irregular power and poor quality power supply were identified to be the major constraints for sustaining economic growth and development of the country.

PGCB launched a vast program for the improving and strengthening of its transmission system. The objective is expansion and strengthening of the 230 kV and 132 kV transmission systems of the Western Zone. The project spreads over eleven (11) regions, i.e. Ishurdi, Rajshahi, Baghabari, Bangura, Jhenaidah, Rajbari, Miithapukur, Khulna, Gopalganj, Mongla and Bagherhat.

The aim of the system expansion is to contribute to an efficient power transmission in PGCB's transmission system, to eliminate the operational bottlenecks and to provide an adequate infrastructure for future power sector development.

The GoB received from the German Government financial assistance to be used for strengthening the transmission system in the country, especially the 230 kV and 132 kV transmission facilities. KfW will provide a loan, while the remaining costs will be financed from PGCB funds.

1.2 Description of this Package

The work covered by this specification for the construction of new and the extension and renovation of existing 230/X kV and 132/X kV AIS substations and civil works is outlined below.

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

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

The Contractor's responsibility is to provide that all parts of the works are 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 & renovation works, not all required as-built drawings may be available for the existing plants & equipment that are required to be modified/renovated; the Contractor is also responsible to make drawings as required to complete the works.

The Bidder shall be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment.

All necessary materials, adjustments, dismantling, remedial and tiding-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 bid price shall include costs of witnessing of factory acceptance tests by the Employer's Engineer (three Engineers in each visit, maximum seven days for each visit) for power transformers 230/132 kV, power transformers 132/33 kV, circuit breakers 230 and 132 kV, disconnectors 230 and 132 kV, instrument transformers 230 and 132 kV, substation automation system, protection relays, and communication equipment.

Factory acceptance tests shall be organized separately for each equipment. In case both equipment 230 kV and 132 kV (circuit breakers, disconnectors, instrument transformers) will be manufactured at the same location, one Factory Acceptance Test shall be foreseen.

The bid price shall include costs of training at the Manufacturer's premises for four Employers' Engineer (each for a period of maximum fourteen days) for installation, testing, operation and maintenance of OLTC, circuit breakers 230 and 132 kV, substation automation system equipment, protection equipment, DFDR, and communication equipment.

The bid price shall include costs of training during and after the installation. The Contractor should provide trainer(s) (authorised by the Manufacturer for on-site training on operation and maintenance of the works, for each new substation, for no more than 15 (fifteen) Employer's staff for minimum 1 (one) week.

The bid price shall include supply and delivery of mandatory spare parts, maintenance tools and test equipment.

The bid price shall include all other miscellaneous works required.

The drawings provided in the bidding documents are indicative only and hence the entire scope of works is not fully reflected in those drawings.

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

The descriptions presented below outline the basic requirements for each Section of the Works. This

is not intended to detail each and every item necessary to complete the works, but to outline the facilities to be provided under the contract.

The Contractor shall be responsible for ensuring that all items necessary for the safe, efficient and complete functioning of the work in compliance with the Specification are provided, whichever they described or not.

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

Denomination	Description
A	245 kV switchgear
B	145 kV switchgear
C	36 kV switchgear
D	235/132/33 kV auto transformers and 132/33 kV transformers
E	Neutral earthing equipment
F	Earthing / auxiliary transformers
G	Control, protection, substation automation and metering etc.
H	Fibre optic multiplexer equipment for communication and protection
I	Multicore low voltage power and control cables
J	Batteries, chargers and dc distribution
K	LVAC distribution
L	Civil works, building and foundations
M	Building lighting, small power and air conditioning
N	Switchyard lighting
P	Earthing and lightning protection

The Contractor is to carry out the works taking full account of the limitations imposed by existing sites and the requirement to maintain all existing supplies during the construction works.

Any temporary works, structures, connections, etc., necessary to achieve this requirement are to be included in the bid price.

The works under this contract include the following:

- **Extension of the new 230/132 kV Substation Rajshahi**
- **New 132/33 kV Substation Bangura**
- **Extension of the existing 132/33 kV Substation Baghabari**
- **New 132/33 kV Substation Miithapukur**

1.2.1 Extension of the new 230/132 kV Substation Rajshahi

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

- complete new 230/132/33kV air insulated switchgear (AIS) substation.
- 230 kV double busbar system, two (2) 230 kV overhead line bays (Bheramara HVDC-1 and Bheramara HVDC-2), two (2) 230 kV transformer bays, one (1) 230 kV bus coupler bay and space

for future extension for four (4) 230 kV bays
- two (2) three phase, 230/132/33 kV, 225/300 MVA autotransformers,

The 132 kV part of the substation, including two (2) 132 kV transformer bays for connection of two (2) three phase, 230/132/33 kV, 225/300 MVA autotransformers, **is not in the scope of works** and shall be built under another project.

The scope of work furthermore includes:

- design, supply, delivery, installation, connection with existing equipment, testing & commissioning of associated substation control and monitoring system, relay protection, metering, telecommunication, AC & DC auxiliary power supply, cables, metal structure, earthing and lightning protection,
- **extension of the existing substation automation/control & monitoring system**
- land development of the complete **required 230 kV switchyard area** by cutting, land filling, compacting up to a suitable level; general land development for other parts of the substation will be done by another project.
- **the approximate total area of the substation is 15 acres; the area required for the 230 kV switchyard part is approx. 10 acres.**
- complete outdoor civil works for the **required 230 kV switchyard area**, including 230 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformer foundations, oil pit, blast wall, **part of the security boundary wall around the required 230 kV switchyard**, internal roads, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing,
- complete civil works and facilities for **extension of existing** control building, including finishing works like rendering, colour, floor finishing, etc.,
- supply and delivery of mandatory spare parts, maintenance tools and test equipment.

The equipment to be supplied, installed and commissioned is shown on the bid drawings.

1A	**245 kV switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 230 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1A1.1	Two (2) sets of 245 kV, 3150A, 50kA, 50Hz, 1050/460 kV BIL, live tank type, SF_6 gas circuit breakers with three spring-stored energy operating mechanism.
1A1.2	Three (3) sets of 245 kV, 3150A, 50kA, 50Hz, 1050/460 kV BIL, live tank type, SF6 gas circuit breakers with one spring-stored energy operating mechanism.
1A2.1	Two (2) sets of 245kV, 3150A, 50kA, 50Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnectors with motor-operated earthing switches.
1A2.2	Two (2) sets of 245kV, 2.000A, 50kA, 50Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnectors with motor-operated earthing switches.
1A2.3	Eight (8) sets of 245kV, 2000A, 50kA, 50Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnectors.
1A3.1	Three (3) single-phase, 5-core, multi ratio, 245kV, 3200-1600/1A, 50kA, 50Hz, 1050/460 kV BIL, post type current transformer.
1A3.2	Twelve (12) single-phase, 5-core, multi ratio, 245kV, 1600-800/1A, 50kA, 50Hz, 1050/460 kV BIL, post type current transformer.

1A4	Twelve (12) single-phase, 2-secondary winding, 245kV, 230/V3 / 110/V3 / 110/V3 kV/V/V, 50kA, 50Hz, 1050/460 kV BIL, capacitor type voltage transformers.
1A5	Twelve (12) 245kV, 192kV continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
1A7.X	One (1) lot of conductors for double busbar and for connection of the 230 kV switchgear, 245 kV, 3150 & 2000 A, 50 kA.
1A8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 230 kV switchgear.
1A9.X	One (1) lot of gantry steel structures and equipment supports required for completing 230 kV switchgear.
1A10.X	All other necessary material and equipment to complete 230 kV switchgear.
1C	**36 kV Switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 33 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1C5	Six (6) 36kV, 30kV continuous operating voltage, 10kA nominal discharge current, 50Hz, 170/70 kV BIL, gapless metal oxide type, single phase surge arresters.
1C7.X	One (1) lot of conductors for connection of the 33 kV switchgear, 36 kV, 2000A, 25 kA.
1C8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 33 kV switchgear.
1C9.X	One (1) lot of gantry steel structures and equipment supports required for completing 33 kV switchgear.
1C10.X	All other necessary material and equipment to complete 33 kV switchgear.
1D	**Transformers**
1D1	Two (2) 235/132/33 kV three phase 225/300 MVA, YNa0d1, ONAN/ONAF, Auto transformer unit, equipped with 33 kV tertiary winding (brought out to terminal bushings) shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract.
1D3	Two (2) sets of Nitrogen Injection Fire Protection System (NIFPS) shall be provided for the new 235/132/33 kV, three phase, 225/300 MVA, YNa0d1, ONAN/ONAF, autotransformer units
1D10.X	All other necessary material and equipment to complete transformers
1G	**Control, Protection, Substation Automation and Metering - Extension of the Existing System** **New equipment shall be integrated into the existing system.** One (1) lot of complete equipment for control, protection, alarm, SAS and metering panels for the 230 kV system shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract. The sequence of the control panels and protection panels shall mirror the actual switchyard layout. Space shall be provided adjacent to the control and relay suites for each voltage level to accommodate sufficient panels for the future circuits indicated in the substation layout drawings. A control panel shall accommodate complete switchgear.

	230 kV transmission line protection relay panels of Main-1 & Main-2 protection shall be supplied and installed. The equipment to be supplied, installed and commissioned is shown on Bid Drawings comprising the following.
1G1.1	Control, protection and SAS for two (2) sets of 230kV Overhead Line circuits
1G2.1	Control, protection and SAS for two (2) set of 235/132/33kV Auto Transformer circuit and associated Earthing/Auxiliary Transformer circuits.
1G3.1	Busbar 230 kV protection panels in one (1) lot.
1G4.X	Tariff metering panel(s) to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters (accuracy class 0.2) for each line and transformer feeder. For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.
1G5.X	Digital Fault and Disturbance Recorder (DFDR) to accommodate all feeders.
1G6.X	One (1) lot of hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and the back-up station at Biddut Bhaban for integration of the complete new 230/132 kV substation. All required electrical signals shall be transmitted to the NLDC and the back-up station through the industrial gateway of the substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from the NLDC through the gateway of the substation automation system using the IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of the NLDC and the back-up station are to be carried out.
1G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in **NLDC**
1G10.X	All other necessary material and equipment to complete control, protection, substation automation and metering system.
1H	**Fibre Optic Multiplexer Equipment for Teleprotection and Communication**
1H1.X	**Fibre Optic Multiplexer Equipment - Extension of the Existing System** **New equipment shall be integrated into the existing system.** One (1) set of complete equipment for indoor fibre optic multiplexer equipment for protection & communication at substation shall be designed, supplied, delivered, installed, tested and commissioned, under this contract. Fibre optic multiplexer equipment is to be provided for. • Distance relay carrier signal (main and back-up) • Bus protection / breaker failure relay • SCADA data from switchgear and control system • Hot-line telephone system
1H3.X	One (1) lot of underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame) shall be designed, supplied, delivered, installed, tested and commissioned in control room. The Contract includes supply and installation of MDF and digital cables with adequate length.

1I	**Multicore Low Voltage Auxiliary Power and Control Cables**
1I1.X	One (1) complete set of multicore low voltage auxiliary power and control cables between all items of equipment supplied under the contract and for connection and integration of the **new** equipment with the existing equipment shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours & tags. The production of the overall substation cable routing and core schedules shall also be provided.
1I10.X	All other necessary material and equipment to complete LV auxiliary power and control cables.
1J	**LV DC, Batteries, Chargers and DC Distribution**
1J1.X	**Extension of the existing system.** **New equipment shall be integrated into the existing system.** • One (1) set of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide **extension** of the existing LV DC auxiliary power supply and for connection and integration of **new** equipment with the existing equipment. • One (1) set DC distribution switchboard.
1J2.X	**Extension of the existing system.** **New equipment shall be integrated into the existing system.** • One (1) set of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide **extension** of the existing 48V DC auxiliary power supply and for connection and integration of **new** equipment with the existing equipment. • One (1) set DC distribution switchboard.
1J10.X	All other necessary material and equipment to complete LV DC distribution system.
1K	**LV AC Distribution**
1K1.X	**Extension of the existing system.** **New equipment shall be integrated into the existing system.** • One (1) set of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide **extension** of the existing LV AC auxiliary power supply and for connection and integration of **new** equipment with the existing equipment • One (1) set AC distribution switchboard.
1K10.X	All other necessary material and equipment to complete LV AC distribution system.
1L	**Civil Works, Control Building and Foundations**
1L1.X	• One (1) lot of complete land development of **required 230 kV switchyard area** as shown in the bid drawing by cutting, land filling, compacting up to a suitable level. • General land development for other parts of the substation will be done by another project; **the approximate total area of the substation is 15 acres. The area required for the 230 kV switchyard part is approx. 10 acres.**

1L2.X	One (1) lot of complete design, supply and construction of outdoor civil works of **required 230 kV switchyard area**, including 230 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformers foundation, oil pit, blast wall, **part of the security boundary wall around the required 230 kV switchyard**, internal roads, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
1L3.X	One (1) lot of complete design, supply and construction of civil works and facilities for **extension of the existing** control building, including finishing works such as rendering, colour, floor finishing, etc.
1N	**Switchyard Lighting**
1N1.X	One (1) set of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide **extension** of the existing switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.
1P	**Earthing and Lightning Protection**
1P.1.X	One (1) set of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide **extension** of the existing earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.
1P.2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

1.2.2 New 132/33 kV Substation Bangura

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

- complete new 132/33kV air insulated switchgear (AIS) substation.

The scope of work under this turnkey contract includes design, supply, delivery, installation, connection with existing equipment, testing & commissioning of

- 132 kV single busbar system, one (1) 132 kV overhead line bays (Baghabari), two (2) 132 kV transformer bays and space for future extension for six (6) 132 kV bays
- two (2) three phase, 132/33 kV, 50/75 MVA power transformers,
- 33 kV single busbars system, two (2) 33 kV transformer bays, two (2) 33 kV auxiliary power transformer bays, one (1) bus coupler bay and space for eight (8) 33 kV bays
- two (2) three phase, 33/0.415 kV, 200 kVA, auxiliary power transformers
- associated substation control and monitoring system, relay protection, metering, telecommunication, AC & DC auxiliary power supply, cables, metal structure, earthing and lightning protection
- land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection; **the approximate total area of the substation is 5 acres.**
- complete outdoor civil works, including 132 kV and 33 kV gantry foundations, 132 kV and 33 kV equipment foundations, power transformers and auxiliary transformer foundations, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfac-

ing

- complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, superstructure works, finishing works such as rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.
- supply and delivery of mandatory spare parts, maintenance tools and test equipment.

The equipment to be supplied, installed and commissioned as shown on the bid drawings.

1B	**145 kV Switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 132 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1B1.1	One (1) sets of 145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, live tank type, SF6 gas circuit breakers with three spring-stored energy operating mechanism.
1B1.4	Two (2) sets of 145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, live tank type, SF6 gas circuit breakers with one spring-stored energy operating mechanism.
1B2.3	One (1) sets of 145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnectors with motor-operated earthing switches
1B2.5	Three (3) sets of 145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnectors.
1B3.2	Nine (9) single-phase, 5-core, multi ratio, 145 kV, 1600-800-400/1A, 40 kA, 50 Hz, 650/275 kV BIL, post type current transformer.
1B4	Six (6) single-phase, 2-secondary winding, 145 kV, 130/V3 / 110/V3 / 110/V3 kV/V/V, 40 kA, 50 Hz, 650/275 kV BIL, capacitor type voltage transformers.
1B5	Nine (9) 145 kV, 120 kV continuous operating voltage, 10 kA nominal discharge current, 50 Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
1B6	Three (3) sets of 145 kV, 50 Hz, 650/275 kV BIL, single pole, post insulators.
1B7.X	One (1) lot of conductors for single busbar and for connection of the 132 kV switchgear, 145 kV, 2000 A and 1250 A, 40 kA.
1B8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 132 kV switchgear.
1B9.X	One (1) lot of gantry steel structures and equipment supports required for completing 132 kV switchgear.
1B10.X	All other necessary material and equipment to complete the 132 kV switchgear.
1C	**36 kV Switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 33 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1C1	Two sets of 36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vacuum circuit breaker, for outdoor installation with one spring-stored energy operating mechanism
1C2.1	Three (3) sets of 36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, centre break, post type, manually operated disconnectors

1C2.2	Two (2) sets of 36 kV, 100 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, centre break, post type, manually operated disconnectors with integrated fuse of 10 A
1C3.1	Six (6) single-phase, 4-core, single ratio, 36 kV, 1600/1A, 25 kA, 50 Hz, 170/70 kV BIL, post type current transformer.
1C3.2	Six (6) (12) single-phase, 4-core, single ratio, 36 kV, 10/1A, 25 kA, 50 Hz, 170/70 kV BIL, post type current transformer.
1C4	Twelve (12) single-phase, 2-secondary winding, 36 kV, 33/V3 / 110/V3 / 110/V3 kV/V/V, 25 kA, 50 Hz, 170/70 kV BIL, inductive type voltage transformers.
1C5	Six (6) 36 kV, 30 kV continuous operating voltage, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, gapless metal oxide type, single phase surge arresters.
1C7.X	One (1) lot of conductors for double busbar and for connection of the 33 kV switchgear, 36 kV, 2000 A, 25 kA.
1C8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 33 kV switchgear.
1C9.X	One (1) lot of gantry steel structures and equipment supports required for completing 33 kV switchgear.
1C10.X	All other necessary material and equipment to complete the 33 kV switchgear.
1D	**Transformers**
1D2	Two (2) 132/33 kV three phase 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract.
1D4	Two (2) sets of water-spray fire protection system shall be provided for new 132/33 kV three phase 50/75 MVA, Dyn1, ONAN/ONAF power transformer units
1D10.X	All other necessary material and equipment to complete the transformers
1F	**Earthing/Auxiliary Transformers**
1F2	Two (2) 200 kVA, 33/0.4 kV, Dyn11, 3-phase earthing transformers to supply the substation auxiliary loads shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract.
1F10.X	All other necessary material and equipment to complete the auxiliary transformers.
1G	**Control, Protection, Substation Automation and Metering** One (1) lot of complete equipment for control, protection, alarm, SAS and metering panels for 132, 33 kV as well as LV AC and LV DC system shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract. The sequence of the control panels and protection panels shall mirror the actual switchyard layout. Space shall be provided adjacent to the control and relay suites for each voltage level to accommodate sufficient panels for the future circuits indicated in the substation layout drawings. A control panel shall accommodate the complete switchgear. 132 kV transmission line protection relay panels of Main-1 & Main-2 protection shall be supplied and installed. The equipment to be supplied, installed and commissioned is shown on Bid Drawings comprising the following.
1G1.2	Control, protection and SAS for one (1) sets of 132 kV overhead line circuit.

1G2.2	Control, protection and SAS for two (2) set of 132/33 kV power transformer circuit.
1G3.X	Busbar protection panels in one (1) lot.
1G4.X	Tariff metering panel(s) to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters (accuracy class 0.2) for each line, transformer feeder and auxiliary transformer. For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.
1G6.X	One (1) lot of hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and Back up station at Biddut Bhaban for integration of complete new 132/33 kV Substation. All required electrical signals shall be transmitted to the NLDC and Back up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of the NLDC and the back-up station are to be carried out.
1G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in **NLDC**
1G10.X	All other necessary material and equipment to complete the control, protection, substation automation and metering system.
1H	**Fibre Optic Multiplexer Equipment for Teleprotection and Communication**
1H1.X	**Fibre Optic Multiplexer Equipment** One (1) set of complete equipment for Indoor Fibre Optic Multiplexer Equipment for protection & communication at substation shall be designed, supplied, delivered, installed, tested and commissioned, under this contract. Fibre optic multiplexer equipment is to be provided for. • Distance relay carrier signal (main and back-up) • Bus-protection / breaker failure relay • SCADA data from switchgear and control system • Hot-line telephone system
1H2.X	One (1) set of complete equipment for **Telephone System** shall be designed, supplied, delivered, installed, tested and commissioned
1H3.X	One (1) lot of underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame) shall be designed, supplied, delivered, installed, tested and commissioned in control room. The contract includes supply and installation of MDF and digital cables with adequate length.
1I	**Multicore Low Voltage Auxiliary Power and Control Cables**
1I1.X	One (1) lot complete set of multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours & tags. The production of the overall substation cable routing and core schedules shall also be provided.
1I10.X	All other necessary material and equipment to complete the LV auxiliary power and control cables.

1J	**LV DC, Batteries, Chargers and DC Distribution**
1J1.X	One (1) lot consists of two (2) sets 110 V substation alkaline batteries complete with chargers and distribution switchboard shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, to provide all DC supplies to equipment being supplied for the new substation. One set shall be used as standby supply. The system shall generally be as shown in the bid drawings and shall include the following. (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. (c) One (1) set DC distribution switchboard.
1J2.X	One (1) lot consists of two (2) sets of 48V DC system complete with chargers and distribution switchboard shall be designed, supplied, delivered, installed, tested and commissioned in the control building to provide all DC supplies for fibre optic multiplexure equipment for communication and protection. One set shall be used as standby supply. The system shall generally be as shown in Bid Drawings and shall include the following. (a) Two (2) sets 100% Ni-cadmium batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 50 A rating. (c) One (1) set DC distribution switchboard.
1J10.X	All other necessary material and equipment to complete the LV DC distribution system.
1K	**LV AC Distribution**
1K1.X	One (1) set LV AC switchboard for substation services shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, to provide the 400/230V supplies to all equipment being supplied. The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the auto transformers.
1K10.X	All other necessary material and equipment to complete the LV AC distribution system.
1L	**Civil Works, Control Building and Foundations**
1L1.X	One (1) lot of complete land development of complete switchyard area as shown in the bid drawing by cutting, land filling, compacting up to a suitable level including slope protection; **The approximate total area of the substation is 5 acres.**
1L2.X	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformer foundations, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
1L3.X	One (1) lot of complete design, supply and construction of civil works and facilities for a new two-storey control room building with cable basement, including foundation works,

	super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.
1M	**Building Lighting, Small Power, Air Conditioning and Ventilation**
1M1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.
1N	**Switchyard Lighting**
1N1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.
1P	**Earthing and Lightning Protection**
1P1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.
1P2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

1.2.3 Extension of the Existing 132/33 kV Substation Baghabari

The existing 230/132 kV substation has a 132 kV switchyard, with one and half breaker arrangement. One (1) existing, fully equipped 132 kV bay shall be used.

The scope of work under this turnkey contract is:

- re-testing & re-commissioning of a one (1) existing 132 kV overhead line bay.
- supply, delivery, installation, connection with existing equipment, **if any**, testing & commissioning of associated control and relay protection, metering, telecommunication, AC & DC auxiliary power supply, cables, metal structure, earthing and lightning protection and associated civil works.

The equipment to be supplied, installed and commissioned is shown on the bid drawings.

1B	**145 kV Switchgear, equipment connection and steel structures**
	One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1B10.X	All other necessary material and equipment, if any, to complete the 132 kV switchgear.
1G	**Control, Protection, Substation Automation and Metering** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in **NLDC**

1G10.X	All other necessary material and equipment, if any, to complete the control, protection, sub-station automation and metering system.
1H	**Fibre Optic Multiplexer Equipment for Teleprotection and Communication** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1I	**Multicore Low Voltage Auxiliary Power and Control Cables** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1I10.X	All other necessary material and equipment, if any, to complete the LV auxiliary power and control cables.
1J	**LV DC, Batteries, Chargers and DC Distribution** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1J10.X	All other necessary material and equipment, if any, to complete the LV DC distribution sys-tem.
1K	**LV AC Distribution** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1K10.X	All other necessary material and equipment, if any, to complete the LV AC distribution sys-tem.
1P	**Earthing and Lightning Protection** One (1) existing, fully equipped 132 kV shall be re-tested and re-commissioned, under this contract.
1P10.X	All other necessary material and equipment, if any, to complete the earthing and lightning protection system.

1.2.4 New 132/33 kV Substation Miithapukur

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

- complete new 132/33kV air insulated switchgear (AIS) substation.

The scope of work under this turnkey contract includes design, supply, delivery, installation, connection with existing equipment, testing & commissioning of

- 132 kV double busbar system, four (4) 132 kV overhead line bays (Palashbari-1, Palashbari-2, Rangur-1 and Rangur-2), two (2) 132 kV transformer bays, one (1) 132 kV bus coupler bay and space for future extension for four (4) 132 kV bays
- two (2) three phase, 132/33 kV, 50/75 MVA power transformers,
- 33 kV single busbars system, two (2) 33 kV transformer bays, two (2) 33 kV auxiliary power transformer bays, one (1) bus coupler bay and space for eight (8) 33 kV bays
- two (2) three phase, 33/0.415 kV, 200 kVA, auxiliary power transformers
- associated substation control and monitoring system, relay protection, metering, telecommunication, AC & DC auxiliary power supply, cables, metal structure, earthing and lightning protection
- land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection**; the approximate total area of the substation is 5 acres.**
- complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road,

internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing

- Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.
- supply and delivery of mandatory spare parts, maintenance tools and test equipment.

The equipment to be supplied, installed, and commissioned is shown on the bid drawings.

1B	**145 kV Switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 132 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1B1.1	Four (4) sets of 145 kV, 1250A, 40kA, 50Hz, 650/275 kV BIL, live tank type, SF_6 gas circuit breakers with three spring-stored energy operating mechanism.
1B1.3	One (1) sets of 145 kV, 2000A, 40kA, 50Hz, 650/275 kV BIL, live tank type, SF_6 gas circuit breakers with one spring-stored energy operating mechanism.
1B1.4	Two (2) sets of 145 kV, 1250A, 40kA, 50Hz, 650/275 kV BIL, live tank type, SF_6 gas circuit breakers with one spring-stored energy operating mechanism.
1B2.2	Two (2) sets of 145kV, 2000A, 40kA, 50Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnectors with motor-operated earthing switches
1B2.3	Four (4) sets of 145kV, 1250A, 40kA, 50Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnectors with motor-operated earthing switches.
1B2.5	Twelve (12) sets of 145kV, 1250A, 40kA, 50Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnectors.
1B3.2	Twenty one (21) single-phase, 5-core, multi ratio, 145kV, 1600-800-400/1A, 40kA, 50Hz, 650/275 kV BIL, post type current transformer.
1B4	Eighteen (18) single-phase, 2-secondary winding, 145kV, 130/V3 / 110/V3 / 110/V3 kV/V/V, 40kA, 50Hz, 650/275 kV BIL, capacitor type voltage transformers.
1B5	Eighteen (18) 145kV, 120kV continuous operating voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
1B7.X	One (1) lot of conductors for double busbar and for connection of the 132 kV switchgear, 145 kV, 2000 A and 1250 A, 40 kA.
1B8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 132 kV switchgear.
1B9.X	One (1) lot of gantry steel structures and equipment supports required for completing 132 kV switchgear.
1B10.X	All other necessary material and equipment to complete the 132 kV switchgear.
1C	**36 kV Switchgear, equipment connection and steel structures**
	One (1) set of complete equipment for switchgear 33 kV shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, comprise the following:
1C1	Two sets of 36 kV, 1600 A, 25kA, 50Hz, 170/70 kV BIL, three pole, vacuum circuit breaker, for outdoor installation with one spring-stored energy operating mechanism
1C2.1	Three (3) sets of 36kV, 1600A, 25kA, 50Hz, 170/70 kV BIL, three pole, centre break, post type, manually operated disconnectors

1C2.2	Two (2) sets of 36kV, 100A, 25kA, 50Hz, 170/70 kV BIL, three pole, centre break, post type, manually operated disconnectors with integrated fuse of 10A
1C3.1	Six (6) single-phase, 4-core, single ratio, 36kV, 1600/1A, 25kA, 50Hz, 170/70 kV BIL, post type current transformer.
1C3.2	Six (6) (12) single-phase, 4-core, single ratio, 36kV, 10/1A, 25kA, 50Hz, 170/70 kV BIL, post type current transformer.
1C4	Twelve (12) single-phase, 2-secondary winding, 36kV, 33/V3 / 110/V3 / 110/V3 kV/V/V, 25kA, 50Hz, 170/70 kV BIL, inductive type voltage transformers.
1C5	Six (6) 36kV, 30kV continuous operating voltage, 10kA nominal discharge current, 50Hz, 170/70 kV BIL, gapless metal oxide type, single phase surge arresters.
1C7.X	One (1) lot of conductors for double busbar and for connection of the 33 kV switchgear, 36 kV, 2000A, 25 kA.
1C8.X	One (1) lot of insulators and fittings including all necessary clamps and connectors required for completing 33 kV switchgear.
1C9.X	One (1) lot of gantry steel structures and equipment supports required for completing 33 kV switchgear.
1C10.X	All other necessary material and equipment to complete the 33 kV switchgear.
1D	**Transformers**
1D2	Two (2) 132/33 kV three phase 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract.
1D4	Two (2) sets of water-spray fire protection system shall be provided for new 132/33 kV three-phase 50/75 MVA, Dyn1, ONAN/ONAF power transformer units
1D10.X	All other necessary material and equipment to complete the transformers.
1F	**Earthing/Auxiliary Transformers**
1F2	Two (2) 200 kVA, 33/0.4 kV, Dyn11, 3-phase earthing transformers to supply the substation auxiliary loads shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract.
1F10.X	All other necessary material and equipment to complete the auxiliary transformers.
1G	**Control, Protection, Substation Automation and Metering** One (1) lot of complete equipment for control, protection, alarm, SAS and metering panels for 132, 33 kV as well as LV AC and LV DC system shall be designed, calculated, supplied, delivered, installed, tested and commissioned, under this contract. The sequence of the control panels and protection panels shall mirror the actual switchyard layout. Space shall be provided adjacent to the control and relay suites for each voltage level to accommodate sufficient panels for the future circuits indicated in the substation layout drawings. A control panel shall accommodate complete switchgear. 132 kV transmission line protection relay panels of Main-1 & Main-2 protection shall be supplied and installed. The equipment to be supplied, installed and commissioned is shown on Bid Drawings comprising the following.
1G1.2	Control, protection and SAS for four (4) sets of 132kV Overhead Line circuit.

1G2.2	Control, protection and SAS for two (2) set of 132/33kV Power Transformer circuit.
1G3.X	Busbar protection panels in one (1) lot.
1G4.X	Tariff metering panel(s) to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters (accuracy class 0.2) for each line, transformer feeder and auxiliary transformer. For each feeder, minimum two (2) meters (main-1 & main-2) are to be provided.
1G6.X	One (1) lot of hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and the back-up station at Biddut Bhaban for integration of complete new 132/33 kV Substation. All required electrical signals shall be transmitted to the NLDC and Back up station through the industrial gateway of the substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and the back-up station are to be carried out.
1G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in **NLDC**
1G10.X	All other necessary material and equipment to complete the control, protection, substation automation and metering system.
1H	**Fibre Optic Multiplexer Equipment for Teleprotection and Communication**
1H1.X	**Fibre Optic Multiplexer Equipment** One (1) set of complete equipment for indoor fibre optic multiplexer equipment for protection & communication at substation shall be designed, supplied, delivered, installed, tested and commissioned, under this contract. Fibre Optic Multiplexer Equipment is to be provided for. • Distance relay carrier signal (main and back-up) • Bus-protection / breaker failure relay • SCADA data from switchgear and control system • Hot-line telephone system
1H2.X	One (1) set of complete equipment for **Telephone System** shall be designed, supplied, delivered, installed, tested and commissioned
1H3.X	One (1) lot of underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame) shall be designed, supplied, delivered, installed, tested and commissioned in control room. The Contract includes supply and installation of MDF and digital cables with adequate length.
1I	**Multicore Low Voltage Auxiliary Power and Control Cables**
1I1.X	One (1) lot complete set of multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract shall be designed, supplied, delivered, installed, tested and commissioned with necessary gland, terminated, and identified by colours & tags. The production of the overall substation cable routing and core schedules shall also be provided.
1I10.X	All other necessary material and equipment to complete the LV auxiliary power and control cables.

1J	**LV DC, Batteries, Chargers and DC Distribution**
1J1.X	One (1) lot consists of two (2) sets 110V substation alkaline batteries complete with chargers and distribution switchboard shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, to provide all DC supplies to equipment being supplied for the new substation. One set shall be used as standby supply. The system shall generally be as shown in Bid Drawings and shall include the following. a. Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. b. Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. c. One (1) set DC distribution switchboard.
1J2.X	One (1) lot consists of two (2) sets of 48V DC system complete with chargers and distribution switchboard shall be designed, supplied, delivered, installed, tested and commissioned in the control building to provide all DC supplies for fibre optic multiplexure equipment for communication and protection. One set shall be used as standby supply. The system shall generally be as shown in Bid Drawings and shall include the following. a. Two (2) sets 100% Ni-cadmium batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. b. Two (2) sets battery chargers complete, each float charge shall not be less than 50A rating. c. One (1) set DC distribution switchboard.
1J10.X	All other necessary material and equipment to complete the LV DC distribution system.
1K	**LV AC Distribution**
1K1.X	One (1) set LV AC switchboard for substation services shall be designed, supplied, delivered, installed, tested and commissioned, under this contract, to provide the 400/230V supplies to all equipment being supplied. The system shall generally be as per Bid Drawings and shall include one 125A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the auto transformers.
1K10.X	All other necessary material and equipment to complete the LV AC distribution system.
1L	**Civil Works, Control Building and Foundations**
1L1.X	One (1) lot of complete land development of complete switchyard area as shown in the bid drawing by cutting, land filling, compacting up to a suitable level including slope protection. **The approximate total area of the substation is 5 acres.**
1L2.X	One (1) lot of complete design, supply and construction of outdoor civil works, including 132 kV and 33 kV gantry foundations, 132 kV and 33 kV equipment foundations, power transformer and auxiliary transformer foundations, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing
1L3.X	One (1) lot of complete design, supply and construction of civil works and facilities for a new two-storey control room building with cable basement, including foundation works, superstructure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage

	facilities including septic tank, etc.
1M	**Building Lighting, Small Power, Air Conditioning and Ventilation**
1M1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.
1N	**Switchyard Lighting**
1N1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.
1P	**Earthing and Lightning Protection**
1P1.X	One (1) lot of complete equipment shall be designed, supplied, delivered, installed, tested and commissioned, of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.
1P2	Two (2) sets of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

1.3 Terminal Points

1.3.1 Transmission Line Circuit Connections

The slack spans including overhead earth wires between the 230kV and 132kV 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 Substation gantry and control room building via underground optical fibre cables shall be carried out under this contract that include supply & installation of fibre optic cable of size similar to OPGW.

1.3.2 Communication and SCADA Equipment

The voice communication, teleprotection signalling and main distribution frame (MDF) for optical fibre cable will be supplied and installed under this contract.

Necessary equipment for incorporating new & existing equipment system into the existing SCADA system shall also be supplied and installed under this contract

Complete design, supply, delivery, installation, testing & commissioning of hardware and software shall be provided for the tele-control & tele-metering facilities required at the existing National Load Despatch Centre (NLDC) at Rampura for integration of the scope of the work.

In order to provide the tele-control & tele-metering facilities required at the existing NLDC, all plant supplied under this contract shall be equipped with potential free auxiliary contacts for indications and alarms. CT and VT circuits shall be fitted, where required, with the appropriate shorting and fused terminals.

All required electrical signals for signalization and control shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5- 104 protocol. Necessary transducer, control & interposing relays, RTUs, etc. shall be used. Necessary interfacing between the Substation Automation gateway and the communication equipment is to be carried out.

A sufficient investigation shall be made on the existing telecommunication and SCADA system for new and existing transmission lines and associated new and existing substations so that necessary equipment shall be provided for complete telecommunication system after the new and existing transmission lines and substations are connected/reconnected.

All and complete connection between the new equipment and the existing equipment for control & protection system, SCADA, communication system, and low voltage supply system shall be provided.

In addition, to realize the complete SCADA system after completion of the project, modification of the existing software in the master computer of the national control centre, and modification / extension / renovation of hardware (installing additional printed circuit cards or other equipment, etc. if required) shall be made under this contract.

1.4 System Electrical Parameters

1.4.1 System Conditions

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

Description	Unit	Required		
Nominal system voltage between phases	kV	230	132	33
System frequency	Hz	50		
Rated voltage between phases	kV	245	145	36
Rated lightning impulse withstand voltage	kV	1050	650	170
Rated power frequency withstand voltage	kV, 1 min	460	275	70
Rated symmetrical short-circuit current	kA, 1 sec	50	40	25

1.4.2 System Earthing

The 230/138/33kV auto-transformers and 132/33kV power transformers are solidly earthed.

The 230 kV system 132 kV system is solidly earthed at the power transformer 132 kV neutrals and 230/138/33 kV auto-transformer neutrals but not earthed at the Grid supply points.

The 33 kV system is solidly earthed at some of the 132/33 kV grid substations and resistance earthed at some of the grid substations.

1.4.3 Minimum Substation Clearances

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

Description	Unit	Required		
Nominal system voltage	kV	230	132	33
Minimum clearance between live metal parts and earth	mm	2100	1300	380
Minimum clearance between live metal	mm	2400	1500	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	4270	3500	2740
Minimum insulator creepage distance (at rated voltage between phases)	mm/kV	25		

1.4.4 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

1.4.5 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%

1.5 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 to any equipment in the substation during wet season. Depend on the past recorded maximum flood water level at the project area, sufficient ground level height shall be required for land formation at the Contractor's responsibility. The flooding can be taken as advantage at certain Sites in that the heavy loads may be floated on barges to close proximity to the Sites.

The project area is designated a zone of moderate intensity for earthquakes.

The seismic factor is 0.1 g.

Atmospheric pollution is moderate and special insulator design or washing is not 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/m²	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 1.1m)	°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 chapter is given solely for the general assistance of Bidders; no responsibility for it will be accepted nor will any claim based on this clause be considered.

2. Schedule B: Bid Prices & Schedules

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

(Please use the attached excel file BGD 1800 NZSS vol 3 schedule b price schedules.xlsx)

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
I	**Extension of the New 230/132 kV Substation Rajshahi**					
A	**230 kV Switchgear**					
A1.1	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism		set	2		
A1.2	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism		set	3		
A2.1	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector with motor operated earthing switch		set	2		
A2.2	245 kV, 2000 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector with motor operated earthing switch		set	2		
A2.3	245 kV, 2000 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector		set	8		
A3.1	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 3200-1600/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	3		
A3.2	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 1600-800/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	12		
A4	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 2-secondary windings, 230/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	12		
A5	245 kV, Um = 245 kV, Ur = 192 kV, Uc = 154 kV, 10 kA nominal discharge current, 50 Hz, 1050/460 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	12		
A7.X	245 kV, 3150 A and 2000 A, 50 kA, Conductors for double busbars and for connection of the 230 kV switchgears		lot	1		
A8.X	245 kV, 3150 A and 2000 A, 50 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 230 kV switchgears		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
A9.X	245 kV, Gantry steel structure and equipment support for completing of the 230 kV switchgears		lot	1		
A10.X	Necessary material and equipment to complete 230 kV Switchgear		lot	1		
C	**33 kV Switchgear**					
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	6		
C7.X	36 kV, 2000 A, 25 kA, Conductors for connection of the 33 kV switchgears		lot	1		
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for connection and completing of the 33 kV switchgears		lot	1		
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears		lot	1		
C10.X	Necessary material and equipment to complete 33 kV Switchgear		lot	1		
D	**Transformers**					
D1	235/132/33 kV, 225/300 MVA, YNa0d1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, autotransformer, with On-load tap changer, with tertiary winding (brought out to terminal bushings)		set	2		
D3	Nitrogen Injection Fire Protection System (NIFPS), for new 235/132/33 kV, three phase, 225/300 MVA, YNa0d1, ONAN/ONAF, auto transformer unit		set	2		
D10.X	Necessary material and equipment to complete Transformers		lot	1		
G	**Control, Protection, Substation Automation System and Metering**					
G1.1	Control, protection and SAS for 230 kV Overhead Line circuit		set	2		
G2.1	Control, protection and SAS for 230/132/33 kV Autotransformer circuits and associated Earthing/Auxiliary Transformer circuit		set	2		
G3.1	Control, protection and SAS for 230 kV Busbars		set	1		

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Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
G4.X	Tariff Metering pane(s) to accommodate for each feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy class 0.2		set	1		
G5.X	Digital Fault and Disturbance Recorder (DFDR) to accommodate all feeders		set	1		
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and back-up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and back-up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and back-up station are to be carried out.		set	1		
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC		set	1		
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system		lot	1		
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**					
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation		set	1		
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)		set	1		
I	**Multicore Low Voltage Auxiliary Power and Control Cables**					
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract and for connection and integration of new equipment with the existing equipment, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules		lot	1		
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables		lot	1		

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Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
J	**LV DC, Batteries, Chargers and DC Distribution**					
J1.X	The complete equipment to provide extension of the existing LV DC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.		lot	1		
J2.X	The complete equipment to provide extension of the existing 48 V DC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.		lot	1		
J10.X	Necessary material and equipment to complete LV DC Distribution system		lot	1		
K	**LV AC Distribution**					
K1.X	The complete equipment to provide extension of the existing LV AC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.		lot	1		
K10.X	Necessary material and equipment to complete LV AC Distribution system		lot	1		
L	**Civil Works, Control Building and Foundations**					
L1.X	Land development of complete **required 230 kV switchyard area** by cutting, land filling, compacting up to a suitable level.		lot	1		
L2.X	Complete outdoor civil works of **required 230 kV switchyard area**, including 230 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformers foundation, oil pit, blast wall, internal roads, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing		lot	1		
L3.X	Complete civil works and facilities for **extension of existing** control building, including finishing works like rendering, colour, floor finishing, etc.		lot	1		
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**					
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.		lot	1		

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Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
N	**Switchyard Lighting**					
N1.X	Complete equipment to provide extension of the existing switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.		lot	1		
P	**Earthing and Lightning Protection**					
P1.X	Complete equipment to provide extension of the existing earthing system and lightning protection and for connection and integration of new equipment with the existing equipment, including connections, connectors and clamps, to suit the substation extension, including supporting design calculations.		lot	1		
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.		set	2		
	Mandatory Spare Parts					
A	**230 kV Switchgear**					
AS.1	Circuit breaker 230 kV, Tripping coil		set	4		
AS.2	Circuit breaker 230 kV, Closing coil		set	4		
AS.3	Circuit breaker 230 kV, Motor, in motor drive mechanism, complete with accessories		set	1		
AS.4	Circuit breaker 230 kV, auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type		set	1		
AS.5	Circuit breaker 230 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type		set	1		
AS.6	Circuit breaker 230 kV, SF6 temperature compensated manometer		set	2		
AS.7	Circuit breaker 230 kV, SF6 gas (40 kg) cylinder		set	1		
AS.8	Disconnector 230 kV with earthing switch - complete pole, together with one complete motor drive mechanism of main blades and one complete motor drive mechanism of the earthing blades		set	2		

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Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
A3.2	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 1600-800/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	3		
A4	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 2-secondary windings, 230/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	3		
A5	245 kV, Um = 245 kV, Ur = 192 kV, Uc = 154 kV, 10 kA nominal discharge current, 50 Hz, 1050/460 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	3		
C	**33 kV Switchgear**					
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	1		
D	**Transformers**					
DS.1	Transformer Bushing 230 kV		piece	1		
DS.2	Transformer Bushing 132 kV		piece	1		
DS.3	Transformer Bushing 33 kV		piece	1		
DS.4	Transformer oil		kg	10,000		
DS.5	Transformer silica gel		kg	40		
DS.6	Transformer ventilator with motor		set	2		
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in transformer control cabinet, one of each type		lot	1		
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type		lot	1		
DS.9	Thermometer, one of each type		lot	1		
DS.10	Thermostat, one of each type		lot	1		

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Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
G	**Control, Protection, Substation Automation System and Metering**					
GS.1	Line differential protection relay 230 kV		set	1		
GS.3	Line distance protection relay 230 kV		set	1		
GS.5	Transformer 230/132 kV differential relay with complete REF function		set	1		
GS.7	Overcurrent and earth fault relay 230 kV		set	1		
GS.10	Bay control unit		set	1		
GS.11	Trip Circuit Supervision relay, 3phase		set	1		
GS.13	Electronic meter, same as installed, including communication unit		set	1		
J	**LV DC, Batteries, Chargers and DC Distribution**					
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
K	**LV AC Distribution**					
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
Subtotal Rajshahi Substation to Schedule 5 - Grand Summary						

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
III	**New 132/33 kV Substation Bangura**					
B	**132 kV Switchgear**					
B1.1	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism		set	1		
B1.4	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism		set	2		
B2.3	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch		set	1		
B2.5	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnector		set	3		
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	9		
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	6		
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	9		
B6	145 kV, 50 Hz, 650/275 kV BIL, single phase, post insulator		set	3		
B7.X	145 kV, 2000 A and 1250 A, 40 kA, conductors for single busbars and for connection of the 132 kV switchgears		lot	1		
B8.X	145 kV, 2000 A and 1250 A, 40 kA, Insulators and fittings including all necessary clamps and connectors for single busbars and for connection and completing of the 132 kV switchgears		lot	1		
B9.X	145 kV, Gantry steel structure and equipment support for completing of the 132 kV switchgears		lot	1		
B10.X	Necessary material and equipment to complete 132 kV Switchgear		lot	1		

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Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
C	**33 kV Switchgear**					
C1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, live tank, vacuum circuit breaker, for outdoor installation, with spring-stored energy operating mechanism		set	2		
C2.1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector		set	3		
C2.2	36 kV, 100 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector, with integrated fuse 10 A		set	2		
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	6		
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	6		
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer		set	12		
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	6		
C7.X	36 kV, 2000 A, 25 kA, Conductors for double busbars and for connection of the 33 kV switchgears		lot	1		
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 33 kV switchgears		lot	1		
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears		lot	1		
C10.X	Necessary material and equipment to complete 33 kV Switchgear		lot	1		
D	**Transformers**					
D2	132/33 kV, 50/75 MVA, Dyn1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, power transformer, with On-load tap changer		set	2		

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Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
D4	Water Spray Fire Protection System, for new 132/33 kV, three phase, 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit		set	2		
D10.X	Necessary material and equipment to complete Transformers		lot	1		
F	**Earthing/Auxiliary Transformer**					
F2	33/0.415 kV, 200 kVA, Dyn11, ONAN, three phase, oil-immersed, power transformer, with Off-load tap changer, (to provide an earthing point for the neutral and) to supply the substation auxiliary loads		set	2		
F10.X	Necessary material and equipment to complete Auxiliary Transformers		lot	1		
G	**Control, Protection, Substation Automation System and Metering**					
G1.2	Control, protection and SAS for 132 kV Overhead Line circuit		set	1		
G2.2	Control, protection and SAS for 132/33 kV Power transformer circuit		set	2		
G2.3	Control, protection and SAS for 33/0.415 kV Auxiliary power transformer circuit and AC & DC Auxiliary Power Supply		set	2		
G3.2	Control, protection and SAS for 132 kV Busbars		set	1		
G4.X	Tariff metering pane(s) to accommodate for each line, transformer and auxiliary transformer feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy class 0.2		set	1		
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and back-up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and back-up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and back-up station are to be carried out.		set	1		
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC		set	1		

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Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system		lot	1		
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**					
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation		set	1		
H2.X	Telephone system, complete equipment		set	1		
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)		set	1		
I	**Multicore Low Voltage Auxiliary Power and Control Cables**					
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules		lot	1		
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables		lot	1		
J	**LV DC, Batteries, Chargers and DC Distribution**					
J1.X	110 V DC Auxiliary Power Supply, substation alkaline batteries complete with chargers and distribution switchboard, to provide all DC supplies to equipment being supplied for the new substation, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. (c) One (1) set DC distribution switchboard.		lot	1		
J2.X	48 V DC system, complete with chargers and distribution switchboard to provide all DC supplies for fibre optic multiplexure equipment for communication and control & protection, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 50 A rating. (c) One (1) set DC distribution switchboard.		lot	1		

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Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
J10.X	Necessary material and equipment to complete LV DC Distribution system		lot	1		
K	**LV AC Distribution**					
K1.X	LV AC switchboard for substation services to provide the 400/230V supplies to all equipment being supplied, including one (1) 125 A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the transformers		lot	1		
K10.X	Necessary material and equipment to complete LV AC Distribution system		lot	1		
L	**Civil Works, Control Building and Foundations**					
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.		lot	1		
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing		lot	1		
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.		lot	1		
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**					
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.		lot	1		
N	**Switchyard Lighting**					
N1.X	Complete equipment to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.		lot	1		

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Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
P	**Earthing and Lightning Protection**					
P1.X	Complete equipment of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement, including supporting design calculations.		lot	1		
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.		set	2		
	Mandatory Spare Parts					
B	**132 kV Switchgear**					
BS.1	Circuit breaker 132 kV, Tripping coil		set	1		
BS.2	Circuit breaker 132 kV, Closing coil		set	1		
BS.3	Circuit breaker 132 kV, Motor, in motor drive mechanism, complete with accessories		set	1		
BS.4	Circuit breaker 132 kV, auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type		set	1		
BS.5	Circuit breaker 132 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type		set	1		
BS.6	Circuit breaker 132 kV, SF6 temperature compensated manometer		set	1		
BS.7	Circuit breaker 132 kV, SF6 gas (40 kg) cylinder		set	1		
BS.8	Disconnector 132 kV with earthing switch - complete pole, together with one complete Motor drive mechanism of main blades and one complete Motor drive mechanism of the earthing blades		set	1		
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	1		
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	1		
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
C	**33 kV Switchgear**					
CS.1	Circuit breaker 33 kV, Tripping coil		set	1		
CS.2	Circuit breaker 33 kV, Closing coil		set	1		
CS.3	Circuit breaker 33 kV, Motor, in motor drive mechanism, complete with accessories		set	1		
CS.4	Fuse 10 A		set	3		
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	1		
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	1		
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer		set	1		
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	1		
D	**Transformers**					
DS.2	Transformer Bushing 132 kV		piece	1		
DS.3	Transformer Bushing 33 kV		piece	1		
DS.4	Transformer oil		kg	5,000		
DS.5	Transformer silica gel		kg	20		
DS.6	Transformer ventilator with motor		set	2		
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in Transformer control cabinet, one of each type		lot	1		
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type		lot	1		
DS.9	Thermometer, one of each type		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
DS.10	Thermostat, one of each type		lot	1		
F	**Earthing/Auxiliary Transformer**					
FS.1	Transformer Bushing 33 kV		piece	1		
G	**Control, Protection, Substation Automation System and Metering**					
GS.2	Line differential protection relay 132 kV		set	1		
GS.4	Line distance protection relay 132 kV		set	1		
GS.6	Transformer 132/33 kV differential relay with complete REF function		set	1		
GS.8	Overcurrent and earth fault relay 132 kV		set	1		
GS.10	Bay control unit		set	1		
GS.11	Trip Circuit Supervision relay, 3phase		set	1		
GS.13	Electronic meter, same as installed, including communication unit		set	1		
J	**LV DC, Batteries, Chargers and DC Distribution**					
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
K	**LV AC Distribution**					
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
Subtotal Bangura Substation to Schedule 5 - Grand Summary						

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
IV	**Extension of the Existing 132/33 kV Substation Baghabari**					
B	**132 kV Switchgear**					
B10.X	Necessary material and equipment to complete 132 kV Switchgear		lot	1		
G	**Control, Protection, Substation Automation System and Metering**					
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC		set	1		
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system		lot	1		
I	**Multicore Low Voltage Auxiliary Power and Control Cables**					
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables		lot	1		
J	**LV DC, Batteries, Chargers and DC Distribution**					
J10.X	Necessary material and equipment to complete LV DC Distribution system		lot	1		
K	**LV AC Distribution**					
K10.X	Necessary material and equipment to complete LV AC Distribution system		lot	1		
P	**Earthing and Lightning Protection**					
P10.X	Necessary material and equipment to complete earthing and lightning protection		lot	1		
Subtotal Baghabari Substation to Schedule 5 - Grand Summary						

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
V	**New 132/33 kV Substation Miithapukur**					
B	**132 kV Switchgear**					
B1.1	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism		set	4		
B1.3	145 kV, 2000 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism		set	1		
B1.4	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism		set	2		
B2.2	145 kV, 2000 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch		set	2		
B2.3	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch		set	4		
B2.5	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnector		set	12		
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	21		
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	18		
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	18		
B7.X	145 kV, 2000 A and 1250 A, 40 kA, Conductors for double busbars and for connection of the 132 kV switchgears		lot	1		
B8.X	145 kV, 2000 A and 1250 A, 40 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 132 kV switchgears		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
B9.X	145 kV, Gantry steel structure and equipment support for completing of the 132 kV switchgears		lot	1		
B10.X	Necessary material and equipment to complete 132 kV Switchgear		lot	1		
C	**33 kV Switchgear**					
C1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, live tank, vacuum circuit breaker, for outdoor installation, with spring-stored energy operating mechanism		set	2		
C2.1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector		set	3		
C2.2	36 kV, 100 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector, with integrated fuse 10 A		set	2		
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	6		
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	6		
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer		set	12		
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	6		
C7.X	36 kV, 2000 A, 25 kA, Conductors for double busbars and for connection of the 33 kV switchgears		lot	1		
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 33 kV switchgears		lot	1		
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears		lot	1		
C10.X	Necessary material and equipment to complete 33 kV Switchgear		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
D	**Transformers**					
D2	132/33 kV, 50/75 MVA, Dyn1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, power transformer, with On-load tap changer		set	2		
D4	Water Spray Fire Protection System, for new 132/33 kV, three phase, 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit		set	2		
D10.X	Necessary material and equipment to complete Transformers		lot	1		
F	**Earthing/Auxiliary Transformer**					
F2	33/0.415 kV, 200 kVA, Dyn11, ONAN, three phase, oil-immersed, power transformer, with Off-load tap changer, (to provide an earthing point for the neutral and) to supply the substation auxiliary loads		set	2		
F10.X	Necessary material and equipment to complete Auxiliary Transformers		lot	1		
G	**Control, Protection, Substation Automation System and Metering**					
G1.2	Control, protection and SAS for 132 kV Overhead Line circuit		set	4		
G2.2	Control, protection and SAS for 132/33 kV Power transformer circuit		set	2		
G2.3	Control, protection and SAS for 33/0.415 kV Auxiliary power transformer circuit and AC & DC Auxiliary Power Supply		set	2		
G3.2	Control, protection and SAS for 132 kV Busbars		set	1		
G4.X	Tariff Metering pane(s) to accommodate for each line, transformer and auxiliary transformer feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy class 0.2		set	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and back-up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and back-up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and back-up station are to be carried out.		set	1		
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC		set	1		
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system		lot	1		
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**					
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation		set	1		
H2.X	Telephone system, complete equipment		set	1		
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)		set	1		
I	**Multicore Low Voltage Auxiliary Power and Control Cables**					
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules		lot	1		
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
J	**LV DC, Batteries, Chargers and DC Distribution**					
J1.X	110 V DC Auxiliary Power Supply, substation alkaline batteries complete with chargers and distribution switchboard, to provide all DC supplies to equipment being supplied for the new substation, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. (c) One (1) set DC distribution switchboard.		lot	1		
J2.X	48 V DC system, complete with chargers and distribution switchboard to provide all DC supplies for fibre optic multiplexure equipment for communication and control & protection, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 50 A rating. (c) One (1) set DC distribution switchboard.		lot	1		
J10.X	Necessary material and equipment to complete LV DC Distribution system		lot	1		
K	**LV AC Distribution**					
K1.X	LV AC switchboard for substation services to provide the 400/230V supplies to all equipment being supplied, including one (1) 125 A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the transformers		lot	1		
K10.X	Necessary material and equipment to complete LV AC Distribution system		lot	1		
L	**Civil Works, Control Building and Foundations**					
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing		lot	1		
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.		lot	1		
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**					
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.		lot	1		
N	**Switchyard Lighting**					
N1.X	Complete equipment to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.		lot	1		
P	**Earthing and Lightning Protection**					
P1.X	Complete equipment of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement, including supporting design calculations.		lot	1		
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.		set	2		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
Mandatory Spare Parts						
B	**132 kV Switchgear**					
BS.1	Circuit breaker 132 kV, Tripping coil		set	2		
BS.2	Circuit breaker 132 kV, Closing coil		set	2		
BS.3	Circuit breaker 132 kV, Motor, in motor drive mechanism, complete with accessories		set	1		
BS.4	Circuit breaker 132 kV, auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type		set	1		
BS.5	Circuit breaker 132 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type		set	1		
BS.6	Circuit breaker 132 kV, SF6 temperature compensated manometer		set	3		
BS.7	Circuit breaker 132 kV, SF6 gas (40 kg) cylinder		set	1		
BS.8	Disconnector 132 kV with earthing switch - complete pole, together with one complete Motor drive mechanism of main blades and one complete Motor drive mechanism of the earthing blades		set	3		
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer		set	3		
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer		set	3		
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester		set	3		
C	**33 kV Switchgear**					
CS.1	Circuit breaker 33 kV, Tripping coil		set	1		
CS.2	Circuit breaker 33 kV, Closing coil		set	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
CS.3	Circuit breaker 33 kV, Motor, in motor drive mechanism, complete with accessories		set	1		
CS.4	Fuse 10 A		set	3		
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	1		
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer		set	1		
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer		set	1		
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester		set	1		
D	**Transformers**					
DS.2	Transformer Bushing 132 kV		piece	1		
DS.3	Transformer Bushing 33 kV		piece	1		
DS.4	Transformer oil		kg	5,000		
DS.5	Transformer silica gel		kg	20		
DS.6	Transformer ventilator with motor		set	2		
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in transformer control cabinet, one of each type		lot	1		
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type		lot	1		
DS.9	Thermometer, one of each type		lot	1		
DS.10	Thermostat, one of each type		lot	1		

Name of Bidder: Signature of Bidder:

Schedule 1: Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad

Item	Description	Code	Unit	Quantity	Foreign Currency (in…….)	
					Unit Price[2] CIP	Total Price[2] CIP
				(1)	*(2)*	*(3) = (1) x (2)*
F	**Earthing/Auxiliary Transformer**					
FS.1	Transformer Bushing 33 kV		piece	1		
G	**Control, Protection, Substation Automation System and Metering**					
GS.2	Line differential protection relay 132 kV		set	1		
GS.4	Line distance protection relay 132 kV		set	1		
GS.6	Transformer 132/33 kV differential relay with complete REF function		set	1		
GS.8	Overcurrent and earth fault relay 132 kV		set	1		
GS.10	Bay control unit		set	1		
GS.11	Trip Circuit Supervision relay, 3phase		set	1		
GS.13	Electronic meter, same as installed, including communication unit		set	1		
J	**LV DC, Batteries, Chargers and DC Distribution**					
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
K	**LV AC Distribution**					
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type		lot	1		
Subtotal Miithapukur Substation to Schedule 5 - Grand Summary						

Name of Bidder: Signature of Bidder:

Country of Origin Declaration Form

Item	Description	Code	Country

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

2 Specify currency. Create and use as many columns for Unit Price and Total Price as there are currencies.

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
I	**Extension of NEW 230/132 kV Substation Rajshahi**						
A	**230 kV Switchgear**						
A1.1	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism	set	2				
A1.2	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism	set	3				
A2.1	245 kV, 3150 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector with motor operated earthing switch	set	2				
A2.2	245 kV, 2000 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector with motor operated earthing switch	set	2				
A2.3	245 kV, 2000 A, 50 kA, 50 Hz, 1050/460 kV BIL, three pole, centre break, post type, motor operated disconnector	set	8				
A3.1	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 3200-1600/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	3				
A3.2	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 1600-800/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	12				
A4	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 2-secondary windings, 230/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	12				
A5	245 kV, Um = 245 kV, Ur = 192 kV, Uc = 154 kV, 10 kA nominal discharge current, 50 Hz, 1050/460 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	12				
A7.X	245 kV, 3150 A and 2000 A, 50 kA, Conductors for double busbars and for connection of the 230 kV switchgears	lot	1				
A8.X	245 kV, 3150 A and 2000 A, 50 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 230 kV switchgears	lot	1				
A9.X	245 kV, Gantry steel structure and equipment support for completing of the 230 kV switchgears	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
A10.X	Necessary material and equipment to complete 230 kV Switchgear	lot	1				
C	**33 kV Switchgear**						
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	6				
C7.X	36 kV, 2000 A, 25 kA, Conductors for connection of the 33 kV switchgears	lot	1				
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for connection and completing of the 33 kV switchgears	lot	1				
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears	lot	1				
C10.X	Necessary material and equipment to complete 33 kV Switchgear	lot	1				
D	**Transformers**						
D1	235/132/33 kV, 225/300 MVA, YNa0d1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, autotransformer, with On-load tap changer, with tertiary winding (brought out to terminal bushings)	set	2				
D3	Nitrogen Injection Fire Protection System (NIFPS), for new 235/132/33 kV, three phase, 225/300 MVA, YNa0d1, ONAN/ONAF, auto transformer unit	set	2				
D10.X	Necessary material and equipment to complete Transformers	lot	1				
G	**Control, Protection, Substation Automation System and Metering**						
G1.1	Control, Protection and SAS for 230 kV Overhead Line circuit	set	2				
G2.1	Control, Protection and SAS for 230/132/33 kV Autotransformer circuits and associated Earthing/Auxiliary Transformer circuit	set	2				
G3.1	Control, Protection and SAS for 230 kV Busbars	set	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
G4.X	Tariff Metering pane(s) to accommodate for each feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy class 0.2	set	1				
G5.X	Digital Fault and Disturbance Recorder (DFDR) to accommodate all feeders	set	1				
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and back-up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and back-up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and back-up station are to be carried out	set	1				
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	set	1				
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system	lot	1				
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation	set	1				
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)	set	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract and for connection and integration of new equipment with the existing equipment, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules	lot	1				
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
J	**LV DC, Batteries, Chargers and DC Distribution**						
J1.X	The complete equipment to provide extension of the existing LV DC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.	lot	1				
J2.X	The complete equipment to provide extension of the existing 48 V DC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.	lot	1				
J10.X	Necessary material and equipment to complete LV DC Distribution system	lot	1				
K	**LV AC Distribution**						
K1.X	The complete equipment to provide extension of the existing LV AC Auxiliary Power Supply and for connection and integration of new equipment with the existing equipment. DC distribution switchboard.	lot	1				
K10.X	Necessary material and equipment to complete LV AC Distribution system	lot	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete required 230 kV switchyard area by cutting, land filling, compacting up to a suitable level.	lot	1				
L2.X	Complete outdoor civil works of required 230 kV switchyard area, including 230 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformers foundation, oil pit, blast wall, internal roads, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing	lot	1				
L3.X	Complete civil works and facilities for extension of existing control building, including finishing works like rendering, colour, floor finishing, etc.	lot	1				
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**						
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
N	**Switchyard Lighting**						
N1.X	Complete equipment to provide extension of the existing switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.	lot	1				
P	**Earthing and Lightning Protection**						
P1.X	Complete equipment to provide extension of the existing earthing system and lightning protection and for connection and integration of new equipment with the existing equipment, including connections, connectors and clamps, to suit the substation extension, including supporting design calculations.	lot	1				
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.	set	2				
	Mandatory Spare Parts						
A	**230 kV Switchgear**						
AS.1	Circuit Breaker 230 kV, Tripping coil	set	4				
AS.2	Circuit Breaker 230 kV, Closing coil	set	4				
AS.3	Circuit Breaker 230 kV, Motor, in motor drive mechanism, complete with accessories	set	1				
AS.4	Circuit Breaker 230 kV, Auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type	set	1				
AS.5	Circuit Breaker 230 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type	set	1				
AS.6	Circuit Breaker 230 kV, SF6 temperature compensated manometer	set	2				
AS.7	Circuit Breaker 230 kV, SF6 gas (40 kg) cylinder	set	1				
AS.8	Disconnector 230 kV with Earthing Switch - complete pole, together with one complete motor drive mechanism of main blades and one complete Motor drive mechanism of the earthing blades	set	2				

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Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
A3.2	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 5-cores, 1600-800/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	3				
A4	245 kV, 50 kA, 50 Hz, 1050/460 kV BIL, single phase, 2-secondary windings, 230/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	3				
A5	245 kV, Um = 245 kV, Ur = 192 kV, Uc = 154 kV, 10 kA nominal discharge current, 50 Hz, 1050/460 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	3				
C	**33 kV Switchgear**						
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	1				
D	**Transformers**						
DS.1	Transformer Bushing 230 kV	piece	1				
DS.2	Transformer Bushing 132 kV	piece	1				
DS.3	Transformer Bushing 33 kV	piece	1				
DS.4	Transformer oil	kg	10,000				
DS.5	Transformer silica gel	kg	40				
DS.6	Transformer ventilator with motor	set	2				
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in Transformer control cabinet, one of each type	lot	1				
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type	lot	1				
DS.9	Thermometer, one of each type	lot	1				
DS.10	Thermostat, one of each type	lot	1				

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Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
G	**Control, Protection, Substation Automation System and Metering**						
GS.1	Line differential protection relay 230 kV	set	1				
GS.3	Line distance protection relay 230 kV	set	1				
GS.5	Transformer 230/132 kV differential relay with complete REF function	set	1				
GS.7	Overcurrent and earth fault relay 230 kV	set	1				
GS.10	Bay control unit	set	1				
GS.11	Trip Circuit Supervision relay, 3phase	set	1				
GS.13	Electronic meter, same as installed, including communication unit	set	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
K	**LV AC Distribution**						
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
Subtotal Rajshahi Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
III	**New 132/33 kV Substation Bangura**						
B	**132 kV Switchgear**						
B1.1	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism	set	1				
B1.4	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism	set	2				
B2.3	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch	set	1				
B2.5	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnector	set	3				
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	9				
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	6				
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	9				
B6	145 kV, 50 Hz, 650/275 kV BIL, single phase, post insulator	set	3				
B7.X	145 kV, 2000 A and 1250 A, 40 kA, Conductors for single busbars and for connection of the 132 kV switchgears	lot	1				
B8.X	145 kV, 2000 A and 1250 A, 40 kA, Insulators and fittings including all necessary clamps and connectors for single busbars and for connection and completing of the 132 kV switchgears	lot	1				
B9.X	145 kV, Gantry steel structure and equipment support for completing of the 132 kV switchgears	lot	1				
B10.X	Necessary material and equipment to complete 132 kV Switchgear	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
C	**33 kV Switchgear**						
C1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, live tank, vacuum circuit breaker, for outdoor installation, with spring-stored energy operating mechanism	set	2				
C2.1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector	set	3				
C2.2	36 kV, 100 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector, with integrated fuse 10 A	set	2				
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	6				
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	6				
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer	set	12				
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	6				
C7.X	36 kV, 2000 A, 25 kA, Conductors for double busbars and for connection of the 33 kV switchgears	lot	1				
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 33 kV switchgears	lot	1				
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears	lot	1				
C10.X	Necessary material and equipment to complete 33 kV Switchgear	lot	1				
D	**Transformers**						
D2	132/33 kV, 50/75 MVA, Dyn1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, power transformer, with On-load tap changer	set	2				

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Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
D4	Water Spray Fire Protection System, for new 132/33 kV, three phase, 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit	set	2				
D10.X	Necessary material and equipment to complete Transformers	lot	1				
F	**Earthing/Auxiliary Transformer**						
F2	33/0.415 kV, 200 kVA, Dyn11, ONAN, three phase, oil-immersed, power transformer, with Off-load tap changer, (to provide an earthing point for the neutral and) to supply the substation auxiliary loads	set	2				
F10.X	Necessary material and equipment to complete Auxiliary Transformers	lot	1				
G	**Control, Protection, Substation Automation System and Metering**						
G1.2	Control, Protection and SAS for 132 kV Overhead Line circuit	set	1				
G2.2	Control, Protection and SAS for 132/33 kV Power transformer circuit	set	2				
G2.3	Control, Protection and SAS for 33/0.415 kV Auxiliary power transformer circuit and AC & DC Auxiliary Power Supply	set	2				
G3.2	Control, Protection and SAS for 132 kV Busbars	set	1				
G4.X	Tariff Metering pane(s) to accommodate for each line, transformer and auxiliary transformer feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy cl. 0.2	set	1				
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and Back up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and Back up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and Back up station are to be carried out	set	1				
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	set	1				

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Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system	lot	1				
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation	set	1				
H2.X	Telephone system, complete equipment	set	1				
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)	set	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules	lot	1				
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables	lot	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
J1.X	110 V DC Auxiliary Power Supply, substation alkaline batteries complete with chargers and distribution switchboard, to provide all DC supplies to equipment being supplied for the new substation, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. (c) One (1) set DC distribution switchboard.	lot	1				
J2.X	48 V DC system, complete with chargers and distribution switchboard to provide all DC supplies for fibre optic multiplexure equipment for communication and control & protection, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 50 A rating. (c) One (1) set DC distribution switchboard.	lot	1				

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				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
J10.X	Necessary material and equipment to complete LV DC Distribution system	lot	1				
K	**LV AC Distribution**						
K1.X	LV AC switchboard for substation services to provide the 400/230V supplies to all equipment being supplied, including one (1) 125 A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the transformers	lot	1				
K10.X	Necessary material and equipment to complete LV AC Distribution system	lot	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.	lot	1				
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing	lot	1				
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.	lot	1				
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**						
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.	lot	1				
N	**Switchyard Lighting**						
N1.X	Complete equipment to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.	lot	1				

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Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
P	**Earthing and Lightning Protection**						
P1.X	Complete equipment of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement, including supporting design calculations.	lot	1				
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.	set	2				
	Mandatory Spare Parts						
B	**132 kV Switchgear**						
BS.1	Circuit Breaker 132 kV, Tripping coil	set	1				
BS.2	Circuit Breaker 132 kV, Closing coil	set	1				
BS.3	Circuit Breaker 132 kV, Motor, in motor drive mechanism, complete with accessories	set	1				
BS.4	Circuit Breaker 132 kV, Auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type	set	1				
BS.5	Circuit Breaker 132 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type	set	1				
BS.6	Circuit Breaker 132 kV, SF6 temperature compensated manometer	set	1				
BS.7	Circuit Breaker 132 kV, SF6 gas (40 kg) cylinder	set	1				
BS.8	Disconnector 132 kV with Earthing Switch - complete pole, together with one complete Motor drive mechanism of main blades and one complete Motor drive mechanism of the earthing blades	set	1				
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	1				
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	1				
C	**33 kV Switchgear**						
CS.1	Circuit Breaker 33 kV, Tripping coil	set	1				
CS.2	Circuit Breaker 33 kV, Closing coil	set	1				
CS.3	Circuit Breaker 33 kV, Motor, in motor drive mechanism, complete with accessories	set	1				
CS.4	Fuse 10 A	set	3				
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	1				
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	1				
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer	set	1				
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	1				
D	**Transformers**						
DS.2	Transformer Bushing 132 kV	piece	1				
DS.3	Transformer Bushing 33 kV	piece	1				
DS.4	Transformer oil	kg	5,000				
DS.5	Transformer silica gel	kg	20				
DS.6	Transformer ventilator with motor	set	2				
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in Transformer control cabinet, one of each type	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type	lot	1				
DS.9	Thermometer, one of each type	lot	1				
DS.10	Thermostat, one of each type	lot	1				
F	**Earthing/Auxiliary Transformer**						
FS.1	Transformer Bushing 33 kV	piece	1				
G	**Control, Protection, Substation Automation System and Metering**						
GS.2	Line differential protection relay 132 kV	set	1				
GS.4	Line distance protection relay 132 kV	set	1				
GS.6	Transformer 132/33 kV differential relay with complete REF function	set	1				
GS.8	Overcurrent and earth fault relay 132 kV	set	1				
GS.10	Bay control unit	set	1				
GS.11	Trip Circuit Supervision relay, 3phase	set	1				
GS.13	Electronic meter, same as installed, including communication unit	set	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
K	**LV AC Distribution**						
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
Subtotal Bangura Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
IV	**Extension of existing 132/33 kV Substation Baghabari**						
B	**132 kV Switchgear**						
B10.X	Necessary material and equipment to complete 132 kV Switchgear	lot	1				
G	**Control, Protection, Substation Automation System and Metering**						
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	set	1				
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system	lot	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables	lot	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
J10.X	Necessary material and equipment to complete LV DC Distribution system	lot	1				
K	**LV AC Distribution**						
K10.X	Necessary material and equipment to complete LV AC Distribution system	lot	1				
P	**Earthing and Lightning Protection**						
P10.X	Necessary material and equipment to complete earthing and lightning protection	lot	1				
Subtotal Baghabari Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
V	**New 132/33 kV Substation Miithapukur**						
B	**132 kV Switchgear**						
B1.1	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with three spring-stored energy operating mechanism	set	4				
B1.3	145 kV, 2000 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism	set	1				
B1.4	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, live tank, SF6 gas circuit breaker with one spring-stored energy operating mechanism	set	2				
B2.2	145 kV, 2000 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch	set	2				
B2.3	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL three pole, centre break, post type, motor operated disconnector with motor operated earthing switch	set	4				
B2.5	145 kV, 1250 A, 40 kA, 50 Hz, 650/275 kV BIL, three pole, centre break, post type, motor operated disconnector	set	12				
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	21				
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	18				
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	18				
B7.X	145 kV, 2000 A and 1250 A, 40 kA, Conductors for double busbars and for connection of the 132 kV switchgears	lot	1				
B8.X	145 kV, 2000 A and 1250 A, 40 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 132 kV switchgears	lot	1				
B9.X	145 kV, Gantry steel structure and equipment support for completing of the 132 kV switchgears	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
B10.X	Necessary material and equipment to complete 132 kV Switchgear	lot	1				
C	**33 kV Switchgear**						
C1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, live tank, vacuum circuit breaker, for outdoor installation, with spring-stored energy operating mechanism	set	2				
C2.1	36 kV, 1600 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector	set	3				
C2.2	36 kV, 100 A, 25 kA, 50 Hz, 170/70 kV BIL, three pole, vertical break, post type, hand operated disconnector, with integrated fuse 10 A	set	2				
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	6				
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	6				
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer	set	12				
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	6				
C7.X	36 kV, 2000 A, 25 kA, Conductors for double busbars and for connection of the 33 kV switchgears	lot	1				
C8.X	36 kV, 2000 A, 25 kA, Insulators and fittings including all necessary clamps and connectors for double busbars and for connection and completing of the 33 kV switchgears	lot	1				
C9.X	33 kV, Gantry steel structure and equipment support for completing of the 33 kV switchgears	lot	1				
C10.X	Necessary material and equipment to complete 33 kV Switchgear	lot	1				
D	**Transformers**						
D2	132/33 kV, 50/75 MVA, Dyn1, ONAN/ONAF, three phase, oil-immersed, hermetically sealed, power transformer, with On-load tap changer	set	2				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
D4	Water Spray Fire Protection System, for new 132/33 kV, three phase, 50/75 MVA, Dyn1, ONAN/ONAF Power transformer unit	set	2				
D10.X	Necessary material and equipment to complete Transformers	lot	1				
F	**Earthing/Auxiliary Transformer**						
F2	33/0.415 kV, 200 kVA, Dyn11, ONAN, three phase, oil-immersed, power transformer, with Off-load tap changer, (to provide an earthing point for the neutral and) to supply the substation auxiliary loads	set	2				
F10.X	Necessary material and equipment to complete Auxiliary Transformers	lot	1				
G	**Control, Protection, Substation Automation System and Metering**						
G1.2	Control, Protection and SAS for 132 kV Overhead Line circuit	set	4				
G2.2	Control, Protection and SAS for 132/33 kV Power transformer circuit	set	2				
G2.3	Control, Protection and SAS for 33/0.415 kV Auxiliary power transformer circuit and AC & DC Auxiliary Power Supply	set	2				
G3.2	Control, Protection and SAS for 132 kV Busbars	set	1				
G4.X	Tariff Metering pane(s) to accommodate for each line, transformer and auxiliary transformer feeder minimum two (2) (main-1 & main-2) programmable & recordable digital 3-phase, 4-wire import and export MWh and MVAr meters with accuracy cl. 0.2	set	1				
G6.X	The hardware and software to provide telecontrol & telemetering facilities required both at the existing National Load Despatch Centre (NLDC) at Aftabnagar and Back up station at Biddut Bhaban for integration of complete new 230/132 kV Substation. All required electrical signals shall be transmitted to the NLDC and Back up station through the Industrial Gateway of the Substation automation system. All HV circuit breakers, motorized disconnectors, tap changer, etc., shall be controlled from NLDC through the Gateway of the Substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of the master station of NLDC and Back up station are to be carried out	set	1				
G7.X	Extension of the existing equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	set	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
G10.X	Necessary material and equipment to complete Control, Protection, SAS and Metering system	lot	1				
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
H1.X	Fibre Optic Multiplexer Equipment, complete equipment for control, protection & communication at substation	set	1				
H2.X	Telephone system, complete equipment	set	1				
H3.X	MDF and underground optical fibre (48 cores) cables from terminal box at gantry structure to MDF (Main distribution Frame)	set	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
I1.X	Multicore low voltage auxiliary power and control cables between all items of equipment supplied under the Contract, with necessary gland, terminated, and identified by colours & tags, including the overall substation cable routing and core schedules	lot	1				
I10.X	Necessary material and equipment to complete LV Auxiliary Power and Control Cables	lot	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
J1.X	110 V DC Auxiliary Power Supply, substation alkaline batteries complete with chargers and distribution switchboard, to provide all DC supplies to equipment being supplied for the new substation, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 400 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 75 A rating. (c) One (1) set DC distribution switchboard.	lot	1				
J2.X	48 V DC system, complete with chargers and distribution switchboard to provide all DC supplies for fibre optic multiplexure equipment for communication and control & protection, consisting of: (a) Two (2) sets Ni-cadmium 100% batteries complete, each capacity shall not be less than 250 Ah at the 5-hour rate of discharge. (b) Two (2) sets battery chargers complete, each float charge shall not be less than 50 A rating. (c) One (1) set DC distribution switchboard.	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
J10.X	Necessary material and equipment to complete LV DC Distribution system	lot	1				
K	**LV AC Distribution**						
K1.X	LV AC switchboard for substation services to provide the 400/230V supplies to all equipment being supplied, including one (1) 125 A outdoor weatherproof, 3-phase with neutral and earth switched socket outlet and plug to IEC 60309; to be installed, cabled and connected adjacent to the transformers	lot	1				
K10.X	Necessary material and equipment to complete LV AC Distribution system	lot	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection.	lot	1				
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing	lot	1				
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.	lot	1				
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**						
M1.X	Complete equipment to provide lighting, LV power supply, air conditioning system, ventilation and emergency DC lighting for the substation control building.	lot	1				
N	**Switchyard Lighting**						
N1.X	Complete equipment to provide switchyard lighting for security, roadway and switchyard and emergency DC lighting at strategic locations for equipment operations and inspections.	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
P	**Earthing and Lightning Protection**						
P1.X	Complete equipment of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement, including supporting design calculations.	lot	1				
P2	3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.	set	2				
	Mandatory Spare Parts						
B	**132 kV Switchgear**						
BS.1	Circuit Breaker 132 kV, Tripping coil	set	2				
BS.2	Circuit Breaker 132 kV, Closing coil	set	2				
BS.3	Circuit Breaker 132 kV, Motor, in motor drive mechanism, complete with accessories	set	1				
BS.4	Circuit Breaker 132 kV, Auxiliary contacts, in motor drive mechanism, complete with accessories, one of each type	set	1				
BS.5	Circuit Breaker 132 kV, Contactors, relays, selector switches, push buttons, counters, heaters, etc., in motor drive mechanism and control cubicle, one of each type	set	1				
BS.6	Circuit Breaker 132 kV, SF6 temperature compensated manometer	set	3				
BS.7	Circuit Breaker 132 kV, SF6 gas (40 kg) cylinder	set	1				
BS.8	Disconnector 132 kV with Earthing Switch - complete pole, together with one complete Motor drive mechanism of main blades and one complete Motor drive mechanism of the earthing blades	set	3				
B3.2	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 5-cores, 1600-800-400/1/1/1/1/1 A, 0.2, 0.2, 5P20, 5P20, 5P20; Fs=10, Fs=10; 5 /15 / 30 / 30 / 30 VA, head type, post type current transformer	set	3				
B4	145 kV, 40 kA, 50 Hz, 650/275 kV BIL, single phase, 2-secondary windings, 132/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, capacitor voltage transformer	set	3				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
B5	145 kV, Um = 145 kV, Ur = 120 kV, Uc = 96 kV, 10 kA nominal discharge current, 50 Hz, 650/275 kV BIL, single phase, heavy duty, gapless, metal oxide type surge arrester	set	3				
C	**33 kV Switchgear**						
CS.1	Circuit Breaker 33 kV, Tripping coil	set	1				
CS.2	Circuit Breaker 33 kV, Closing coil	set	1				
CS.3	Circuit Breaker 33 kV, Motor, in motor drive mechanism, complete with accessories	set	1				
CS.4	Fuse 10 A	set	3				
C3.1	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 1600/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	1				
C3.2	36 kV, 25 kA, 50 Hz, 170/70 kV BIL, single phase, 4-cores, 10/1/1/1/1, 0.2, 0.2, 5P20, 5P20; Fs=10, Fs=10; 5 / 15 / 30 / 30 VA, post type current transformer	set	1				
C4	36 kV, 25 kA, 50 Hz, 170/70 BIL, single phase, 2-secondary windings, 33/V3 / 110/V3 / 110/V3 kV/V/V, 0.2, 3P; 25 / 75 VA, inductive voltage transformer	set	1				
C5	36 kV, Um = 36 kV, Ur = 30 kV, Uc = 24 kV, 10 kA nominal discharge current, 50 Hz, 170/70 kV BIL, single phase, gapless, metal oxide type surge arrester	set	1				
D	**Transformers**						
DS.2	Transformer Bushing 132 kV	piece	1				
DS.3	Transformer Bushing 33 kV	piece	1				
DS.4	Transformer oil	kg	5,000				
DS.5	Transformer silica gel	kg	20				
DS.6	Transformer ventilator with motor	set	2				
DS.7	Contactors, relays, selector switches, push buttons, counters, heaters, etc., in transformer control cabinet, one of each type	lot	1				

Name of Bidder: Signature of Bidder:

Schedule 2: Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price2 EXW	Total Price2 EXW	Unit Price EXW	Total Price EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*
DS.8	Contactors, relays, auxiliary contacts, selector switches, push buttons, counters, heaters, etc., in OLTC Motor Drive mechanism, one of each type	lot	1				
DS.9	Thermometer, one of each type	lot	1				
DS.10	Thermostat, one of each type	lot	1				
F	**Earthing/Auxiliary Transformer**						
FS.1	Transformer Bushing 33 kV	piece	1				
G	**Control, Protection, Substation Automation System and Metering**						
GS.2	Line differential protection relay 132 kV	set	1				
GS.4	Line distance protection relay 132 kV	set	1				
GS.6	Transformer 132/33 kV differential relay with complete REF function	set	1				
GS.8	Overcurrent and earth fault relay 132 kV	set	1				
GS.10	Bay control unit	set	1				
GS.11	Trip Circuit Supervision relay, 3phase	set	1				
GS.13	Electronic meter, same as installed, including communication unit	set	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
JS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
K	**LV AC Distribution**						
KS.1	Contactors, relays, MCBs, selector switches, push buttons, counters, heaters, etc., one of each type	lot	1				
Subtotal Miithapukur Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 3: Design Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
I	**Extension of NEW 230/132 kV Substation Rajshahi**						
21	Design and engineering services, local and foreign part	Lump sum	1				
Subtotal Rajshahi Substation to Schedule 5 - Grand Summary							
III	**New 132/33 kV Substation Bangura**						
21	Design and engineering services, local and foreign part	Lump sum	1				
Subtotal Bangura Substation to Schedule 5 - Grand Summary							
V	**New 132/33 kV Substation Miithapukur**						
21	Design and engineering services, local and foreign part	Lump sum	1				
Subtotal Miithapukur Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
I	**Extension of NEW 230/132 kV Substation Rajshahi**						
0	**General**						
	Complete new 230/132/33 kV air insulated substation. The 132 kV part of the substation **is not in the scope of works**.						
A	**230 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
C	**33 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
D	**Transformers**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
G	**Control, Protection, Substation Automation System and Metering**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
33.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2]	Total Price[2]	Unit Price	Total Price
				foreign portion	foreign portion	local portion	local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
K	**LV AC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete required 230 kV switchyard area by cutting, land filling, compacting up to a suitable level. Approximate total area of the substation is 15 acres. Approximate required 230 kV switchyard part is 10 acres.	Lot	1				
L2.X	Complete outdoor civil works of required 230 kV switchyard area, including 230 kV gantry foundation, 230 kV and 33 kV equipment foundation, power transformers foundation, oil pit, blast wall, part of the security boundary wall, around the required 230 kV switchyard, internal roads, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing						
1	Outdoor gantry foundation 230 kV switchyard	Lot	1				
2	Outdoor equipment foundation 230 kV switchyard	Lot	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
3	Outdoor equipment foundation 33 kV switchyard	Lot	1				
4	Power Transformer foundation including oil pit	Lot	1				
5	Blast wall	Lot	1				
6	part of the security boundary wall, around the required 230 kV switchyard						
7	Internal roads, concrete culverts	Lot	1				
8	Surface and switchyard drainage system including outfall.	Lot	1				
9	Cable Trench including soak pit, PVC pipes etc.	Lot	1				
10	Switchyard surface finishing.	Lot	1				
11	Gravel surfacing.	Lot	1				
L3.X	Complete civil works and facilities for extension of existing control building, including finishing works like rendering, colour, floor finishing, etc.	Lot	1				
N	**Switchyard Lighting**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
P	**Earthing and Lightning Protection**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
	Installation and Other Services						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment - General, not mentioned before	Lump sum	1				
41.X	Transport of material and equipment	Lump sum	1				
42.X	Insurance of material and equipment during transport	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
43.X	Environmetal and Social Services - PROVISIONAL SUM (for potential physical measures and the unforeseen which may not be covered by the current description of the scope of supply – however strictly related to environmental and social services only) It is not fixed sum and it may be implemented fully, partly or even not implemented in the end	Lump sum	1	**7,000.00**	**7,000.00**		
Subtotal Rajshahi Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
III	**New 132/33 kV Substation Bangura**						
0	**General**						
	Complete new 132/33 kV Air Insulated Substation						
B	**132 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
C	**33 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
D	**Transformers**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
F	**Earthing/Auxiliary Transformer**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
G	**Control, Protection, Substation Automation System and Metering**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
33.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
K	**LV AC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection. Approximate total area of the substation is 5 acres.	Lot	1				
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing						
1	Outdoor gantry foundation 132 kV switchyard	Lot	1				
2	Outdoor gantry foundation 33 kV switchyard	Lot	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
3	Outdoor equipment foundation 132 kV switchyard	Lot	1				
4	Outdoor equipment foundation 33 kV switchyard	Lot	1				
5	Power Transformer foundation including oil pit	Lot	1				
6	Auxiliary/Station Transformer foundation.	Lot	1				
7	Blast wall	Lot	1				
8	Substation Main gate	Lot	1				
9	Guard house.	Lot	1				
10	Security Boundary Wall	Lot	1				
11	Internal fence	Lot	1				
12	Access road	Lot	1				
13	Internal roads and parking, concrete culverts	Lot	1				
14	Surface and switchyard drainage system including outfall.	Lot	1				
15	Cable Trench including soak pit, PVC pipes etc.	Lot	1				
16	Switchyard surface finishing.	Lot	1				
17	Gravel surfacing.	Lot	1				
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.						
1	Complete Foundation works.	Lot	1				
2	Complete Super structures works.	Lot	1				
3	Complete all finishing works like rendering, colour, water supply & sanitary works, floor finish, furniture, drain & apron, rain water pipes etc.	Lot	1				
4	Water supply, including Pump house with deep tube well for drinking water, motor, pump, water reservoir, water pipe line, necessary fittings etc. all complete.	Lot	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
5	Sewage facilities, including Septic tank, soak well etc. all complete	Lot	1				
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
N	**Switchyard Lighting**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
P	**Earthing and Lightning Protection**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
	Installation and Other Services						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment - General, not mentioned before	Lump sum	1				
41.X	Transport of material and equipment	Lump sum	1				
42.X	Insurance of material and equipment during transport	Lump sum	1				
43.X	Environmetal and Social Services - PROVISIONAL SUM (for potential physical measures and the unforeseen which may not be covered by the current description of the scope of supply – however strictly related to environmental and social services only) It is not fixed sum and it may be implemented fully, partly or even not implemented in the end	Lump sum	1	**7,000.00**	**7,000.00**		
Subtotal Bangura Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
IV	**Extension of the existing 132/33 kV Substation Baghabari**						
0	**General**						
	Re-design, re-testing and re-commissioning of one existing 132 kV overhead line bay						
B	**132 kV Switchgear**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
G	**Control, Protection, Substation Automation System and Metering**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
33.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	Lump sum	1				
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
J	**LV DC, Batteries, Chargers and DC Distribution**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
K	**LV AC Distribution**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
L	**Civil Works, Control Building and Foundations**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
P	**Earthing and Lightning Protection**						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment	Lump sum	1				
	Installation and Other Services						
32.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment - General, not mentioned before	Lump sum	1				
41.X	Transport of material and equipment	Lump sum	1				
42.X	Insurance of material and equipment during transport	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
43.X	Environmetal and Social Services - PROVISIONAL SUM (for potential physical measures and the unforeseen which may not be covered by the current description of the scope of supply – however strictly related to environmental and social services only) It is not fixed sum and it may be implemented fully, partly or even not implemented in the end	Lump sum	1	**4,000.00**	**4,000.00**		
Subtotal Baghabari Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	(2)	(3) = (1) x (2)	(4)	(5)=(1) x (4)
V	**New 132/33 kV Substation Miithapukur**						
0	**General**						
	Complete new 132/33 kV Air Insulated Substation						
B	**132 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
C	**33 kV Switchgear**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
D	**Transformers**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
F	**Earthing/Auxiliary Transformer**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
G	**Control, Protection, Substation Automation System and Metering**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
33.X	Extension of the existing equipment, Installation, testing and commissioning of new equipment, necessary adjustment, adaptation, modification, integration and configuration of new and existing equipment in NLDC	Lump sum	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
H	**Fibre Optic Multiplexer Equipment for Teleprotection & Communication**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
I	**Multicore Low Voltage Auxiliary Power and Control Cables**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
J	**LV DC, Batteries, Chargers and DC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
K	**LV AC Distribution**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
L	**Civil Works, Control Building and Foundations**						
L1.X	Land development of complete switchyard area by cutting, land filling, compacting up to a suitable level including slope protection. Approximate total area of the substation is 5 acres.	Lot	1				
L2.X	Complete outdoor civil works, including 132 kV and 33 kV gantry foundation, 132 kV and 33 kV equipment foundation, power transformers and auxiliary transformers foundation, oil pit, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, concrete culvert, surface and switchyard drainage system including outfall, cable trench including soak pit, PVC pipes etc., switchyard surface finishing and gravel surfacing						
1	Outdoor gantry foundation 132 kV switchyard	Lot	1				
2	Outdoor gantry foundation 33 kV switchyard	Lot	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
3	Outdoor equipment foundation 132 kV switchyard	Lot	1				
4	Outdoor equipment foundation 33 kV switchyard	Lot	1				
5	Power Transformer foundation including oil pit	Lot	1				
6	Auxiliary/Station Transformer foundation.	Lot	1				
7	Blast wall	Lot	1				
8	Substation Main gate	Lot	1				
9	Guard house.	Lot	1				
10	Security Boundary Wall	Lot	1				
11	Internal fence	Lot	1				
12	Access road	Lot	1				
13	Internal roads and parking, concrete culverts	Lot	1				
14	Surface and switchyard drainage system including outfall.	Lot	1				
15	Cable Trench including soak pit, PVC pipes etc.	Lot	1				
16	Switchyard surface finishing.	Lot	1				
17	Gravel surfacing.	Lot	1				
L3.X	Complete civil works and facilities for new two-storey control room building with cable basement, including foundation works, super structure works, finishing works like rendering, colour, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.						
1	Complete Foundation works.	Lot	1				
2	Complete Super structures works.	Lot	1				
3	Complete all finishing works like rendering, colour, water supply & sanitary works, floor finish, furniture, drain & apron, rain water pipes etc.	Lot	1				
4	Water supply, including Pump house with deep tube well for drinking water, motor, pump, water reservoir, water pipe line, necessary fittings etc. all complete.	Lot	1				

Name of Bidder: Signature of Bidder:

Schedule 4: Installation and Other Services

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)	
				Unit Price[2] foreign portion	Total Price[2] foreign portion	Unit Price local portion	Total Price local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
5	Sewage facilities, including Septic tank, soak well etc. all complete	Lot	1				
M	**Building Lighting, Small Power, Air Conditioning and Ventilation**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
N	**Switchyard Lighting**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
P	**Earthing and Lightning Protection**						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment	Lump sum	1				
	Installation and Other Services						
31.X	Installation, testing and commissioning of the equipment, necessary adjustment, adaptation, modification, integration and configuration of the equipment - General, not mentioned before	Lump sum	1				
41.X	Transport of material and equipment	Lump sum	1				
42.X	Insurance of material and equipment during transport	Lump sum	1				
43.X	Environmetal and Social Services - PROVISIONAL SUM (for potential physical measures and the unforeseen which may not be covered by the current description of the scope of supply – however strictly related to environmental and social services only) It is not fixed sum and it may be implemented fully, partly or even not implemented in the end	Lump sum	1	**7,000.00**	**7,000.00**		
Subtotal Miithapukur Substation to Schedule 5 - Grand Summary							

Name of Bidder: Signature of Bidder:

Schedule 5: Grand Summary (Schedules 1 to 4)

		Total Price	
		Foreign Currency (in……)	Local Currency (in BDT)
I	**Extension of NEW 230/132 kV Substation Rajshahi**		
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
II	**New 132/33 kV Substation Bangura**		
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
III	**Extension of existing 132/33 kV Substation Baghabari**		
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 4:	Installation and Other Services		

Name of Bidder: Signature of Bidder:

Schedule 5: Grand Summary (Schedules 1 to 4)

		Total Price	
		Foreign Currency (in……..)	Local Currency (in BDT)
IV	New 132/33 kV Substation Miithapukur		
Schedule No. 1:	Plant & Equipment (including Mandatory Spare Parts) Supplied from Abroad		
Schedule No. 2:	Plant & Equipment (including Mandatory Spare Parts) Supplied from within the Employer's Country		
Schedule No. 3:	Design Services		
Schedule No. 4:	Installation and Other Services		
GRAND TOTAL			

Name of Bidder: Signature of Bidder:

Schedule 6: Spare Parts

Item	Description	Unit	Quantity	Foreign Currency (in….)		Local Currency (in BDT)		
				Unit Price[2] CIP	Total Price[2] CIP	Unit Price EXW	Total Price EXW	VAT on EXW
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*	*(6)*
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

2 Specify currency. Create and use as many columns for Unit Price and Total Price as there are currencies.

Name of Bidder: Signature of Bidder:

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

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

(Bidders may use the attached excel file BGD 1800 NZSS vol 3 schedule c time schedule.xlsx)

3.1 New 230/132 kV Substation Rajshahi

Extension of the Existing 230/132 kV Substation Rajshahi	Time Period in days																								
Activity	Duration	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720
DESIGN																									
Site survey																									
Geotechnical survey																									
I GENERAL																									
EG0-General documentation																									
EG1-Main design of fire protection																									
II ELECTRICAL DESIGN																									
E1-Technical description and calculation of 230 kV switchyard																									
E1-Technical description and calculation of 132 kV switchyard																									
E2-Technical description and calculation of 33 kV switchyard																									
E3-Electro installation part of 230 kV switchyard																									
E3-Electro installation part of 132 kV switchyard																									
E4-Electro installation part of 33 kV switchyard																									
E5-Electro installation part of 230/132/33 kV transformation																									
E5-Electro installation part of 132/33 kV transformation																									
E6-Earthing and lightning protection - EXTENSION																									
E7-Installation of outdoor lighting - EXTENSION																									
E8-Auxiliary power supply - EXTENSION																									
E9-Protection and control system																									
E10-Telecomunications																									
E11-Fire alarm system																									
E12-Earthing installation, lighting protection, Installation of control building																									
III CIVIL DESIGN																									
G1-Sinhro plan - EXTENSION																									
G2-Site levelling, cable duct, path and internal fence - EXTENSION																									
G3-Foundations for 230 kV switchyard																									
G3-Foundations for 132 kV switchyard																									
G4-Foundations for 33 kV switchyard																									
G5-Transformation tub and foundation																									
G6-Oil pit and oil sewerage																									
G7-Steel structure for 230 kV equipment																									
G7-Steel structure for 132 kV equipment																									
G8-Steel structure for 33 kV equipment																									
G9-Control building																									
G10-Lightning and reflector poles - EXTENSION																									
G11-Water supply and sewerage																									
IV MECHANICAL DESIGN																									
M1-Air conditioning and ventilation of control building																									
MANUFACTURING of the EQUIPMENT																									
Design of the equipment																									
Manufacturing																									
Training																									
Factory Acceptance Test																									
Delivery																									
CIVIL WORKS																									
Mobilization and preparation works																									
Site levelling - EXTENSION																									
Gate and fence																									
Access and internal roads - EXTENSION																									
Earthing system - EXTENSION																									
Cable trenches - EXTENSION																									
Transformer foundations and oil pit																									
Control building - EXTENSION																									
Gantry and equipment foundations																									
Steel structure																									
Finishing works and demobilization																									
ELECTRICAL WORKS																									
Mobilization and preparation works																									
Installation, outdoor																									
Installation of metal support structure																									
Installation of switchgear 230 kV																									
Installation of switchgear 132 kV																									
Installation of switchgear 33 kV																									
Installation of power transformers																									
Installation of auxiliary power transformers																									
Primary connections																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of the equipment																									
Outdoor lighting - EXTENSION																									
Testing of the equipment																									
Commissioning																									
Installation, indoor																									
Installation of control, Relay protection, SCADA and Metering equipment																									
Installation of AC and DC Auxiliary Power Supply equipment - EXTENSION																									
Installation of ACU Batteries																									
Installation of Telecommunication equipment																									
Installation of cable channels - EXTENSION																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of equipment																									
Parametrization																									
Testing of the equipment																									
Commissioning																									
Finishing works and demobilization																									

Name of Bidder:

Signature of Bidder:

3.2 New 132 kV Substation Bangura

New 132/33 kV Substation Bangura	Time Period in days																								
Activity	Duration	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720
DESIGN																									
Site survey																									
Geotechnical survey																									
I GENERAL																									
EG0-General documentation																									
EG1-Main design of fire protection																									
II ELECTRICAL DESIGN																									
E1-Technical description and calculation of 230 kV switchyard																									
E1-Technical description and calculation of 132 kV switchyard																									
E2-Technical description and calculation of 33 kV switchyard																									
E3-Electro installation part of 230 kV switchyard																									
E3-Electro installation part of 132 kV switchyard																									
E4-Electro installation part of 33 kV switchyard																									
E5-Electro installation part of 230/132/33 kV transformation																									
E5-Electro installation part of 132/33 kV transformation																									
E6-Earthing and lightning protection																									
E7-Installation of outdoor lighting																									
E8-Auxiliary power supply																									
E9-Protection and control system																									
E10-Telecomunications																									
E11-Fire alarm system																									
E12-Earthing installation, lighting protection, Installation of control building																									
III CIVIL DESIGN																									
G1-Sinhro plan																									
G2-Site levelling, cable duct, path and internal fence in substations																									
G3-Foundations for 230 kV switchyard																									
G3-Foundations for 132 kV switchyard																									
G4-Foundations for 33 kV switchyard																									
G5-Transformation tub and foundation																									
G6-Oil pit and oil sewerage																									
G7-Steel structure for 230 kV equipment																									
G7-Steel structure for 132 kV equipment																									
G8-Steel structure for 33 kV equipment																									
G9-Control building																									
G10-Lightning and reflector poles																									
G11-Water supply and sewerage																									
IV MECHANICAL DESIGN																									
M1-Air conditioning and ventilation of control building																									
MANUFACTURING of the EQUIPMENT																									
Design of the equipment																									
Manufacturing																									
Training																									
Factory Acceptance Test																									
Delivery																									
CIVIL WORKS																									
Mobilization and preparation works																									
Site levelling																									
Gate and fence																									
Access and internal roads																									
Earthing system																									
Cable trenches																									
Transformer foundations and oil pit																									
Control building																									
Gantry and equipment foundations																									
Steel structure																									
Finishing works and demobilization																									
ELECTRICAL WORKS																									
Mobilization and preparation works																									
Installation, outdoor																									
Installation of metal support structure																									
Installation of switchgear 230 kV																									
Installation of switchgear 132 kV																									
Installation of switchgear 33 kV																									
Installation of power transformers																									
Installation of auxiliary power transformers																									
Primary connections																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of the equipment																									
Outdoor lighting																									
Testing of the equipment																									
Commissioning																									
Installation, indoor																									
Installation of control, Relay protection, SCADA and Metering equipment																									
Installation of AC and DC Auxiliary Power Supply equipment																									
Installation of ACU Batteries																									
Installation of Telecommunication equipment																									
Installation of cable channels																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of equipment																									
Parametrization																									
Testing of the equipment																									
Commissioning																									
Finishing works and demobilization																									

Name of Bidder:

Signature of Bidder:

3.3 Extension of the Existing 132/33 kV Substation Baghabari

Extension of the existing 132/33 kV Substation Baghabari Activity	Time Period in days Duration	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720
DESIGN																									
Site survey																									
Geotechnical survey																									
I GENERAL																									
EG0-General documentation - RE - DESIGN																									
EG1-Main design of fire protection																									
II ELECTRICAL DESIGN																									
E1-Technical description and calculation of 230 kV switchyard																									
E1-Technical descript. and calc. of 132 kV switchyard - RE - DESIGN																									
E2-Technical description and calculation of 33 kV switchyard																									
E3-Electro installation part of 230 kV switchyard																									
E3-Electro installation part of 132 kV switchyard - RE - DESIGN																									
E4-Electro installation part of 33 kV switchyard																									
E5-Electro installation part of 230/132/33 kV transformation																									
E5-Electro installation part of 132/33 kV transformation																									
E6-Earthing and lightning protection - RE - DESIGN																									
E7-Installation of outdoor lighting																									
E8-Auxiliary power supply - RE - DESIGN																									
E9-Protection and control system - RE - DESIGN																									
E10-Telecomunications - RE - DESIGN																									
E11-Fire alarm system																									
E12-Earthing installation, lighting protection, Installation of control building																									
III CIVIL DESIGN																									
G1-Sinhro plan - RE - DESIGN																									
G2-Site levelling, cable duct, path and internal fence in substations																									
G3-Foundations for 230 kV switchyard																									
G3-Foundations for 132 kV switchyard																									
G4-Foundations for 33 kV switchyard																									
G5-Transformation tub and foundation																									
G6-Oil pit and oil sewerage																									
G7-Steel structure for 230 kV equipment																									
G7-Steel structure for 132 kV equipment																									
G8-Steel structure for 33 kV equipment																									
G9-Control building																									
G10-Lightning and reflector poles																									
G11-Water supply and sewerage																									
IV MECHANICAL DESIGN																									
M1-Air conditioning and ventilation of control building																									
MANUFACTURING of the EQUIPMENT																									
Design of the equipment																									
Manufacturing																									
Training																									
Factory Acceptance Test																									
Delivery																									
CIVIL WORKS																									
Mobilization and preparation works																									
Site levelling																									
Gate and fence																									
Access and internal roads																									
Earthing system																									
Cable trenches																									
Transformer foundations and oil pit																									
Control building																									
Gantry and equipment foundations																									
Steel structure																									
Finishing works and demobilization																									
ELECTRICAL WORKS																									
Mobilization and preparation works																									
Installation, outdoor																									
Installation of metal support structure																									
Installation of switchgear 230 kV																									
Installation of switchgear 132 kV																									
Installation of switchgear 33 kV																									
Installation of power transformers																									
Installation of auxiliary power transformers																									
Primary connections - RE - TESTING, RE - COMMISSIONING																									
Installation of cables - RE - TESTING, RE - COMMISSIONING																									
Secondary connections - RE - TESTING, RE - COMMISSIONING																									
Earthing/Grounding of the equipment - RE - TEST., RE - COMMISS.																									
Outdoor lighting																									
Testing of the equipment																									
Commissioning																									
Installation, indoor																									
Installation of control, Relay protection, SCADA and Metering equipment																									
Installation of AC and DC Auxiliary Power Supply equipment																									
Installation of ACU Batteries																									
Installation of Telecommunication equipment																									
Installation of cable channels																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of equipment																									
Parametrization																									
Testing of the equipment																									
Commissioning																									
Finishing works and demobilization																									

Name of Bidder:

Signature of Bidder:

3.4 New 132/33 kV Substation Miithapukur

New 132/33 kV Substation Miithapukur	Time Period in days																							
Activity	Duration	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720
DESIGN																									
Site survey																									
Geotechnical survey																									
I GENERAL																									
EG0-General documentation																									
EG1-Main design of fire protection																									
II ELECTRICAL DESIGN																									
E1-Technical description and calculation of 230 kV switchyard																									
E1-Technical description and calculation of 132 kV switchyard																									
E2-Technical description and calculation of 33 kV switchyard																									
E3-Electro installation part of 230 kV switchyard																									
E3-Electro installation part of 132 kV switchyard																									
E4-Electro installation part of 33 kV switchyard																									
E5-Electro installation part of 230/132/33 kV transformation																									
E5-Electro installation part of 132/33 kV transformation																									
E6-Earthing and lightning protection																									
E7-Installation of outdoor lighting																									
E8-Auxiliary power supply																									
E9-Protection and control system																									
E10-Telecomunications																									
E11-Fire alarm system																									
E12-Earthing installation, lighting protection, Installation of control building																									
III CIVIL DESIGN																									
G1-Sinhro plan																									
G2-Site levelling, cable duct, path and internal fence in substations																									
G3-Foundations for 230 kV switchyard																									
G3-Foundations for 132 kV switchyard																									
G4-Foundations for 33 kV switchyard																									
G5-Transformation tub and foundation																									
G6-Oil pit and oil sewerage																									
G7-Steel structure for 230 kV equipment																									
G7-Steel structure for 132 kV equipment																									
G8-Steel structure for 33 kV equipment																									
G9-Control building																									
G10-Lightning and reflector poles																									
G11-Water supply and sewerage																									
IV MECHANICAL DESIGN																									
M1-Air conditioning and ventilation of control building																									
MANUFACTURING of the EQUIPMENT																									
Design of the equipment																									
Manufacturing																									
Training																									
Factory Acceptance Test																									
Delivery																									
CIVIL WORKS																									
Mobilization and preparation works																									
Site levelling																									
Gate and fence																									
Access and internal roads																									
Earthing system																									
Cable trenches																									
Transformer foundations and oil pit																									
Control building																									
Gantry and equipment foundations																									
Steel structure																									
Finishing works and demobilization																									
ELECTRICAL WORKS																									
Mobilization and preparation works																									
Installation, outdoor																									
Installation of metal support structure																									
Installation of switchgear 230 kV																									
Installation of switchgear 132 kV																									
Installation of switchgear 33 kV																									
Installation of power transformers																									
Installation of auxiliary power transformers																									
Primary connections																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of the equipment																									
Outdoor lighting																									
Testing of the equipment																									
Commissioning																									
Installation, indoor																									
Installation of control, Relay protection, SCADA and Metering equipment																									
Installation of AC and DC Auxiliary Power Supply equipment																									
Installation of ACU Batteries																									
Installation of Telecommunication equipment																									
Installation of cable channels																									
Installation of cables																									
Secondary connections																									
Earthing/Grounding of equipment																									
Parametrization																									
Testing of the equipment																									
Commissioning																									
Finishing works and demobilization																									

Name of Bidder:

Signature of Bidder:

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

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

Manufacturers

The following Manufacturers are proposed for carrying out the facilities:

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
Power Transformer					
1.1.	Power transformer 230/132/33 kV				
1.2.	Power transformer 132/33 kV				
Auxiliary Power Transformer					
2	Auxiliary power transformer 33/0.4 kV				
230 kV Equipment					
3.1.	Circuit breakers 230 kV				
3.2.	Disconnectors 230 kV				
3.3.	Current transformers 230 kV				
3.4.	Voltage transformers 230 kV				
3.5.	Surge arresters 230 kV				
132 kV Equipment					
4.1.	Circuit breakers 132 kV				
4.2.	Disconnectors 132 kV				
4.3.	Current transformers 132 kV				
4.4.	Voltage transformers 132 kV				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
4.5.	Surge arresters 132 kV				
33 kV Equipment					
5.1.	Circuit breakers 33 kV				
5.2.	Disconnectors 33 kV				
5.3.	Current transformers 33 kV				
5.4.	Voltage transformers 33 kV				
5.5.	Surge arresters 33 kV				
Control, Protection, and Metering Equipment					
6.1	Control & monitoring equipment				
6.2	Relay protection equipment				
6.3.	Control & protection panels				
6.4.	Metering equipment				
6.5.	Metering panels				
6.6.	DFDR				
Telecommunication Equipment					
7.	Communication equipment				
Auxiliary Power Supply Equipment					
8.1.	ACU battery				
8.2.	Charger				
8.3	DC distribution switchboard				
8.4	AC distribution switchboard				

Item	Equipment	Type of Equipment	Manufacturer's Name and Address	Place of Manufacture and Testing	Nationality
Conductors, Insulators & Fittings					
9.1.	Conductors				
9.2.	Insulators				
9.3.	Fittings				
Multicore LV Auxiliary Power and Control Cables					
10.1	Cables				
	Name of Bidder:				
	Signature of Bidder:				

5. Schedule E: Technical Particulars and Guarantees

5.1 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.

5.2 Technical Data Schedules

Please find hereafter the following schedules:

5.2.1 A: Switchgear 230 kV

5.2.1.1 A1.1: Circuit Breaker 230 kV, Three OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**3**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	≥ 3150	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 50	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 125	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**1p+3p**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1750	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 1250	
2.30.3	Static vertical force F_{tv}	N	≥ 1500	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.1.2 A1.2: Circuit Breaker 230 kV, One OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**1**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	230	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	245	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	≥ 3150	
2.7	Rated short-circuit breaking current I_{sc}	kA $_{rms}$	≥ 50	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 125	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**No**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1750	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 1250	
2.30.3	Static vertical force F_{tv}	N	≥ 1500	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.1.3 A2.1: Disconnector 230 kV, 3150 A, with Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Motor driven**	
1.13	Number of earthing blade operating mechanism		**1**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 3150**	
2.8	Rated short withstand current I_k	kA_{rms}	≥ 50	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**3**	
2.11	Rated maximum withstand current Ip	kA	≥ 125	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 1000	
2.17.2	Transversal loading, static F_b	N	> 330	
2.17.3	Vertical force F_c	N	> 1250	
2.17.4	Direct loading, dynamic	N	> 4500	
2.17.5	Transversal loading, dynamic	N	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	**1+1**	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.1.4 A2.2: Disconnector 230 kV, 2000 A, with Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Motor driven**	
1.13	Number of earthing blade operating mechanism		**1**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	230	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	245	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 2000**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 50	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**3**	
2.11	Rated maximum withstand current Ip	kA	≥ 125	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 1000	
2.17.2	Transversal loading, static F_b	N	> 330	
2.17.3	Vertical force F_c	N	> 1250	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.4	Direct loading, dynamic	N	> 4500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	**1+1**	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.1.5 A2.3: Disconnector 230 kV without Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**not applicable**	
1.13	Number of earthing blade operating mechanism		**not applicable**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 2000**	
2.8	Rated short withstand current I_k	kA_{rms}	≥ 50	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**Not applicable**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static F_a	N	> 1000	
2.17.2	Transversal loading, static F_b	N	> 330	
2.17.3	Vertical force Fc	N	> 1250	
2.17.4	Direct loading, dynamic	N	> 4500	
2.17.5	Transversal loading, dynamic	N	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	Kg	Insert	
3.1.7.9	Total weight	Kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.1.6 A3.1: Current Transformers 230 kV, 3200-1600/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape / design		Head type	
1.9	Sealing		Hermetically closed	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	230	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	245	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	50	
2.7	Rated dynamic current I_{dyn}	kV peak	125	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core • IV core • V core	 % In % In % In % In % In	 200 200 120 120 120	
2.9	Rated transformer ratio: • I core • II core • III core • IV core • V core	 A/A A/A A/A A/A A/A	 **3200-1600/1** **3200-1600/1** **3200-1600/1** **3200-1600/1** **3200-1600/1**	
2.10	Accuracy class: • I core • II core • III core • IV core • V core		 0.2 0.2 5P20 5P20 5P20	
2.11	Security factor: • I core • II core		 Fs=10 Fs=10	
2.12	Rated power: • I core • II core • III core • IV core • V core	 VA VA VA VA VA	 10 15 30 30 30	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13	Rated mechanical terminal loads	Class	Min. Class II	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	tgδ test terminal		Yes	
3.11	Oil drain cock and sampling device		Yes	
3.13	Secondary reconnection		Yes	
3.14	Outdoor metal part made of aluminium or stain-less steel		Yes	
3.15	Mass and dimensions			
3.15.1	Total mass	kg	Insert	
3.15.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.1.7 A3.2: Current Transformers 230 kV, 1600-800/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape / design		Head type	
1.9	Sealing		Hermetically closed	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	230	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	245	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	50	
2.7	Rated dynamic current I_{dyn}	kV peak	125	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core • IV core • V core	 % In % In % In % In % In	 200 200 120 120 120	
2.9	Rated transformer ratio: • I core • II core • III core • IV core • V core	 A/A A/A A/A A/A A/A	 **1600-800/1** **1600-800/1** **1600-800/1** **1600-800/1** **1600-800/1**	
2.10	Accuracy class: • I core • II core • III core • IV core • V core		 0.2 0.2 5P20 5P20 5P20	
2.11	Security factor: • I core • II core		 Fs=10 Fs=10	
2.12	Rated power: • I core • II core • III core • IV core • V core	 VA VA VA VA VA	 10 15 30 30 30	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13	Rated mechanical terminal loads	Class	Min. Class II	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	tgδ test terminal		Yes	
3.11	Oil drain cock and sampling device		Yes	
3.13	Secondary reconnection		Yes	
3.14	Outdoor metal part made of aluminium or stain-less steel		Yes	
3.15	Mass and dimensions			
3.15.1	Total mass	kg	Insert	
3.15.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.1.8 A4: Voltage Transformers 230 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Voltage Transformers - General**			
1.1	Manufacturer		Insert	
1.2	Type		Capacitive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-2 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape		Insert	
1.9	Sealing		Hermetically closed	
2.	**Voltage Transformers - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	230	
2.2	Highest voltage for equipment U_n	kV_{rms}	245	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	1050	
2.4	Rated short duration power frequency voltage	kV	460	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	50	
2.7	Rated dynamic current I_{dyn}	kV_{peak}	125	
2.8	Rated primary voltage	kV	230/√3	
2.9	Rated secondary voltage • I winding • II winding	 V V	 110√3 110√3	
2.10	Accuracy class: • I winding • II winding		 0.2 1/3P	
2.11	Rated power: • I winding • II winding	 VA VA	 25 75	
2.12	Load		Simultaneously	
2.13	Voltage factor	p.u./s	1.5/30	
2.14	Rated mechanical strength	Class	Min. Class II	
2.15	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
3.	**Voltage Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper - Mixed dielectric	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. to IEC 60694)	µV	Max. 2500	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Vertical or horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Oil drain cock and sampling device		Yes	
3.11	Enable sealing after accuracy class checks (sealing possibilities)		Yes	
3.13	Outdoor metal part made of aluminium or stainless steel		Yes	
3.14	Mass and dimensions			
3.14.1	Total mass	kg	Insert	
3.14.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.1.9 A5: Surge Arresters 230 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Surge Arresters - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
2.	**Surge Arresters - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	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 In (8/20 µs)	kA $_{peak}$	10	
2.10	High current impulse of an arrester (4/10 µs)	kA $_{peak}$	100	
3.	**Surge Arresters - Design and Construction**			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 µs)	A	≥ 850	
3.4	Maximum residual voltage 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	≥ 2250	
3.6.2	Specified long-term load SSL (F_{stat})	N	≥ 1550	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		Composite/Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	

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

5.2.2 B: Switchgear 132 kV

5.2.2.1 B1.1: Circuit Breaker 132 kV, three OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**3**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	**≥ 1250**	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 40	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 100	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**1p+3p**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1250	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 750	
2.30.3	Static vertical force F_{tv}	N	≥ 1000	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.2 B1.2: Circuit Breaker 132 kV, 3150 A, one OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**1**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	**≥ 3150**	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 40	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 100	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**No**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1750	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 1250	
2.30.3	Static vertical force F_{tv}	N	≥ 1500	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.3 B1.3: Circuit Breaker 132 kV, 2000 A, one OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**1**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	**≥ 2000**	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 40	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 100	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**No**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1750	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 1250	
2.30.3	Static vertical force F_{tv}	N	≥ 1500	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.4 B1.4: Circuit Breaker 132 kV, 1250 A, one OM

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF_6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	**1**	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	**≥ 1250**	
2.7	Rated short-circuit breaking current I_{sc}	kA_{rms}	≥ 40	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 100	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 1.0 2.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		**No**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening inter-rupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	≥ 1750	
2.30.2	Static horizontal force, transversal F_{thB}	N	≥ 1250	
2.30.3	Static vertical force F_{tv}	N	≥ 1500	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	
3.1.5.3	Pole weight	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.5 B2.1: Disconnector 132 kV, 3150 A, with Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Motor driven**	
1.13	Number of earthing blade operating mechanism		**1**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 3150**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**3**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 500	
2.17.2	Transversal loading, static F_b	N	> 170	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.3	Vertical force F_c	N	> 1000	
2.17.4	Direct loading, dynamic	N	> 1500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	**1+1**	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.6 B2.2: Disconnector 132 kV, 2000 A, with Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Motor driven**	
1.13	Number of earthing blade operating mechanism		**1**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 2000**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**3**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 500	
2.17.2	Transversal loading, static F_b	N	> 170	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.3	Vertical force F_c	N	> 1000	
2.17.4	Direct loading, dynamic	N	> 1500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	**1+1**	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.7 B2.3: Disconnector 132 kV, 1250 A, with Earthing Switch

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Motor driven**	
1.13	Number of earthing blade operating mechanism		**1**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 1250**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**3**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 500	
2.17.2	Transversal loading, static F_b	N	> 170	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.3	Vertical force F_c	N	> 1000	
2.17.4	Direct loading, dynamic	N	> 1500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	**1+1**	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.8 B2.4: Disconnector 132 kV, 2000 A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Not applicable**	
1.13	Number of earthing blade operating mechanism		**Not applicable**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 2000**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**Not applicable**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 500	
2.17.2	Transversal loading, static F_b	N	> 170	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.3	Vertical force F_c	N	> 1000	
2.17.4	Direct loading, dynamic	N	> 1500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.9 B2.5: Disconnector 132 kV, 1250 A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		**Not applicable**	
1.13	Number of earthing blade operating mechanism		**Not applicable**	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 1250**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	**Not applicable**	
2.11	Rated maximum withstand current Ip	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	> 500	
2.17.2	Transversal loading, static F_b	N	> 170	
2.17.3	Vertical force F_c	N	> 1000	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17.4	Direct loading, dynamic	N	> 1500	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	Quality of insulator		Min. C130	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.1.7	Weight and dimensions			
3.1.7.1	Pole height	mm	Insert	
3.1.7.2	Support insulator height	mm	Insert	
3.1.7.3	Total height	mm	Insert	
3.1.7.4	Pole length	mm	Insert	
3.1.7.5	Distance between support axis of a pole	mm	Insert	
3.1.7.6	Shipping dimensions	mm	Insert	
3.1.7.7	Pole weight	kg	Insert	
3.1.7.8	Weight of operating mechanism	kg	Insert	
3.1.7.9	Total weight	kg	Insert	
3.1.7.10	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.2.10 B3.1: Current Transformer 132 kV, 3200-1600/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape / design		Head type	
1.9	Sealing		Hermetically closed	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	40	
2.7	Rated dynamic current I_{dyn}	kV peak	100	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core • IV core • V core	 % In % In % In % In % In	 200 200 120 120 120	
2.9	Rated transformer ratio: • I core • II core • III core • IV core • V core	 A/A A/A A/A A/A A/A	 **3200-1600/1** **3200-1600/1** **3200-1600/1** **3200-1600/1** **3200-1600/1**	
2.10	Accuracy class: • I core • II core • III core • IV core • V core		 0.2 0.2 5P20 5P20 5P20	
2.11	Security factor: • I core • II core		 Fs=10 Fs=10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.12	Rated power: • I core • II core • III core • IV core • V core	 VA VA VA VA VA	 10 15 30 30 30	
2.13	Rated mechanical terminal loads	Class	Min. Class II	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. to IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	tgδ test terminal		Yes	
3.11	Oil drain cock and sampling device		Yes	
3.13	Secondary reconnection		Yes	
3.14	Outdoor metal part made of aluminium or stain-less steel		Yes	
3.15	Mass and dimensions			
3.15.1	Total mass	kg	Insert	
3.15.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.2.11 B3.2: Current Transformer 132 kV, 1600-800-400/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape / design		Head type	
1.9	Sealing		Hermetically closed	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	40	
2.7	Rated dynamic current I_{dyn}	kV peak	100	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core • IV core • V core	 % In % In % In % In % In	 200 200 120 120 120	
2.9	Rated transformer ratio: • I core • II core • III core • IV core • V core	 A/A A/A A/A A/A A/A	 **1600-800-400/1** **1600-800-400/1** **1600-800-400/1** **1600-800-400/1** **1600-800-400/1**	
2.10	Accuracy class: • I core • II core • III core • IV core • V core		 0.2 0.2 5P20 5P20 5P20	
2.11	Security factor: • I core • II core		 Fs=10 Fs=10	
2.12	Rated power: • I core • II core • III core • IV core • V core	 VA VA VA VA VA	 10 15 30 30 30	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13	Rated mechanical terminal loads	Class	Min. Class II	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	tgδ test terminal		Yes	
3.11	Oil drain cock and sampling device		Yes	
3.13	Secondary reconnection		Yes	
3.14	Outdoor metal part made of aluminium or stain-less steel		Yes	
3.15	Mass and dimensions			
3.15.1	Total mass	kg	Insert	
3.15.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.2.12 B4: Voltage Transformer 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Voltage Transformers - General**			
1.1	Manufacturer		Insert	
1.2	Type		Capacitive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-2 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape		Insert	
1.9	Sealing		Hermetically closed	
2.	**Voltage Transformers - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	132	
2.2	Highest voltage for equipment U_n	kV_{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	40	
2.7	Rated dynamic current I_{dyn}	kV_{peak}	100	
2.8	Rated primary voltage	kV	132/√3	
2.9	Rated secondary voltage • I winding • II winding	 V V	 110√3 110√3	
2.10	Accuracy class: • I winding • II winding		 0.2 1/3P	
2.11	Rated power: • I winding • II winding	 VA VA	 25 75	
2.12	Load		Simultaneously	
2.13	Voltage factor	p.u./s	1.5/30	
2.14	Rated mechanical strength	Class	Min. Class II	
2.15	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
3.	**Voltage Transformers - Design and Construction**			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper - Mixed dielectric	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Vertical or horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Oil drain cock and sampling device		Yes	
3.11	Enable sealing after accuracy class checks (sealing possibilities)		Yes	
3.13	Outdoor metal part made of aluminium or stainless steel		Yes	
3.14	Mass and dimensions			
3.14.1	Total mass	kg	Insert	
3.14.2	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.2.13 B5: Surge Arrester 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Surge Arresters - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
2.	**Surge Arresters - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.4	Rated voltage of surge arrester U_r	kV $_{rms}$	120	
2.5	Max. continuous operating voltage U_c	kV $_{rms}$	96	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current In (8/20 µs)	kA $_{peak}$	10	
2.10	High current impulse of an arrester (4/10 µs)	kA $_{peak}$	100	
3.	**Surge Arresters - Design and Construction**			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 µs)	A	≥ 850	
3.4	Maximum residual voltage U_{res}			
3.4.1	For switching impulse current 30/60 µs at 0,5 kA	kV $_{peak}$	≤ 235	
3.4.2	For switching impulse current 30/60 µs at 1 kA	kV $_{peak}$	≤ 240	
3.4.3	For switching impulse current 30/60 µs at 2 kA	kV $_{peak}$	≤ 255	
3.4.4	For lightning impulse current 8/20 µs at 5 kA	kV $_{peak}$	≤ 280	
3.4.5	For lightning impulse current 8/20 µs at 10 kA	kV $_{peak}$	≤ 300	
3.4.6	For lightning impulse current 8/20 µs at 20 kA	kV $_{peak}$	≤ 320	
3.5.	Dielectric endurance of arrester housing**)**			
3.5.1	Lightning impulse withstand voltage of arrester housing up (1.2/50 µs)	kV	≥ 550	
3.5.2	Power frequency withstand voltage of arrester housing (1 min wet)	kV	≥ 250	
3.6.	Mechanical requirements			
3.6.1	Specified short-term load SSL (F_{dyn})	N	≥ 3750	
3.6.2	Specified long-term load SSL (F_{stat})	N	≥ 2500	
3.7	Minimum creepage distance	mm/kV	≥ 25 mm/kV	
3.8.	Housing insulating material		Composite/Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	

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

5.2.2.14 B6: Post Insulator Arrester 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Post Insulators - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60168 IEC 60273 IEC 60672 IEC 60694	
1.6	Quality control		ISO 9001	
1.7	Design		Solid core, porcelain, outdoor	
2	Post Insulators - Characteristics			
2.1	Nominal system voltage	kV $_{rms}$	132	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	145	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
2.7	Failing load bending (p0) (C10)	N	≥ 10000	
2.8	Failing load torsion	Nm	≥ 4000	
3	Post Insulators - Design and Construction			
3.1	Insulation material		Porcelain, brown	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	Min. material density ρ_a	Mgm^{-3}	≥ 2.5	
3.4	Min. stretch strength of material σ_{fg}	MPa	≥ 140	
3.5	Insulator height	mm	Insert	
3.6	Max. diameter of insulating part	mm	Insert	
3.7	Diameter of upper base	mm	Insert	
3.8	Number of holes on upper base		Insert	
3.9	Diameter distance between holes on upper base	mm	Insert	
3.10	Hole type on upper base		Insert	
3.11	Diameter on lower base	mm	Insert	
3.12	Number of holes on lower base		Insert	
3.13	Diameter distance between holes on lower base	mm	Insert	
3.14	Hole type on lower base		Insert	
3.15	Insulator weight	kg	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.3 C: Switchgear 33 kV

5.2.3.1 C1: Circuit Breaker 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Circuit Breaker - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		Vacuum	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	1	
2.	**Circuit Breaker - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	≥ 1600	
2.7	Rated short-circuit breaking current I_{sc}	kA $_{rms}$	≥ 25	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 63	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	 p.u. p.u. p.u.	 1.3 N.A. N.A.	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/µs	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		3p	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 100	
2.18	Time of final arc extinction (3.7..134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	 ms ms	 Insert Insert	
2.20	Maximum time interval between opening interrupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch) • Without current • 100 % making current	 ms ms	 Insert Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance • CO at no-load • CO at rated current • CO at rated breaking current Isc		 ≥ 10000 ≥ 2500 ≥ 5	
2.26	The frequency of mechanical operations	Class	Min M1	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF_6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal F_{thA}	N	Insert	
2.30.2	Static horizontal force, transversal F_{thB}	N	Insert	
2.30.3	Static vertical force F_{tv}	N	Insert	
2.30.4	Dynamic horizontal force, longitudinal F_{wx}	N	Insert	
2.30.5	Dynamic horizontal force, transversal	N	Insert	
3.	**Circuit Breaker - Design and Construction**			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 50	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.5	Weight and dimensions			
3.1.5.1	Support insulator height	mm	Insert	
3.1.5.2	Total height	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.5.3	Pole weight	kg	Insert	
3.1.5.4	Weight of operating mechanism	kg	Insert	
3.1.5.5	Total weight (with metal structure)	kg	Insert	
3.1.6	Minimum distance			
3.1.6.1	Between poles	mm	Insert	
3.1.6.2	To ground	mm	Insert	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	1	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		6NO+6NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	Local/remote control selector switch		Yes	
3.4	Local operation push buttons			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Operation counter		Yes	
3.4.3	Motor MCB (miniature circuit breakers)		Yes	
3.4.4	Heater - 230 V, 50 HZ		Yes	
3.4.5	Cu earthing rails inside central control cabinet		Yes	
3.4.6	Detachable plates, the bottom of central control cabinet		Yes	
3.4.7	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.3.2 C2.1: Disconnector 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Vertical break, horizontal or wall mounting	
1.9	Number of poles	pcs.	3	
1.10	Type of operating mechanism		Hand operated	
1.11	Number of operating mechanisms	pcs.	1	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 1600**	
2.8	Rated short withstand current I_k	kA $_{rms}$	≥ 25	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 63	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	Min M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static F_b	N	Insert	
2.17.3	Vertical force F_c	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	HV terminals			
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 50	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.4	Weight and dimensions			
3.1.4.1	Pole height	mm	Insert	
3.1.4.2	Pole length	mm	Insert	
3.1.4.3	Distance between support axis of a pole	mm	Insert	
3.1.4.4	Shipping dimensions	mm	Insert	
3.1.4.5	Pole weight	kg	Insert	
3.1.4.6	Total weight	kg	Insert	
3.1.4.7	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Minimum number of available contacts (NO/NC)	pcs.	6NO+6NC	
3.2.4	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.5	Heater, 230 V, 50 Hz		Yes	
3.2.6	Total heater power	W	Insert	
3.2.7	Water-tight corrosion-resistant housing		IP54	
3.2.8	Housing of Al or stainless steel		Yes	
3.2.9	Equipotential bonding rails		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.3.3 C2.2: Disconnector 33 kV with integrated fuse

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Disconnector- General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Vertical break, horizontal or wall mounting, **with integrated fuse 10 A**	
1.9	Number of poles	pcs.	3	
1.10	Type of operating mechanism		Hand operated	
1.11	Number of operating mechanisms	pcs.	1	
2.	**Disconnector - Characteristics**			
2.1	Nominal system voltage	kV_{rms}	33	
2.2	Highest voltage for equipment U_n	kV_{rms}	36	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	**≥ 100**	
2.8	Rated short withstand current I_k	kA_{rms}	≥ 25	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 63	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	Min M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static F_b	N	Insert	
2.17.3	Vertical force F_c	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.1.3	HV terminals			
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 50	
3.1.3.3	Number of holes		Min 2	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.1.4	Weight and dimensions			
3.1.4.1	Pole height	mm	Insert	
3.1.4.2	Pole length	mm	Insert	
3.1.4.3	Distance between support axis of a pole	mm	Insert	
3.1.4.4	Shipping dimensions	mm	Insert	
3.1.4.5	Pole weight	kg	Insert	
3.1.4.6	Total weight	kg	Insert	
3.1.4.7	Shipping weight	kg	Insert	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Minimum number of available contacts (NO/NC)		6NO+6NC	
3.2.4	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.5	Heater, 230 V, 50 Hz		Yes	
3.2.6	Total heater power	W	Insert	
3.2.7	Water-tight corrosion-resistant housing		IP54	
3.2.8	Housing of Al or stainless steel		Yes	
3.2.9	Equipotential bonding rails		Yes	
3.3	Fuse			
3.3.1	Integrated fuse 10 A		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.3.4 C3.1: Current Transformer 33 kV, 1600/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor, post type	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	25	
2.7	Rated dynamic current I_{dyn}	kV peak	63	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core • IV core	 % In % In % In % In	 200 200 120 120	
2.9	Rated transformer ratio: • I core • II core • III core • IV core	 A/A A/A A/A A/A	 **1600/1** **1600/1** **1600/1** **1600/1**	
2.10	Accuracy class: • I core • II core • III core • IV core		 0.2 0.2 5P20 5P20	
2.11	Security factor: • I core • II core		 Fs=10 Fs=10	
2.12	Rated power: • I core • II core • III core • IV core	 VA VA VA VA	 10 15 30 30	
2.13	Rated mechanical terminal loads	Class	Min. Class I	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain or araldite	
3.2	Insulating medium		Oil-paper or araldite	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 50	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Mass and dimensions			
3.11	Total mass	kg	Insert	
3.13	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.3.5 C3.2: Current Transformer 33 kV, 10/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Current Transformers - General**			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-1	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor, post type	
2.	**Current Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	25	
2.7	Rated dynamic current I_{dyn}	kV peak	63	
2.8	Rated continuous thermal current (40°C): • I core • II core • III core	 % In % In % In	 200 120 120	
2.9	Rated transformer ratio: • I core • II core • III core	 A/A A/A A/A	 **10/1** **10/1** **10/1**	
2.10	Accuracy class: • I core • II core • III core		 0.2 5P20 5P20	
2.11	Security factor: • I core		 Fs=10	
2.12	Rated power: • I core • II core • III core	 VA VA VA	 5 15 15	
2.13	Rated mechanical terminal loads	Class	Min. Class I	
3.	**Current Transformers - Design and Construction**			
3.1	Insulator material		Porcelain or araldite	
3.2	Insulating medium		Oil-paper or araldite	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. to IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage $1.2*U_M/\sqrt{3}$ • Test voltage U_M	 pC pC	 Max. ≤ 5 ≤ 10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 50	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Mass and dimensions			
3.11	Total mass	kg	Insert	
3.13	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.3.6 C4: Voltage Transformer 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Voltage Transformers - General**			
1.1	Manufacturer		Insert	
1.2	Type		Inductive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-2 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor, post type	
2.	**Voltage Transformers - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV $_{peak}$	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	25	
2.7	Rated dynamic current I_{dyn}	kV $_{peak}$	63	
2.8	Rated primary voltage	kV	33/√3	
2.9	Rated secondary voltage • I winding • II winding	 V V	 110√3 110√3	
2.10	Accuracy class: • I winding • II winding		 0.2 1/3P	
2.11	Rated power: • I winding • II winding	 VA VA	 25 75	
2.12	Load		Simultaneously	
2.13	Voltage factor	p.u./s	1.5/30	
2.14	Rated mechanical strength	Class	Min. Class I	
2.15	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
3.	**Voltage Transformers - Design and Construction**			
3.1	Insulator material		Porcelain or araldite	
3.2	Insulating medium		Oil-paper or araldite	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 25 mm/kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	µV	Max. 2500	
3.5	Permissible level of partial discharges: • Test voltage 1.2*UM/√3 • Test voltage UM	 pC pC	 Max. ≤ 5 ≤ 10	
3.7	Min. LV enclosure protection		IP54	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Vertical or horizontal	
3.8.3	Dimensions	mm x mm	Min 100 x 50	
3.8.4	Number of holes		Min 2	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Mass and dimensions			
3.11	Total mass	kg	Insert	
3.13	Height	mm	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.3.7 C5: Surge Arrester 33 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	**Surge Arresters - General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60099-4	
1.6	Quality control		ISO 9001	
1.7	Design		Metal oxide, gapless, outdoor	
1.8	Short circuit testing authority		Insert authority	
2.	**Surge Arresters - Characteristics**			
2.1	Nominal system voltage	kV $_{rms}$	33	
2.2	Highest voltage for equipment U_n	kV $_{rms}$	36	
2.4	Rated voltage of surge arrester U_r	kV $_{rms}$	30	
2.5	Max. continuous operating voltage U_c	kV $_{rms}$	24	
2.8	Rated frequency	Hz	50	
2.9	Nominal discharge current In (8/20 µs)	kA $_{peak}$	10	
2.10	High current impulse of an arrester (4/10 µs)	kA $_{peak}$	100	
3.	**Surge Arresters - Design and Construction**			
3.1	Line discharge class	Class	3	
3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 6.5	
3.3	Long duration current impulse (2000 µs)	A	≥ 850	
3.4	Maximum residual voltage 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		Composite/Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	

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

5.2.4 D: Transformers

5.2.4.1 D1: 230/132/33 kV 225/300 MVA 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	 300 / 300 **100**	
2.2	Rated power (MVA) by cooling ONAN / ONAF • Primary / secondary winding • Tertiary - minimum	 MVA MVA	 225 / 300 75 / 100	
2.3	Rated voltage of windings: • HV winding • MV winding • LV - stabilizing winding	 kV kV kV	 235 135 34.5	
2.4	Tap changer:			
	• Manufacturer			
	• Country of origin			
	• Model designation			
	• Type of tap changing		On-load	
	• Tap changer location		Neutral point	
	• Type of voltage regulation	%	V.F.V.V.	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	• Tapping range	%	±10	
	• Tapping step		1.25	
	• Rating		Rated power 300 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		Si145	
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 300 MWA with on-load tap changer in middle position	%	13 ±10 %	
3.1.2	HV - LV, on the basis of rated power 'x' MWA with on-load tap changer in middle position	%	Insert	
3.1.3	MV - LV, on the basis of rated power 'x' MWA 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.	 50 40 25 1.05	
3.4	Guaranteed losses			
3.4.1	No-load losses with tap changer in 9th regulation position: • at rated voltage and rated ***frequency (this value will be evaluated)*** • at 110 % rated voltage, at rated frequency	 kW kW	 **Insert** Insert	
	No-load losses with tap changer in 17th regulation position: • at 110 % rated voltage, at rated frequency	 kW	 Insert	
3.4.2	No-load losses capitalized value	€/kW	**7000**	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position ***(this value will be evaluated)***	kW	**Insert**	
3.4.5	On-load losses capitalized value	€/kW	**3500**	
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 ***(this value will be evaluated)***	kW	**Insert**	
3.5.2	Capitalized valued of ancillary equipment load	€/kW	**3500**	
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 1050 AC 460	
3.6.2	Medium voltage (MV)		LI 650 AC 275	
3.6.3	Neutral		LI 650 AC 275	
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	245	
3.7.2	Medium voltage (MV)	kV	145	
3.7.3	Neutral	kV	145	
3.7.4	Low voltage (LV)	kV	36	
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 cosφ = 1.0 and: 25 % load of the rated value 50 % load of the rated value 75 % load of the rated value 100 % load of the rated value		 Insert Insert Insert Insert	
3.9.2	If cosφ = 0.8 (inductive) and: 25 % load of the rated value 50 % load of the rated value 75 % load of the rated value 100 % load of the rated value		 Insert Insert Insert Insert	
3.10	Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position			
3.10.1	cosφ = 1.00		Insert	
3.10.2	cosφ = 0.95 (inductive)		Insert	
3.10.3	cosφ = 0.90 (inductive)		Insert	
3.10.4	cosφ = 0.80 (inductive)		Insert	
3.11	No-load current at rated frequency			
3.11.1	At 0.90 Un		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.11.2	At 1.00 Un		Insert	
3.11.3	At 1.05 Un		Insert	
3.12	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.12.1	Top oil	K	≤ 50	
3.12.2	Winding	K	≤ 55	
3.12.3	Hottest spot	K	≤ 65	
3.13	At the emergency cases it is allowed: • Continuous overload at the highest winding temperature which exceeds by 2.5°C the guaranteed limit value • Continuous voltage increase when the top oil temperature exceeds the guaranteed limit by 2.5°C at rated power (in % of the rated voltage)	MVA %	Compliant to IEC 60076-7	
3.14	Guaranteed value of overloads in % of the rated power			
3.14.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.14.1.1	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		 Insert Insert Insert	
3.14.1.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		 Insert Insert Insert	
3.14.1.3	After operation under 120 min • full rated power • ¾ rated power • ½ rated power		 Insert Insert Insert	
3.14.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.14.2.1	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		 Insert Insert Insert	
3.14.2.2	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		 Insert Insert Insert	
3.14.2.3	After operation under 15 min • 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: • 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		**No**	
4.10	PCB content		**Without PCB**	
5	**Bushing**			
5.1	HV bushing (245 kV)			
5.1.1	Quantity		3	
5.1.2	Class	kV	245	
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	50	
5.1.7	Rated lightning impulse withstand voltage	kV peak	1050	
5.1.8	Rated switching impulse withstand voltage	kV peak	N.A.	
5.1.9	Rated power frequency withstand voltage	kV rms	460	
5.1.10	Connectors			
5.1.10.1	Shape	mm	Ø 50	
5.1.10.2	Length	mm	125	
5.1.10.3	Suitable for		Al wire	
5.1.11	Minimum creepage distance (25 mm/kV)	mm/kV	≥ 25 mm/kV	
5.1.12	Full vacuum withstand of complete bushing		YES	
5.2	Neutral bushing (identical as MV bushing)			
5.2.1	Quantity		1	
5.2.2	Class	kV	145	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Insert	
5.2.5	Rated current	A	≥ 1600	
5.2.6	Rated short-circuit current (2 s)	kA rms	40	
5.2.7	Rated lightning impulse withstand voltage	kV peak	650	
5.2.8	Rated switching impulse withstand voltage	kV peak	-	
5.2.9	Rated power frequency withstand voltage	kV rms	275	
5.2.10	Connectors			
5.2.10.1	Shape	mm	Ø 50	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.10.2	Length	mm	125	
5.2.10.3	Suitable for		Al 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	145	
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	40	
5.3.7	Rated lightning impulse withstand voltage	kV peak	650	
5.3.8	Rated switching impulse withstand voltage	kV peak	-	
5.3.9	Rated power frequency withstand voltage	kV rms	275	
5.3.10	Connectors			
5.3.10.1	Shape	mm	Ø 60	
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: • 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: • 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'	
6.6.2	MV winding		Cu - Interleaved / disc - transposed, cured in epoxy coating	
6.6.3	LV - stabilizing winding		Cu - transposed, cured in epoxy coating	
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	Insert	
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: • Highest point of HV bushing • Highest point of tank • Highest point of conservator • Highest point of lifting hook for removal of core and oil assembly	 mm mm mm mm	 Insert Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7.11	Outer dimensions: • Length • Width	 mm mm	 Insert Insert	
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 Insert 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	Si 145	
8.4	Rated current	A	≥ 1600	
8.5	Number of steps		17	
8.6	Regulating coil		At neutral 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 Tap Changer		In all phases, 3 cores characteristics shall be defined in design stage	
10.2	CT in MV bushings, for protection, WTI and 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, 2 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)	
11.3	Conservator tank		To be defined in design stage	
11.4	Tap changer		To be defined in design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	4520	
14.4.3	Transversal distance between wheels in pair	mm	1435	
14.4.4	Distance between wheels in longitudinal direction	mm	1435	
14.5	Corrosion protection of the tank		YES	
14.6	Vacuum withstand of the complete tank with cooler	mbar	1	
14.7	Over-pressure withstand of the complete autotransformer	bar	0.3	
15	**Conservator**			
15.1	Type		With diaphragm	
15.2	Number of compartments	pcs.	2	
15.3	Total volume of conservator	m^3	Insert	
15.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.6	Diagraph design parameters: • Maximum diagraph stress at highest working pressure • Diagraph construction details • Type of diagraph material		Insert Insert Insert	
15.7	Corrosion protection of conservator		Insert	
15.8	Oil level indicators with alarm for minimum oil level	pcs.	2	
16	**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	
	Overall compliance with the requirements (yes/no)			

5.2.4.2 D2: 132/33 kV 50/75 MVA Power transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, two windings, without 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		N.A.	
1.8	Thermal insulation class		A	
2	**Ratings and properties**			
2.1	Rated power: • Primary / Secondary winding	MVA	75 / 75	
2.2	Rated power (MVA) by cooling ONAN / ONAF	MVA	50 / 75	
2.3	Rated voltage of windings: • HV winding • MV winding	 kV kV	 135 34.5	
2.4	Tap changer:			
	• Manufacturer			
	• Country of origin			
	• Model designation			
	• Type of tap changing		On-load	
	• Tap changer location		Insert	
	• Type of voltage regulation	%	C.F.V.V.	
	• Tapping range	%	±10	
	• Tapping step		1.25	
	• Rating	MVA	75, all taps	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		Dyn1	
2.7	Neutral point insulation		Si 36	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.8	Low voltage winding connection (LV)		N.A.	
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 300 MWA with on-load tap changer in middle position	%	12 ±10 %	
3.1.2	HV - LV, on the basis of rated power 'x' MWA with on-load tap changer in middle position	%	N.A.	
3.1.3	MV - LV, on the basis of rated power 'x' MWA with on-load tap changer in middle position	%	N.A:	
3.2	Zero-sequence impedance, with tap changer in middle position: HV/MV	%	Insert	
3.3	Power transformer 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 • Pre-fault voltage	 kA kA p.u.	 40 25 1.05	
3.4	Guaranteed losses			
3.4.1	No-load losses with tap changer in 9th regulation position: • at rated voltage and rated frequency (this value will be evaluated) • at 110 % rated voltage, at rated frequency No-load losses with tap changer in 17th regulation position: • at 110 % rated voltage, at rated frequency	 kW kW kW	 Insert Insert Insert	
3.4.2	No-load losses capitalized value	€/kW	7000	
3.4.3	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.4	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position ***(this value will be evaluated)***	kW	Insert	
3.4.5	On-load losses capitalized value	€/kW	3500	
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 ***(this value will be evaluated)***	kW	Insert	
3.5.2	Capitalized valued of ancillary equipment load	€/kW	3500	
3.5.3	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	20	
3.6	Insulation level			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.6.1	High voltage (HV)		LI 650 AC 275	
3.6.2	Medium voltage (MV)		LI 270 AC 70	
3.6.3	Neutral		LI 270 AC 70	
3.6.4	Low voltage (LV)		N.A.	
3.7	The highest voltage for equipment (effective value)			
3.7.1	High voltage (HV)	kV	145	
3.7.2	Medium voltage (MV)	kV	36	
3.7.3	Neutral	kV	36	
3.7.4	Low voltage (LV)	kV	N.A.	
3.8	Rated insulation level			
3.8.1	Induced voltage (ACSD, ACLD)	kV	In accordance with IEC 60076-3	
3.9	Efficiencies			
3.9.1	If cosφ = 1.0 and: • 25 % load of the rated value • 50 % load of the rated value • 75 % load of the rated value • 100 % load of the rated value		 Insert Insert Insert Insert	
3.9.2	If cosφ = 0.8 (inductive) and: • 25 % load of the rated value • 50 % load of the rated value • 75 % load of the rated value • 100 % load of the rated value		 Insert Insert Insert Insert	
3.10	Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position			
3.10.1	cosφ = 1.00		Insert	
3.10.2	cosφ = 0.95 (inductive)		Insert	
3.10.3	cosφ = 0.90 (inductive)		Insert	
3.10.4	cosφ = 0.80 (inductive)		Insert	
3.11	No-load current at rated frequency			
3.11.1	At 0.90 Un		Insert	
3.11.2	At 1.00 Un		Insert	
3.11.3	At 1.05 Un		Insert	
3.12	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.12.1	Top oil	K	≤ 50	
3.12.2	Winding	K	≤ 55	
3.12.3	Hottest spot	K	≤ 65	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.13	At the emergency cases it is allowed: • Continuous overload at the highest winding temperature which exceeds by 2.5°C the guaranteed limit value • Continuous voltage increase when the top oil temperature exceeds the guaranteed limit by 2.5°C at rated power (in % of the rated voltage)	MVA %	Compliant to IEC 60076-7	
3.14	Guaranteed value of overloads in % of the rated power			
3.14.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.14.1.1	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.2	After operation under 20 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.1.3	After operation under 120 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.14.2.1	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.2	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.14.2.3	After operation under 15 min • full rated power • ¾ rated power • ½ rated power		Insert Insert Insert	
3.15	Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits: • with all cooling groups in operation (excluding stand-by cooling group) • with one cooling group out of operation • with two cooling groups out of operation		Insert Insert Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4	**Oil**			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm^2/s	Insert	
4.7	Maximum dielectric strength	kV/cm	Insert	
4.8	Data sheet attached		Insert	
4.9	Corrosive Sulphur		NO	
4.10	PCB content		Without PCB	
5	**Bushing**			
5.1	HV bushing (245 kV)			
5.1.1	Quantity		3	
5.1.2	Class	kV	145	
5.1.3	Manufacturer		Insert	
5.1.4	Type		Insert	
5.1.5	Rated current	A	≥ 400	
5.1.6	Rated short circuit current (2 s)	kA rms	50	
5.1.7	Rated lightning impulse withstand voltage	kV peak	650	
5.1.8	Rated switching impulse withstand voltage	kV peak	N.A.	
5.1.9	Rated power frequency withstand voltage	kV rms	275	
5.1.10	Connectors			
5.1.10.1	• Shape	mm	Ø 40	
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	MV bushings			
5.2.1	Quantity		3	
5.2.2	Class	kV	145	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Insert	
5.2.5	Rated current	A	≥ 1600	
5.2.6	Rated short-circuit current (2 s)	kA rms	40	
5.2.7	Rated lightning impulse withstand voltage	kV peak	650	
5.2.8	Rated switching impulse withstand voltage	kV peak	-	
5.2.9	Rated power frequency withstand voltage	kV rms	275	
5.2.10	Connectors			
5.2.10.1	Shape	mm	Ø 50	
5.2.10.2	Length	mm	125	
5.2.10.3	Suitable for		Al 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	Neutral bushing (identical as MV bushing)			
5.3.1	Quantity		1	
5.3.2	Class	kV	145	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	40	
5.3.7	Rated lightning impulse withstand voltage	kV peak	650	
5.3.8	Rated switching impulse withstand voltage	kV peak	-	
5.3.9	Rated power frequency withstand voltage	kV rms	275	
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	
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	
6.3	Maximum current density in windings at rated power and normal tap changer position: • HV winding • MV winding	 A/mm^2 A/mm^2	 Insert Insert	
6.4	Winding resistance at 75°C and middle tap changer position: • HV winding • MV winding	 Ω Ω	 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'	
6.6.2	MV winding		Cu - 'Interleaved' / 'disc' - transposed, cured in epoxy coating	
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 transformer, equipped for service	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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: • Highest point of HV bushing • Highest point of tank • Highest point of conservator • Highest point of lifting hook for removal of core and oil assembly	 mm mm mm mm	 Insert Insert Insert Insert	
7.11	Outer dimensions: • Length • Width	 mm mm	 Insert Insert	
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 Insert 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	Si 145	
8.4	Rated current	A	≥ 400	
8.5	Number of steps		17	
8.6	Regulating coil		Insert	
8.7	Short-circuit withstand	kA rms	Insert	
8.8	BIL to ground through the regulating coil	kV peak	Insert	
8.9	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
8.10	Tap position indicator		Digital code matrix (BCD)	
8.11	Auxiliary supply		3x400 V / 230 V, 50 Hz	
9	**Auxiliary power supply**			
9.1	Motors		3x400 V / 50 Hz	
9.2	Heaters		230 V / 50 Hz	
9.3	Control voltage		110 V DC	
9.4	Oil pump		3x400 V / 50 Hz	
10	**Current transformer incorporated into the power transformer**			
10.1	CT in HV bushings, for protection, WTI and Tap Changer		In all phases, 3 cores Characteristics shall be defined in design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2	CT in MV bushings, for protection, WTI and Tap Changer		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)	
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	**Transformer tank**			
14.1	Type of design			
14.2	Thickness of transformer tank: • Sides • Bottom • Top	 mm mm mm	 Insert Insert Insert	
14.3	Material of the autotransformer tank		Insert	
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	4520	
14.4.3	Transversal distance between wheels in pair	mm	1435	
14.4.4	Distance between wheels in longitudinal direction	mm	1435	
14.5	Corrosion protection of the tank		YES	
14.6	Vacuum withstand of the complete tank with cooler	mbar	1	
14.7	Over-pressure withstand of the complete autotransformer	bar	0.3	
15	**Conservator**			
15.1	Type		With diagraph	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.2	Number of compartments	pcs.	2	
15.3	Total volume of conservator	m^3	Insert	
15.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	
15.5	Pressure rise inside the tank due to oil expansion		Insert	
15.6	Diagraph design parameters: • Maximum diagraph stress at highest working pressure • Diagraph construction details • Type of diagraph material		Insert Insert Insert	
15.7	Corrosion protection of conservator		Insert	
15.8	Oil level indicators with alarm for minimum oil level	pcs.	2	
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	
	Overall compliance with the requirements (yes/no)			

5.2.5 F: Auxiliary Transformers

5.2.5.1 F1: 33/0.415 kV 200 kVA Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, two windings, without tertiary winding, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	**Ratings and properties**			
2.1	Rated power:	kVA	200	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage of windings: • MV winding • LV winding	 kV V	 34.5 415	
2.4	Tap changer: • Type of tap changing • Tapping range • Tapping step • Rating	 % %	 Off-load ±5 2.5 Rated power 200 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			
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	
3.2.2	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		**NO**	
4.10	PCB content		**Without PCB**	
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)			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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: • MV winding • LV winding	 A/mm^2 A/mm^2	 < 4 < 4	
6.4	Winding resistance at 75°C and middle tap changer position: • 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: • Length • Width	 mm mm	 Insert Insert	
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 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	
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)			

5.2.5.2 F2: 33/0.415 kV 200 kVA Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Power transformer three-phase, oil immersed, two windings, without tertiary winding, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	**Ratings and properties**			
2.1	Rated power:	kVA	200	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage of windings: • MV winding • LV winding	 kV V	 34.5 415	
2.4	Tap changer: • Type of tap changing • Tapping range • Tapping step • Rating	 % %	 Off-load ±5 2.5 Rated power 200 kVA, all taps	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		Dyn11	
3	**Special technical requirements**			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period: • 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	
3.2.2	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.2.3	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	
3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Insulation level			
3.3.1	Medium voltage (MV)		LI 170 AC 70	
3.3.2	Low voltage (LV)		LI - AC 3	
3.4	The highest voltage for equipment (effective value)			
3.4.1	Medium voltage (MV)	kV	36	
3.4.2	Low voltage (LV)	kV	1.1	
3.5	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.5.1	Top oil	K	≤ 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		**NO**	
4.10	PCB content		**Without PCB**	
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)			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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: • MV winding • LV winding	 A/mm^2 A/mm^2	 < 4 < 4	
6.4	Winding resistance at 75°C and middle tap changer position: • 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: • Length • Width	 mm mm	 Insert Insert	
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 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	
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)			

5.2.6 G-P: Control, Relay Protection, Substation Automation System & Metering

All auxiliary equipment such as MCBs, heaters, lighting, AC sockets, terminals, auxiliary relays, wiring and necessary electrical/optical converters for communication, etc. shall be foreseen

Enough auxiliary relays/contactors for OHL/transformer/busbar protection shall be foreseen and delivered as built-in elements in the cubicles.

The central unit for busbar protection must be supported for min. 16 bays.

The design proposal of the cubicles is subject of approval.

The cubicles shall be delivered completely wired and tested.

5.2.6.1 14291 - Control Cubicle for OHL & Bus Coupler

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14291	**Control Cubicle for OHL & Bus Couplers with Switch / Code number: 14291**			
1.1	Control cubicle for OHL & bus couplers with LAN switch			
1.1.1	Bay control unit for OHL & bus couplers (Code: 14251)	pcs.	1	
1.1.2	Back-up control panel (Code: 14254)	pcs.	1	
1.1.3	Front panel annunciation for OHL & TR (Code: 14255)	pcs.	1	
1.1.4	Ethernet switch-process LAN (Code: 14273)	pcs.	1	
1.2	Other equipment (specify if any)		Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.2 14292 - Control Cubicle for Power Transformers HV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14292	**Control Cubicle for Power Transformers HV Side with LAN Switch / Code number: 14292**			
1.1	Control cubicle for power transformers HV side with LAN switch			
1.1.1	Bay control unit for power transformers HV & LV (Code: 14252)	pcs.	1	
1.1.2	Back-up control panel (Code: 14254)	pcs.	1	
1.1.3	Front panel annunciation for OHL & TR (Code: 14255)	pcs.	1	
1.1.4	Ethernet switch process LAN (Code: 14273)	pcs.	1	
1.2	Other equipment (specify if any)		Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.3 14293 - Control Cubicle for Power Transformers LV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14293	**GENERAL (Control Cubicle for Power Transformers LV Side / Code number: 14293)**			
1.1	Control cubicle for power transformers LV side			
1.1.1	Bay control unit for power transformers HV&LV (Code: 14252)	pcs.	1	
1.1.2	Back-up control panel (Code: 14254)	pcs.	1	
1.1.3	Front panel annunciation for OHL & TR (Code: 14255)	pcs.	1	
1.1.4	Ethernet switch-process LAN (Code: 14273)	pcs.	1	
1.1.5	AVR (Code: 14008)	pcs.	1	
1.2	Other equipment (specify if any)		Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.4 14294 - Control Cubicle for LV AC & DC Switchgear

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14294	**Control Cubicle for LV AC & DC SWG / Code number: 14294**			
1.1	Control cubicle for LV AC&DC SWG			
1.1.1	Bay control unit for LV AC&DC SWG (Code: 14253)	pcs.	4	
1.1.2	Front panel annunciation for control room (Code: 14256)	pcs.	1	
1.1.3	Weather station interface unit item (Code: 14272-item 1.2.5)	pcs.	1	
1.1.4	Horn on/off switch		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.5 14295 - Control Cubicle for SCADA Server

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14295	**Control Cubicle for SCADA Server / Code number: 14295**			
1.1	Cubicle for SCADA servers			
1.1.1	SCADA server (Code: 14261)	pcs.	2	
1.1.2	Ethernet switch-process LAN (Code: 14273)	pcs.	2	
1.1.3	Ethernet switch-control room LAN (Code: 14274)	pcs.	2	
1.1.4	Time synchronisation device (GPS) (Code: 14271)	pcs.	2	
	Overall compliance with the requirements (yes/no)			

5.2.6.6 14101 - Protection Cubicle No. 1 for 230 kV OHL

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14101	**Protection Cubicle No. 1 for 230 kV OHL / Code number: 14101**			
1.1	Protection cubicle No. 1 for 230 kV OHL			
1.1.1	Protection terminal for 230 kV OHL - Main 1 (Code: 14001)	pcs.	1	
1.1.2	Trip circuit supervision relay (Code: 14011)	pcs.	3	
1.1.3	Tripping unit (Code: 14012)	pcs.	4 (To be confirmed with detailed design)	
1.1.4	Test socket (Code: 14013)	pcs.	1	
	Overall compliance with the requirements (yes/no)			

5.2.6.7 14102 - Protection Cubicle No. 2 for 230 kV OHL

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14102	**Protection Cubicle No. 2 for 230 kV OHL / Code number: 14102**			
1.1	Protection cubicle No. 2 for 230 kV OHL			
1.1.1	Protection terminal for 230 kV OHL - Main 2 (Code: 14002)	pcs.	1	
1.1.2	Busbar & breaker failure protection bay unit (Code: 14010)	pcs.	1	
1.1.3	Trip circuit supervision relay (Code: 14011)	pcs.	3	
1.1.4	Tripping unit (Code: 14012)	pcs.	4 (To be confirmed with detailed design)	
1.1.5	Test socket (Code: 14013)	pcs.	2	
	Overall compliance with the requirements (yes/no)			

5.2.6.8 14103 - Protection Cubicle No. 3 for 132 kV OHL

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14103	**Protection Cubicle No. 3 for 132 kV OHL / Code number: 14103**			
1.1	Protection cubicle No. 3 for 132 kV OHL-Long			
1.1.1	Protection terminal for 132 kV OHL Main 1 (Code: 14003)	pcs.	1	
1.1.2	Protection terminal for 132 kV OHL Main 2 (Code: 14004)	pcs.	1	
1.1.3	Busbar & breaker failure protection bay unit (Code: 14010)	pcs.	1	
1.1.4	Trip circuit supervision relay (Code: 14011)	pcs.	6	
1.1.5	Tripping unit (Code: 14012)	pcs.	8 (To be confirmed with detailed design)	
1.1.6	Test socket (Code: 14013)	pcs.	3	
	Overall compliance with the requirements (yes/no)			

5.2.6.9 14104 - Protection Cubicle No. 4 for Power Transformer HV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14104	**Protection Cubicle No. 4 for Power Transformer HV Side / Code number: 14104)**			
1.1	Protection cubicle No. 5 for Power Transformer HV Side			
1.1.1	Protection terminal for power transformer Main 1 (Code: 14005)	pcs.	1	
1.1.2	Busbar & breaker failure protection bay unit (Code: 14010)	pcs.	1	
1.1.3	Trip circuit supervision relay (Code: 14011)	pcs.	6	
1.1.4	Tripping unit (Code: 14012)	pcs.	4 (To be confirmed with detailed design)	
1.1.5	Test socket (Code: 14013)	pcs.	2	
	Overall compliance with the requirements (yes/no)			

5.2.6.10 14105 - Protection Cubicle No. 5 for Power Transformer LV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14105	**Protection Cubicle No. 5 for Power Transformer LV Side / Code number: 14105**			
1.1	Protection cubicle No. 5 for Power Transformer LV Side			
1.1.1	Protection terminal for power transformer Main 2 (Code: 14006)	pcs.	1	
1.1.2	Protection terminal for power transformer LV Side (Code: 14007)	pcs.	1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1.3	Busbar & breaker failure protection bay unit (Code: 14010)	pcs.	1	
1.1.4	Trip circuit supervision relay (Code: 14011)	pcs.	2	
1.1.5	Tripping unit (Code: 14012)	pcs.	3 (To be confirmed with detailed design)	
1.1.6	Test socket (Code: 14013)	pcs.	3	
	Overall compliance with the requirements (yes/no)			

5.2.6.11 14106 - Protection Cubicle No. 6 for Bus Couplers 230 kV & 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14106	**Protection Cubicle No. 6 for Bus couplers 230 kV & 132 kV / Code number: 14106**			
1.1	Protection cubicle No. 6 for bus couplers 230 kV & 132 kV			
1.1.1	Protection terminal for bus couplers 230 kV & 110 kV (Code: 14009)	pcs.	1	
1.1.2	Busbar & breaker failure protection central unit (Code: 14010)	pcs.	2	
1.1.3	Trip circuit supervision relay (Code: 14011)	pcs.	2	
1.1.4	Tripping unit (Code: 14012)	pcs.	2 (To be confirmed with detailed design)	
1.1.5	Test socket (Code: 14013)	pcs.	2	
	Overall compliance with the requirements (yes/no)			

5.2.6.12 14251 - Bay Control Unit for OHL and Bus Couplers

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14251	**Bay Control Unit for OHL and Bus Couplers / Code number: 14251**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 45	
2.4.1	Number of BI groups with common root		Max. 4	
2.4.2	Number of inputs per BI group with common root		Max. 8	
2.4.3	Rated voltage	V d.c.	110	
2.5	Binary outputs		Min. 24	
2.5.1	Number of BO with common contact		Max. 4	
2.5.2	Rated voltage	V d.c.	110	
2.5.3	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.4	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.5	Number of tripping contacts (high-speed out-put)	pcs.	Insert	
2.5.6	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Min. 16	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface			
2.8.1	HMI with single line diagram, measurement, signalling and control		Yes	
2.9	Synchronism & energising check			
2.9.1	Frequency difference range	mHz.	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.9.2	Voltage difference range	% Ur	Insert	
2.9.3	Phase difference range	°	Insert	
2.9.4	Operating time for synchro check function	ms	Insert	
2.9.5	Operating time for energising check function	ms	Insert	
2.10	Event recorder			
2.10.1	Max. number of events		Insert	
2.10.2	Time tagging resolution	ms	1	
2.11	Self-supervision		Yes	
2.12	Measurement			
2.12.1	Active power measurement		Yes	
2.12.2	Reactive power measurement		Yes	
2.12.3	Energy measurement		Yes	
2.12.4	Voltage measurement		Yes	
2.12.5	Frequency measurement		Yes	
2.12.6	Current measurement		Yes	
	Overall compliance with the requirements (yes/no)			

Bay Control Units must be from the same manufacturer as substation protection system. Bay Control Units must be parameterized, configured and delivered as per Engineer's requirements.

5.2.6.13 14252 - Bay Control Unit for Power Transformers HV & LV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14252	**Bay Control Unit for Power Transformers HV&LV / Code number: 14252**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	mA inputs			
2.4.1	Number of mA inputs	pcs.	Min. 2	
2.4.2	Input range		4-20 mA	
2.5	Binary inputs		Min. 45	
2.5.1	Number of BI groups with common root		Max. 4	
2.5.2	Number of inputs per BI group with common root		Max. 8	
2.5.3	Rated voltage	V d.c.	110	
2.6	Binary outputs		Min. 24	
2.6.1	Number of BO with common contact		Max. 4	
2.6.2	Rated voltage	V d.c.	110	
2.6.3	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.6.4	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.6.5	Number of tripping contacts (high-speed output)	pcs.	Insert	
2.6.6	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.7	LED indications			
2.7.1	Number of LED's		Min. 16	
2.7.2	Multi-colour LED's	Yes/No	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.8	Communication ports		Yes	
2.8.1	Port for front-connected PC			
2.8.1.1	Protocols supported		Insert	
2.8.1.2	Communication speed	Kbit/s	Insert	
2.8.1.3	PC side connector type		Insert	
2.8.2	System interface			
2.8.2.1	Number of rear ports		2	
2.8.2.2	Protocols supported		IEC 61850	
2.8.2.3	Communication speed	Mbit/s	Min. 100	
2.8.2.4	Connector type		RJ45 or FO	
2.8.3	Time synchronisation		SNTP	
2.9	Human-machine interface			
2.9.1	HMI with single line diagram, measurement, signalling and control		Yes	
2.10	Synchronism & energising check			
2.10.1	Frequency difference range	mHz.	Insert	
2.10.2	Voltage difference range	% Ur	Insert	
2.10.3	Phase difference range	°	Insert	
2.10.4	Operating time for synchro check function	ms	Insert	
2.10.5	Operating time for energising check function	ms	Insert	
2.11	Event recorder			
2.11.1	Max. number of events		Insert	
2.11.2	Time tagging resolution	ms	1	
2.12	Self-supervision		Yes	
2.13	Measurement			
2.13.1	Active power measurement		Yes	
2.13.2	Reactive power measurement		Yes	
2.13.3	Energy measurement		Yes	
2.13.4	Voltage measurement		Yes	
2.13.5	Frequency measurement		Yes	
2.13.6	Current measurement		Yes	
	Overall compliance with the requirements (yes/no)			

Bay Control Units for Transformer HV & LV side must be from the same manufacturer as substation protection system. Bay Control Units for Transformer HV & LV side must be parameterized, configured and delivered as per Engineer's requirements.

5.2.6.14 14253 - Bay Control Unit for LV AC & DC

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14253	**Bay Control Unit for LV AC&DC -SWG / Code number: 14253**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 3	
2.2.2	Rated current Ir	A	5	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA		
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 3	
2.3.2	Rated voltage Ph-Ph Ur	V	250	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA		
2.4	mA inputs			
2.4.1	Number of mA inputs	pcs.	Min. 4	
2.4.2	Input range		4-20 mA	
2.5	Binary inputs		Min. 45	
2.5.1	Number of BI groups with common root		Max. 4	
2.5.2	Number of inputs per BI group with common root		Max. 8	
2.5.3	Rated voltage	V d.c.	110	
2.6	Binary outputs		Min. 4	
2.6.1	Number of BO with common contact		Insert	
2.6.2	Rated voltage	V d.c.	110	
2.6.3	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.6.4	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.6.5	Number of tripping contacts (high-speed out-put)	pcs.	Insert	
2.6.6	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.7	LED indications			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7.1	Number of LED's		Insert	
2.7.2	Multi-colour LED's	Yes/No	Insert	
2.8	Communication ports		Yes	
2.8.1	Port for front-connected PC			
2.8.1.1	Protocols supported		Insert	
2.8.1.2	Communication speed	Kbit/s	Insert	
2.8.1.3	PC side connector type		Insert	
2.8.2	System interface			
2.8.2.1	Number of rear ports		2	
2.8.2.2	Protocols supported		IEC 61850	
2.8.2.3	Communication speed	Mbit/s	Min. 100	
2.8.2.4	Connector type		RJ45 or FO	
2.8.3	Time synchronisation		SNTP	
2.9	Human-machine interface			
2.9.1	HMI with single line diagram, measurement, signalling and control		Yes	
2.10	Event recorder			
2.10.1	Max. number of events		Insert	
2.10.2	Time tagging resolution	ms	1	
2.11	Self-supervision		Yes	
2.12	Measurement			
2.12.1	Voltage measurement		Yes	
2.12.2	Frequency measurement		Yes	
2.12.3	Current measurement		Yes	
	Overall compliance with the requirements (yes/no)			

Bay Control Units must be from the same manufacturer as substation protection system. Bay Control Units must be parameterized, configured and delivered as per Engineer's requirements.

5.2.6.15 14254 - Back-Up Control Panel

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14254	**Back-up Control Panel / Code number: 14254**			
1.1	Scheme elements			
1.1.1	Switch selector for HV apparatus	pcs.	1	
1.1.2	Close/open push buttons for HV apparatus		Yes	
1.1.3	Ammeter	pcs.	Min. 1	
1.1.4	Voltmeter	pcs.	1	
1.1.5	Voltmeter selector switch	pcs.	1	
1.1.6	Local/Remote switch		Yes	
1.1.7	Push button for lamp tests		Yes	
1.1.8	Switchgear status indicator		Yes	
1.1.9	Horn on/off switch		Yes	
	Overall compliance with the requirements (yes/no)			

- Back-up control panel must have single-line bay diagram with indicators for switchgear status and push buttons for switchgear control for every HV apparatus in the bay.
- Design proposal of the back-up control panel is subject to Engineer's approval
- Back-up control panels should be delivered completely wired and tested.

5.2.6.16 14255 - Front Panel Annunciation for OHL & Power Transformers

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14255	**Front Panel annunciation for OHL & TR / Code number: 14255**			
1.1	Panel mounting		Yes	
1.2	Number of inputs		Min. 16	
1.3	Contact type		NO/NC	
1.4	Galvanic isolation		Yes	
1.5	Self-monitoring • via front indication • via relay contact		Yes	
1.6	Response delay time		Adjustable	
1.7	Bright LED technology		Yes	
1.8	Audible device output		Yes	
1.9	Lamp test button		Yes	
1.10	Acknowledgement button		Yes	
1.11	Horn acknowledgement button		Yes	
	Overall compliance with the requirements (yes/no)			

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

5.2.6.17 14256 - Front Panel Annunciation for Control Room

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14256	**Front Panel annunciation for Control Room / Code number: 14256**			
1.1	Panel mounting		Yes	
1.2	Number of inputs		Min. 48	
1.3	Contact type		NO/NC	
1.4	Galvanic isolation		Yes	
1.5	Self-monitoring • via front indication • via relay contact		Yes	
1.6	Response delay time		Adjustable	
1.7	Bright LED technology		Yes	
1.8	Audible device output		Yes	
1.9	Lamp test button		Yes	
1.10	Acknowledgement button		Yes	
1.11	Horn acknowledgement button		Yes	
	Overall compliance with the requirements (yes/no)			

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

5.2.6.18 14261 - SCADA Server

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14261	**SCADA Server / Code number: 14261**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Industrial 19" rack	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	Insert	
2.6	Video display adapter type		Insert	
2.7	Video display adapter memory		Insert	
2.8	Hard disc type		Insert	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	Insert	
2.11	Number of hard discs	pcs.	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Serial interface RS232		Yes	
2.15	Number of serial interfaces		Min. 2	
2.16	Fast Ethernet network interface card type		Insert	
2.17	Number of fast Ethernet network interface cards	pcs.	4	
2.18	Fans	Yes/No	Insert	
2.19	Monitor 19"	pcs.	1	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		TFT	
2.19.4	Standards		IEC	
2.19.5	Supply voltage			
2.19.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.19.5.2	Power consumption	W	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

SCADA servers must be in hot-standby redundant configuration.

5.2.6.19 14262- Operator Workstation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14262	**Operator Workstation / Code number: 14262**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Insert	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	Insert	
2.6	Video display adapter type		Dual head capability	
2.7	Video display adapter memory	MB	Insert	
2.8	Hard disc type		Insert	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	Insert	
2.11	Number of hard discs	pcs.	Insert	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Sound card type		Insert	
2.15	Fast Ethernet network interface card type		Insert	
2.16	Number of fast Ethernet network interface cards	pcs.	4	
2.17	Fans	Yes/No	Insert	
2.18	Monitor 24"	pcs.	2	
2.18.1	Manufacturer		Insert	
2.18.2	Country of origin		Insert	
2.18.3	Type		TFT	
2.18.4	Standards		IEC	
2.18.5	Supply voltage			
2.18.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.18.5.2	Power consumption	W	Insert	
2.19	Visible diagonal	"	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.20 14263 - Printer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14263	**Printer / Code number: 14263**			
1.1	Manufacturer		Insert	
1.2	Model		Insert	
1.3	Country of origin		Insert	
1.4	Standards		IEC / ISO	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Type		Colour laser	
2.3	Format		A4	
2.4	Resolution	dpi	Insert	
2.5	Memory	MB	Insert	
2.6	Parallel port	Yes/No	Insert	
2.7	Fast Ethernet port		Yes	
2.8	USB port	Yes/No	Insert	
2.9	Minimum speed	Page/min	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.21 14264- Monitoring Workstation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14264	**Monitoring Workstation / Code number: 14264**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
1.5	Type of housing		Insert	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Processor type		Insert	
2.3	Processor clock	GHz	Insert	
2.4	Memory type		Insert	
2.5	Memory capacity	MB	Insert	
2.6	Video display adapter type		Insert	
2.7	Video display adapter memory	MB	Insert	
2.8	Hard disc type		Insert	
2.9	Rotating hard disc	Yes/No	Insert	
2.10	Hard disc capacity	GB	Insert	
2.11	Number of hard discs	pcs.	Insert	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Sound card type		Insert	
2.15	Serial interface RS232		Yes	
2.16	Fast Ethernet network interface card type		Insert	
2.17	Number of fast Ethernet network interface cards	pcs.	1	
2.18	Fans	Yes/No	Insert	
2.19	Monitor 24"	pcs.	1	
2.19.1	Manufacturer		Insert	
2.19.2	Country of origin		Insert	
2.19.3	Type		TFT	
2.19.4	Standards		IEC	
2.19.5	Supply voltage			
2.19.5.1	Rated auxiliary supply voltage	V a.c.	110 ±15 %	
2.19.5.2	Power consumption	W	Insert	
2.20	Vertical frequency	Hz	Insert	
2.21	Max. resolution		Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.22 14271 - Time Synchronization Device

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

5.2.6.23 14272 - Weather Station

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14272	**Weather Station / Code number: 14272**			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	**Characteristics**			
2.1	Hygro-thermo transmitter with weather thermal radiation shield			
2.1.1	Input	°C	–40..+60	
2.1.1.1	Output	mA	4-20	
2.1.1.2	Accuracy		1/3 Class B (±0.3 K)	
2.1.2	Input	% rel. h	0..100	
2.1.2.1	Output	mA	4-20	
2.1.2.2	Accuracy	% rel. h	±3	
2.2	Wind transmitter	Yes/No		
2.2.1	Input	m/s		
2.2.2	Output	mA		
2.2.3	Accuracy	%		
2.3	Wind direction transmitter	Yes/No		
2.3.1	Input	°		
2.3.2	Output	mA		
2.3.3	Accuracy	°		
2.4	Baro transmitter	Yes/No		
2.4.1	Input	mbar		
2.4.2	Output	mA		
2.5	Interface unit		Yes	
2.6	Overvoltage protection		Yes	
2.7	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

5.2.6.24 14273- Ethernet Switch Process LAN

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14273	**Ethernet Switch-Process LAN / Code number: 14273**			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Ethernet ports			
2.2.1	Number of ports		Min. 6xRJ45 or Min. 6xFO for IED connections AND 2xFO (1 GB) for process LAN	
2.2.1	Type of ports		RJ45 or FO and Fibre Optical (1 GB)	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..50°C	
2.4.2	Storage		–20..+70°C	
2.5	Switching method an layer		Store & Forward Layer 3 (IEC 61850), RSTP (802.1w); eRSTP™ or RSTP (802.1D-2004) network fault recovery	
2.6	Switching latency		≤ 5µs	
2.7	Switching bandwidth		≤ 1.6 Gbps	
2.8	Failsafe output relay		Potential-free	
2.9	Cyber security features			
2.9.1	Multi-level passwords		Yes	
2.9.2	SSH/SSL encryption		Yes	
2.9.3	Enable/disable ports, MAC based port security		Yes	
2.9.4	Port based network access control		Yes	
2.10	System features			
2.10.1	Automatic learning negotiation and crossover detection			
2.10.2	Port configuration, status, statistics, mirroring, security			
2.10.3	Network fault recovery		≤ 5 ms	
2.11	Type Test Reports		To be included with bid	
2.12	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

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

5.2.6.25 14274 - Ethernet Switch Control Room

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14274	**Ethernet Switch-Control Room / Code number: 14274**			
1.1	Terminal Type		Insert	
1.2	Terminal version (software version)		Insert	
1.3	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Dual power supply		Yes	
2.2	Ethernet ports			
2.2.1	Number of ports		Min. 16	
2.2.1	Type of ports		RJ45	
2.3	Immunity to EMI and heavy electrical surges		Insert	
2.4	Temperature range			
2.4.1	Operation		0..50°C	
2.4.2	Storage		–20..+70°C	
2.5	Switching method an layer		Store & Forward Layer 3 (IEC 61850), RSTP (802.1w); eRSTPTM or RSTP (802.1D-2004) network fault recovery	
2.6	Switching latency		≤ 5µs	
2.7	Switching bandwidth		≤ 1.6 Gbps	
2.8	Failsafe output relay		Potential-free	
2.9	Cyber security features			
2.9.1	Multi-level passwords		Yes	
2.9.2	SSH/SSL encryption		Yes	
2.9.3	Enable/disable ports, MAC based port security		Yes	
2.9.4	Port based network access control		Yes	
2.10	System features			
2.10.1	Automatic learning negotiation and crossover detection			
2.10.2	Port configuration, status, statistics, mirroring, security			
2.10.3	Network fault recovery		≤ 5 ms	
2.11	Type Test Reports		To be included with bid	
2.12	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

5.2.6.26 14281 - Protection Monitoring Software

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

5.2.6.27 14282 - SCADA Software

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

5.2.6.28 14298 - Fibre Optic Cables & Terminal Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14298	**Fibre Optic Cables & Terminal Equipment / Code number: 14298**			
1.1	Sufficient quantity of adequate glass fibre optic cables for overall Protection & Control & Monitoring & Metering system should be foreseen and included in the bid.		Yes	
1.2	Below proposed quantities shall be verified according to specific Bidder's design.		Yes	
1.3	Final quantities must be estimated and delivered as per Single Line Diagram and Substation layouts.		Yes	
1.4	At least 20% spare in cable length, as well as in number of fibres in cable, should be foreseen.		Yes	
1.5	Fibre optic ducted cables shall be foreseen.		Yes	
1.6	Type of fibre optic		Multimode	
1.7	Number of fibres in cable		Min. 4	
1.8	Operational Wave length		Insert	
1.9	Attenuation factor maximum		Insert	
1.10	Band-width minimum		Insert	
1.11	Manufacturer		Insert	
2	**Characteristics**			
2.1	Fibre optic terminations. Overall quantities of specific fibre optic terminations should be closely related to number of fibres in each cable (each fibre, used or spare, should be properly terminated). At least 20% spare terminations for each proposed type should be foreseen.		Yes	
2.1.1	Plug connectors type		Insert	
2.1.2	Connection technology		Insert	
2.1.3	Plug pin type		Insert	
2.1.4	Manufacturer		Insert	
2.2	Optical distributor with connectors Overall quantity of Optical Distributor with Connectors should be closely related to number of relay houses. Optical Distributor with Connectors should be foreseen for both cable ends. At least 10% spare Optical Distributors with Connectors should be foreseen.		Yes	
2.2.1	Fibre optic cable gland		To accept metal-free optical cable	
2.2.3	Patch-cord connection		Yes	
2.2.4	Type of optical connectors		Insert	
2.2.5	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3	Patch-cord with optical connectors Overall quantity of fibre optic patch-cord cables should be closely related to number of protection and control devices (terminals) in each particular relay house. At least 20% spare patch-cord cables should be foreseen.		Yes	
	Overall compliance with the requirements (yes/no)			

- Quantities and specifications of optical distributor with connectors and patch-cord with optical connectors predicted according to the optical ring configuration for control and according to the configuration of busbar protection.
- Technical characteristics of fibre optic cables for protection and control have influence on optical ports characteristics of process LAN Ethernet switches.

5.2.6.29 14299 - Special Control Equipment and Tools

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14299	**Special Control Equipment and Tools / Code number: 14299**			
1.1	Special Control Equipment and Tools			
1.1.1	Special equipment and tools for setting, repairing, handling and maintaining of control system	set	1	
1.1.2	Software needed for configuration, setting, commissioning, testing, communication, interfacing with substation system	set	1	
1.1.3	Laptop brand-name computer	pcs.	2	
1.1.4	Test plugs, including all necessary accessories (transport case, cables, plugs, etc.)	set	2	
	Overall compliance with the requirements (yes/no)			

5.2.6.30 14001 - Protection Terminal 230 kV OHL-Main 1

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14001	**Protection Terminal 230 kV OHL-Main 1 / Code number: 14001**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.3	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Minimum 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root			
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Distance protection			
2.10.1	Number of protection zones		Min. 5	
2.10.2	Basic operating time	ms	< 25	
2.10.3	Operational characteristic		Quadrilateral	
2.10.4	Zone 1 direction software selectable		Insert	
2.10.5	Zone 2 direction software selectable		Insert	
2.10.6	Zone 3 direction software selectable		Insert	
2.10.7	Zone 4 direction software selectable		Insert	
2.10.8	Zone 5 direction software selectable		Insert	
2.10.9	Minimum impedance setting	Ω	Insert	
2.10.10	Full scheme protection phase segregated		Yes	
2.11	Communication scheme logic			
2.11.1	Operational modes		Intertrip Permissive under-reach Permissive overreach Blocking	
2.12	Power swing detection		Yes	
2.13	Secondary circuits supervision: • VT circuits supervision • CT circuits supervision		 Yes Yes	
2.14	Automatic switch onto fault logic • Impedance criteria • Instantaneous overcurrent criteria		 Yes Yes	
2.15	Multistage three-phase overcurrent protection			
2.15.1	Directional		Insert	
2.15.2	Number of stages		Min. 2	
2.15.3	Setting range	% Ir	Insert	
2.15.4	Characteristics			
2.15.4.1	Definite time delayed	Yes/no	Yes	
2.15.4.2	Normal inverse	Yes/No	Yes	
2.15.4.3	Very inverse	Yes/No	Insert	
2.15.4.4	Extremely inverse	Yes/No	Insert	
2.16	Multistage earth fault overcurrent protection			
2.16.1	Directional		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.16.2	Number of stages		Min. 2	
2.16.3	Setting range	% Ir	Insert	
2.16.4	Type of protection		Non-directional	
2.16.5	Characteristics			
2.16.5.1	Definite time delayed	Yes/no	Yes	
2.16.5.2	Normal inverse	Yes/No	Yes	
2.16.5.3	Very inverse	Yes/No	Insert	
2.16.5.4	Extremely inverse	Yes/No	Insert	
2.17	Directional earth fault protection			
2.17.1	Number of stages		Insert	
2.17.2	Setting range	% Ir	Insert	
2.17.3	Type of protection		Directional	
2.17.4	Characteristics			
2.17.4.1	Definite time delayed	Yes/no	Yes	
2.17.4.2	Normal inverse	Yes/No	Yes	
2.17.4.3	Very inverse	Yes/No	Insert	
2.17.4.4	Extremely inverse	Yes/No	Insert	
2.17.5	Minimum polarizing voltage	% Ur	3 %	
2.17.6	Communication scheme logic		Yes	
2.17.6.1	Permissive and blocking		Yes	
2.17.7	Single and three-pole tripping schemes		Yes	
2.18	Current negative sequence protection			
2.18.1	Number of stages		Insert	
2.18.2	Setting range	% Ir	Insert	
2.18.3	Characteristic		Definite time	
2.19	Power system supervision			
2.19.1	Broken conductor check		Yes	
2.19.2	Overload protection			
2.19.2.1	Setting range of 1 stage	% Ir	Insert	
2.19.2.2	Time delay range of 1 stage	min	> 20	
2.19.2.3	Setting range of 2 stage	% Ir	Insert	
2.19.2.4	Time delay range of 2 stage	s	> 20	
2.19.2.5	Blocking external (system or HMI)		Yes	
2.19.3	Additional supervision functions (thermal state, etc.)		Insert	
2.20	Autoreclosing			
2.20.1	Number of shots		Min. 2	
2.20.2	AR program		1/3 pole	
2.20.3	Reclosing pulse duration	s	Insert	
2.20.4	Dead time range	s	Insert	
2.20.5	Counters for AR operation		Yes	
2.20.6	Inhibit time range	s	Insert	
2.20.7	Reclaim time range	s	Insert	
2.20.8	Synchronism & energising check during 3 ph AR		Yes	
2.20.9	Evolving faults treatment		Yes	
2.20.10	AR blocking for CB not ready		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.20.11	AR operation 1/3ph in 1st and 2nd zone		Yes	
2.21	Synchronism & energising check			
2.21.1	Frequency difference range	mHz.	Insert	
2.21.2	Voltage difference range	% Ur	Insert	
2.21.3	Phase difference range	°	Insert	
2.21.4	Operating time for synchro check function	ms	Insert	
2.21.5	Operating time for energizing check function	ms	Insert	
2.22	Disturbance recorder			
2.22.1	Number of digital signals		Min. 40	
2.22.2	Number of analogue signals		Min. 8	
2.22.3	External/manual initiation of recording		Yes	
2.22.4	Sampling rate	kHz	Insert	
2.22.5	Pre-fault time	ms	≥ 300	
2.22.6	Recording time	ms	≥ 2000	
2.22.7	Number of recorded disturbances		Min. 5	
2.22.8	Total recording time with max. analogue and binary signals	s	> 10	
2.22.9	Output file comtrade format		Yes	
2.23	Event recorder			
2.23.1	Max. number of events		Insert	
2.23.2	Time tagging resolution	ms	1	
2.24	Fault locator, measurement in (km)		Yes	
2.25	Self-supervision		Yes	
2.26	Measurement			
2.26.1	Active power measurement		Yes	
2.26.2	Reactive power measurement		Yes	
2.26.3	Voltage measurement		Yes	
2.26.4	Current measurement		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.31 14002 - Protection Terminal 230 kV OHL Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14002	**Protection Terminal 230 kV OHL Main 2 / Code number: 14002**			
1.1	Manufacturer		Different than Main 1	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Distance protection			
2.10.1	Number of protection zones		Min. 5	
2.10.2	Basic operating time	ms	< 25	
2.10.3	Operational characteristic		Quadrilateral	
2.10.4	Zone 1 direction software selectable		Insert	
2.10.5	Zone 2 direction software selectable		Insert	
2.10.6	Zone 3 direction software selectable		Insert	
2.10.7	Zone 4 direction software selectable		Insert	
2.10.8	Zone 5 direction software selectable		Insert	
2.10.9	Minimum impedance setting	Ω	Insert	
2.10.10	Full scheme protection phase segregated		Yes	
2.11	Communication scheme logic			
2.11.1	Operational modes		Intertrip Permissive under-reach Permissive overreach Blocking	
2.12	Power swing detection		Yes	
2.13	Secondary circuits supervision: • VT circuits supervision • CT circuits supervision		 Yes Yes	
2.14	Automatic switch onto fault logic • Impedance criteria • Instantaneous overcurrent criteria		 Yes Yes	
2.15	Multistage three-phase overcurrent protection			
2.15.1	Directional		Insert	
2.15.2	Number of stages		Min. 2	
2.15.3	Setting range	% Ir	Insert	
2.15.4	Characteristics			
2.15.4.1	Definite time delayed	Yes/no	Yes	
2.15.4.2	Normal inverse	Yes/No	Yes	
2.15.4.3	Very inverse	Yes/No	Insert	
2.15.4.4	Extremely inverse	Yes/No	Insert	
2.16	Multistage earth fault overcurrent protection			
2.16.1	Directional		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.16.2	Number of stages		Min. 2	
2.16.3	Setting range	% Ir	Insert	
2.16.4	Type of protection		Non-directional	
2.16.5	Characteristics			
2.16.5.1	Definite time delayed	Yes/no	Yes	
2.16.5.2	Normal inverse	Yes/No	Yes	
2.16.5.3	Very inverse	Yes/No	Insert	
2.16.5.4	Extremely inverse	Yes/No	Insert	
2.17	Directional earth fault protection			
2.17.1	Number of stages		Insert	
2.17.2	Setting range	% Ir	Insert	
2.17.3	Type of protection		Directional	
2.17.4	Characteristics			
2.17.4.1	Definite time delayed	Yes/no	Yes	
2.17.4.2	Normal inverse	Yes/No	Yes	
2.17.4.3	Very inverse	Yes/No	Insert	
2.17.4.4	Extremely inverse	Yes/No	Insert	
2.17.5	Minimum polarizing voltage	% Ur	3 %	
2.17.6	Communication scheme logic		Yes	
2.17.6.1	Permissive and blocking		Yes	
2.17.7	Single and three-pole tripping schemes		Yes	
2.18	Current negative sequence protection			
2.18.1	Number of stages		Insert	
2.18.2	Setting range	% Ir	Insert	
2.18.3	Characteristic		Definite time	
2.19	Power system supervision			
2.19.1	Broken conductor check		Yes	
2.19.2	Overload protection			
2.19.2.1	Setting range of 1 stage	% Ir	Insert	
2.19.2.2	Time delay range of 1 stage	min	> 20	
2.19.2.3	Setting range of 2 stage	% Ir	Insert	
2.19.2.4	Time delay range of 2 stage	s	> 20	
2.19.2.5	Blocking external (system or HMI)		Yes	
2.19.3	Additional supervision functions (thermal state, etc.)		Insert	
2.20	Autoreclosing			
2.20.1	Number of shots		Min. 2	
2.20.2	AR program		1/3 pole	
2.20.3	Reclosing pulse duration	s	Insert	
2.20.4	Dead time range	s	Insert	
2.20.5	Counters for AR operation		Yes	
2.20.6	Inhibit time range	s	Insert	
2.20.7	Reclaim time range	s	Insert	
2.20.8	Synchronism & energising check during 3 ph AR		Yes	
2.20.9	Evolving faults treatment		Yes	
2.20.10	AR blocking for CB not ready		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.20.11	AR operation 1/3ph in 1st and 2nd zone		Yes	
2.21	Synchronism & energising check			
2.21.1	Frequency difference range	mHz.	Insert	
2.21.2	Voltage difference range	% Ur	Insert	
2.21.3	Phase difference range	°	Insert	
2.21.4	Operating time for synchro check function	ms	Insert	
2.21.5	Operating time for energising check function	ms	Insert	
2.22	Disturbance recorder			
2.22.1	Number of digital signals		Min. 40	
2.22.2	Number of analogue signals		Min. 8	
2.22.3	External/manual initiation of recording		Yes	
2.22.4	Sampling rate	kHz	Insert	
2.22.5	Pre-fault time	ms	≥ 300	
2.22.6	Recording time	ms	≥ 2000	
2.22.7	Number of recorded disturbances		Min. 5	
2.22.8	Total recording time with max. analogue and binary signals	s	> 10	
2.22.9	Output file comtrade format		Yes	
2.23	Event recorder			
2.23.1	Max. number of events		Insert	
2.23.2	Time tagging resolution	ms	1	
2.24	Fault locator, measurement in (km)		Yes	
2.25	Self-supervision		Yes	
2.26	Measurement			
2.26.1	Active power measurement		Yes	
2.26.2	Reactive power measurement		Yes	
2.26.3	Voltage measurement		Yes	
2.26.4	Current measurement		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.32 14003 - Protection Terminal 132 kV OHL Main 1

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14003	**Protection Terminal 132 kV OHL Main 1 / Code number: 14003**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16 (code 14004) Min. 24 (code 14004A)	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.5	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.6	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.7	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.8	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	
2.6.2	Multi-colour LED's	Yes/No	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Line differential protection			
2.10.1	Sensitive differential current trip stage		Yes	
2.10.2	High current differential trip stage		Yes	
2.10.3	Inrush restraint 2^{nd} harmonic		Yes	
2.10.4	Crossblock function		Yes	
2.10.5	Operating time, typical	ms	< 30	
2.10.6	Resetting time at I_{diff}=0	ms	Insert	
2.10.7	Transfer trip operating time	ms	< 40	
2.11	Remote end data communication			
2.11.1	Transmission type		Insert	
2.11.2	Data transfer rate	Kbit/s	Insert	
2.11.3	FO protection interface			
2.11.3.1	Type of fibre optic	µm	Insert	
2.11.3.2	Connector type		Insert	
2.11.3.3	Wavelength	nm	1300	
2.11.3.4	Optical transmitter injected power	dBm	Insert	
2.11.3.5	Optical receiver sensitivity	dBm	Insert	
2.11.3.6	Transmission distance (estimated)	km	Min. 15	
2.12	Back-up Distance protection			
2.12.1	Number of protection zones		Min. 4	
2.12.2	Operating time	ms	< 35	
2.12.3	Operating characteristic		quadrilateral	
2.12.4	Zone 1 direction software selectable		Insert	
2.12.5	Zone 2 direction software selectable		Insert	
2.12.6	Zone 3 direction software selectable		Insert	
2.12.7	Zone 4 direction software selectable		Insert	
2.12.8	Minimum impedance setting	Ω	Insert	
2.12.9	Full scheme protection phase segregated		Yes	
2.13	Communication scheme logic			
2.13.1	Operational modes		Intertrip Permissive under-reach Permissive overreach Blocking	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.14	Power swing detection		Yes	
2.15	Secondary circuits supervision: • VT circuits supervision • CT circuits supervision		 Yes Yes	
2.16	Automatic switch onto fault logic • Impedance criteria • Instantaneous overcurrent criteria		 Yes Yes	
2.17	Multistage three-phase overcurrent protection			
2.17.1	Directional		Insert	
2.17.2	Number of stages		Min. 2	
2.17.3	Setting range	% Ir	Insert	
2.17.4	Characteristics			
2.17.4.1	Definite time delayed	Yes/no	Yes	
2.17.4.2	Normal inverse	Yes/No	Yes	
2.17.4.3	Very inverse	Yes/No	Insert	
2.17.4.4	Extremely inverse	Yes/No	Insert	
2.18	Multistage earth fault overcurrent protection			
2.18.1	Directional		Insert	
2.18.2	Number of stages		Min. 2	
2.18.3	Setting range	% Ir	Insert	
2.18.4	Type of protection		Non-directional	
2.18.5	Characteristics			
2.18.5.1	Definite time delayed	Yes/no	Yes	
2.18.5.2	Normal inverse	Yes/No	Yes	
2.18.5.3	Very inverse	Yes/No	Insert	
2.18.5.4	Extremely inverse	Yes/No	Insert	
2.19	Current negative sequence protection			
2.19.1	Number of stages		Insert	
2.19.2	Setting range	% Ir	Insert	
2.19.3	Characteristic		Insert	
2.20	Directional earth fault protection			
2.20.1	Number of stages		Insert	
2.20.2	Setting range	% Ir	Insert	
2.20.3	Type of protection		Directional	
2.20.4	Characteristics			
2.20.4.1	Definite time delayed	Yes/no	Yes	
2.20.4.2	Normal inverse	Yes/No	Yes	
2.20.4.3	Very inverse	Yes/No	Insert	
2.20.4.4	Extremely inverse	Yes/No	Insert	
2.20.5	Minimum polarizing voltage	% Ur	3 %	
2.20.6	Communication scheme logic		Yes	
2.20.6.1	Permissive and blocking		Yes	
2.20.7	Single and three-pole tripping schemes		Yes	
2.21	Power system supervision			
2.21.1	Broken conductor check		Yes	
2.21.2	Overload protection			
2.21.2.1	Setting range of 1 stage	% Ir	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.21.2.2	Time delay range of 1 stage	min	> 20	
2.21.2.3	Setting range of 2 stage	% Ir	Insert	
2.21.2.4	Time delay range of 2 stage	s	> 20	
2.21.2.5	Blocking external (system or HMI)		Yes	
2.22	Autoreclosing			
2.22.1	Number of shots		Min. 2	
2.22.2	AR program		1/3 pole	
2.22.3	Reclosing pulse duration	s	Insert	
2.22.4	Dead time range	s	Insert	
2.22.5	Counters for AR operation		Yes	
2.22.6	Inhibit time range	s	Insert	
2.22.7	Reclaim time range	s	Insert	
2.22.8	Synchronism & energising check during 3 ph AR		Yes	
2.22.9	Evolving faults treatment		Yes	
2.22.10	AR blocking for CB not ready		Yes	
2.22.11	AR operation 1/3ph in 1st and 2nd zone		Yes	
2.23	Synchronism & energising check			
2.23.1	Frequency difference range	mHz.	Insert	
2.23.2	Voltage difference range	% Ur	Insert	
2.23.3	Phase difference range	°	Insert	
2.23.4	Operating time for synchro check function	ms	Insert	
2.23.5	Operating time for energising check function	ms	Insert	
2.24	Disturbance recorder			
2.24.1	Number of digital signals		Min. 40	
2.24.2	Number of analogue signals		Min. 8	
2.24.3	External/manual initiation of recording		Insert	
2.24.4	Sampling rate	kHz	Insert	
2.24.5	Pre-fault time	ms	≥ 300	
2.24.6	Recording time	ms	≥ 2000	
2.24.7	Number of recorded disturbances		Min. 5	
2.24.8	Total recording time with max. analogue and binary signals	s	> 10	
2.24.9	Output file comtrade format		Yes	
2.25	Event recorder			
2.25.1	Max. number of events		Insert	
2.25.2	Time tagging resolution	ms	1	
2.26	Fault locator, measurement in (km)		Yes	
2.27	Self-supervision		Yes	
2.28	Measurement			
2.28.1	Active power measurement		Yes	
2.28.2	Reactive power measurement		Yes	
2.28.3	Voltage measurement		Yes	
2.28.4	Current measurement		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.33 14004 - Protection Terminal 132 kV OHL Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14004	**Protection Terminal 132 kV OHL Main 2 / Code number: 14004**			
1.1	Manufacturer		Different than Main 1	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	
2.6.2	Multi-colour LED's	Yes/No	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Distance protection			
2.10.1	Number of protection zones		Min. 5	
2.10.2	Basic operating time	ms	< 30	
2.10.3	Operational characteristic		Quadrilateral	
2.10.4	Zone 1 direction software selectable		Insert	
2.10.5	Zone 2 direction software selectable		Insert	
2.10.6	Zone 3 direction software selectable		Insert	
2.10.7	Zone 4 direction software selectable		Insert	
2.10.8	Zone 5 direction software selectable		Insert	
2.10.9	Minimum impedance setting	Ω	Insert	
2.11	Communication scheme logic			
2.11.1	Operational modes		Intertrip Permissive under-reach Permissive overreach Blocking	
2.12	Power swing detection		Yes	
2.13	Secondary circuits supervision: • VT circuits supervision • CT circuits supervision		 Yes Yes	
2.14	Automatic switch onto fault logic • Impedance criteria • Instantaneous overcurrent criteria		 Yes Yes	
2.15	Multistage three-phase overcurrent protection			
2.15.1	Directional		Insert	
2.15.2	Number of stages		Min. 2	
2.15.3	Setting range	% Ir	Insert	
2.15.4	Characteristics			
2.15.4.1	Definite time delayed	Yes/no	Yes	
2.15.4.2	Normal inverse	Yes/No	Yes	
2.15.4.3	Very inverse	Yes/No	Insert	
2.15.4.4	Extremely inverse	Yes/No	Insert	
2.16	Multistage earth fault overcurrent protection			
2.16.1	Directional		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.16.2	Number of stages		Min. 2	
2.16.3	Setting range	% Ir	Insert	
2.16.4	Type of protection		Non-directional	
2.16.5	Characteristics			
2.16.5.1	Definite time delayed	Yes/no	Yes	
2.16.5.2	Normal inverse	Yes/No	Yes	
2.16.5.3	Very inverse	Yes/No	Insert	
2.16.5.4	Extremely inverse	Yes/No	Insert	
2.17	Directional earth fault protection			
2.17.1	Number of stages		Insert	
2.17.2	Setting range	% Ir	Insert	
2.17.3	Type of protection		Directional	
2.17.4	Characteristics			
2.17.4.1	Definite time delayed	Yes/no	Yes	
2.17.4.2	Normal inverse	Yes/No	Yes	
2.17.4.3	Very inverse	Yes/No	Insert	
2.17.4.4	Extremely inverse	Yes/No	Insert	
2.17.5	Minimum polarizing voltage	% Ur	3 %	
2.17.6	Communication scheme logic		Yes	
2.17.6.1	Permissive and blocking		Yes	
2.17.7	Single and three-pole tripping schemes		Yes	
2.18	Current negative sequence protection			
2.18.1	Number of stages		Insert	
2.18.2	Setting range	% Ir	Insert	
2.18.3	Characteristic		Definite time	
2.19	Power system supervision			
2.19.1	Broken conductor check		Yes	
2.19.2	Overload protection			
2.19.2.1	Setting range of 1 stage	% Ir	Insert	
2.19.2.2	Time delay range of 1 stage	min	> 20	
2.19.2.3	Setting range of 2 stage	% Ir	Insert	
2.19.2.4	Time delay range of 2 stage	s	> 20	
2.19.2.5	Blocking external (system or HMI)		Yes	
2.19.3	Additional supervision functions (thermal state, etc.)		Insert	
2.20	Autoreclosing			
2.20.1	Number of shots		Min. 2	
2.20.2	AR program		1/3 pole	
2.20.3	Reclosing pulse duration	s	Insert	
2.20.4	Dead time range	s	Insert	
2.20.5	Counters for AR operation		Yes	
2.20.6	Inhibit time range	s	Insert	
2.20.7	Reclaim time range	s	Insert	
2.20.8	Synchronism & energising check during 3 ph AR		Yes	
2.20.9	Evolving faults treatment		Yes	
2.20.10	AR blocking for CB not ready		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.20.11	AR operation 1/3ph in 1st and 2nd zone		Yes	
2.21	Synchronism & energising check			
2.21.1	Frequency difference range	mHz.	Insert	
2.21.2	Voltage difference range	% Ur	Insert	
2.21.3	Phase difference range	°	Insert	
2.21.4	Operating time for synchro check function	ms	Insert	
2.21.5	Operating time for energising check function	ms	Insert	
2.22	Disturbance recorder			
2.22.1	Number of digital signals		Min. 40	
2.22.2	Number of analogue signals		Min. 8	
2.22.3	External/manual initiation of recording		Yes	
2.22.4	Sampling rate	kHz	Insert	
2.22.5	Pre-fault time	ms	≥ 300	
2.22.6	Recording time	ms	≥ 2000	
2.22.7	Number of recorded disturbances		Min. 5	
2.22.8	Total recording time with max. analogue and binary signals	s	> 10	
2.22.9	Output file comtrade format		Yes	
2.23	Event recorder			
2.23.1	Max. number of events		Insert	
2.23.2	Time tagging resolution	ms	1	
2.24	Fault locator, measurement in (km)		Yes	
2.25	Self-supervision		Yes	
2.26	Measurement			
2.26.1	Active power measurement		Yes	
2.26.2	Reactive power measurement		Yes	
2.26.3	Voltage measurement		Yes	
2.26.4	Current measurement		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Main Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.34 14005 - Protection Terminal for Power Transformers Main 1

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14005	**Protection Terminal for Power Transformers Main 1 / Code number: 14005**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 9	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0,3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	
2.6.2	Multi-colour LED's	Yes/No	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Autotransformer / Transformer Differential protection			
2.10.1	Inrush restraint		Yes	
2.10.2	Over excitation restraint		Yes	
2.10.3	Basic differential current range	% Ir	Insert	
2.10.4	Operating characteristic with 2 slope		Yes	
2.10.5	High non-restraint differential current range	% Ir	Insert	
2.10.6	Operating time	ms	< 30	
2.10.7	Internal CT ratio and vector group compensation		Yes	
2.10.8	Cross block function		Yes	
2.10.9	Zero sequence subtraction		Yes	
2.11	Restricted earth fault protection for autotransformer / transformer			
2.11.1	Low Impedance		Yes	
2.11.2	Internal CT ratio vector group compensation		Yes	
2.11.3	Basic differential current range	% Ir	Insert	
2.11.4	Operating time	ms	< 30	
2.12	Current negative sequence protection			
2.12.1	Number of stages		Insert	
2.12.2	Setting range	% Ir	Insert	
2.12.3	Characteristic		Insert	
2.13	Multistage three-phase overcurrent protection	pcs.	Min. 2	
2.13.1	Instantaneous overcurrent protection with inrush restraint			
2.13.1.1	Setting range	% Ir	Insert	
2.13.1.2	Min. operating time at $I > 10*I_{set}$	ms	< 30	
2.13.2	Time delayed overcurrent protection			
2.13.2.1	Setting range	% Ir	Insert	
2.13.2.2	Type of protection		Non-directional	
2.13.2.3	Characteristics			
2.13.2.3.1	Definite time delayed	Yes/no	Yes	
2.13.2.3.2	Normal inverse	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13.2.3.3	Very inverse	Yes/No	Insert	
2.13.2.3.4	Extremely inverse	Yes/No	Insert	
2.14	Multistage earth fault overcurrent protection	pcs.	Min. 2	
2.14.1	Instantaneous earth fault overcurrent protection with inrush restraint			
2.14.1.1	Setting range	% Ir	Insert	
2.14.1.2	Min. operating time at $I > 10*I_{set}$	ms	< 30	
2.14.2	Time delayed earth fault overcurrent protection			
2.14.2.1	Setting range	% Ir	Insert	
2.14.2.2	Type of protection		Non-directional	
2.14.2.3	Characteristics			
2.14.2.3.1	Definite time delayed	Yes/no	Yes	
2.14.2.3.2	Normal inverse	Yes/No	Yes	
2.14.2.3.3	Very inverse	Yes/No	Insert	
2.14.2.3.4	Extremely inverse	Yes/No	Insert	
2.15	Thermal overload protection		Yes	
2.16	Disturbance recorder			
2.16.1	Number of digital signals		Min. 40	
2.16.2	Number of analogue signals		Min. 9	
2.16.3	External/manual initiation of recording			
2.16.4	Sampling rate	kHz	Insert	
2.16.5	Pre-fault time	ms	≥ 300	
2.16.6	Recording time	ms	≥ 2000	
2.16.7	Number of recorded disturbances		Min. 5	
2.16.8	Total recording time with max. analogue and binary signals	s	> 10	
2.16.9	Output file comtrade format		Yes	
2.17	Event recorder			
2.17.1	Max. number of events		Insert	
2.17.2	Time tagging resolution	ms	1	
2.18	Self-supervision		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.35 14006 - Protection Terminal for Power Transformers Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14006	**Protection Terminal for Power Transformers Main 2 / Code number: 14006**			
1.1	Manufacturer		Different than Main 1	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 9	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0,3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Autotransformer / Transformer Differential protection			
2.10.1	Inrush restraint		Yes	
2.10.2	Overexcitation restraint		Yes	
2.10.3	Basic differential current range	% Ir	Insert	
2.10.4	Operating characteristic with 2 slope		Yes	
2.10.5	High non-restraint differential current range	% Ir	Insert	
2.10.6	Operating time	ms	< 30	
2.10.7	Internal CT ratio and vector group compen-sation		Yes	
2.10.8	Crossblock function		Yes	
2.10.9	Zero sequence subtraction		Yes	
2.11	Restricted earth fault protection for auto-transformer / transformer			
2.11.1	Low Impedance		Yes	
2.11.2	Internal CT ratio vector group compensation		Yes	
2.11.3	Basic differential current range	% Ir	Insert	
2.11.4	Operating time	ms	< 30	
2.12	Current negative sequence protection			
2.12.1	Number of stages		Insert	
2.12.2	Setting range	% Ir	Insert	
2.12.3	Characteristic		Insert	
2.13	Multistage three-phase overcurrent protec-tion	pcs.	Min. 2	
2.13.1	Instantaneous overcurrent protection with in-rush restraint			
2.13.1.1	Setting range	% Ir	Insert	
2.13.1.2	Min. operating time at $I > 10*I_{set}$	Ms	< 30	
2.13.2	Time delayed overcurrent protection			
2.13.2.1	Setting range	% Ir	Insert	
2.13.2.2	Type of protection		Non-directional	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13.2.3	Characteristics			
2.13.2.3.1	Definite time delayed	Yes/no	Yes	
2.13.2.3.2	Normal inverse	Yes/No	Yes	
2.13.2.3.3	Very inverse	Yes/No	Insert	
2.13.2.3.4	Extremely inverse	Yes/No	Insert	
2.14	Multistage earth fault overcurrent protection	pcs.	Min. 2	
2.14.1	Instantaneous earth fault overcurrent protection with inrush restraint			
2.14.1.1	Setting range	% Ir	Insert	
2.14.1.2	Min. operating time at $I > 10*I_{set}$	Ms	< 30	
2.14.2	Time delayed earth fault overcurrent protection			
2.14.2.1	Setting range	% Ir	Insert	
2.14.2.2	Type of protection		Non-directional	
2.14.2.3	Characteristics			
2.14.2.3.1	Definite time delayed	Yes/no	Yes	
2.14.2.3.2	Normal inverse	Yes/No	Yes	
2.14.2.3.3	Very inverse	Yes/No	Insert	
2.14.2.3.4	Extremely inverse	Yes/No	Insert	
2.15	Thermal overload protection		Yes	
2.16	Disturbance recorder			
2.16.1	Number of digital signals		Min. 40	
2.16.2	Number of analogue signals		Min. 9	
2.16.3	External/manual initiation of recording			
2.16.4	Sampling rate	kHz	Insert	
2.16.5	Pre-fault time	ms	≥ 300	
2.16.6	Recording time	ms	≥ 2000	
2.16.7	Number of recorded disturbances		Min. 5	
2.16.8	Total recording time with max. analogue and binary signals	s	> 10	
2.16.9	Output file comtrade format		Yes	
2.17	Event recorder			
2.17.1	Max. number of events		Insert	
2.17.2	Time tagging resolution	ms	1	
2.18	Self-supervision		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.36 14007 - Protection Terminal for LV side of Power Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14007	**Protection Terminal for LV side of Power Transformer / Code number: 14007**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 16	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		< 8	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 16	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed out-put)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Distance protection			
2.10.1	Number of protection zones		Min. 5	
2.10.2	Basic operating time	ms	< 30	
2.10.3	Operational characteristic		Quadrilateral	
2.10.4	Zone 1 direction software selectable		Yes (F/R/ND)	
2.10.5	Zone 2 direction software selectable		Yes (F/R/ND)	
2.10.6	Zone 3 direction software selectable		Yes (F/R/ND)	
2.10.7	Zone 4 direction software selectable		Yes (F/R/ND)	
2.10.8	Zone 5 direction software selectable		Yes (F/R/ND)	
2.10.9	Minimum impedance setting	Ω	Insert	
2.10.10	Full scheme protection phase segregated		Yes	
2.11	Power swing detection		Yes	
2.12	Secondary circuits supervision: • VT circuits supervision • CT circuits supervision		 Yes Yes	
2.13	Automatic switch onto fault logic • Impedance criteria • Instantaneous overcurrent criteria		 Yes Yes	
2.14	Multistage three-phase overcurrent protection			
2.14.1	Number of stages		Min. 2	
2.14.2	Setting range	% Ir	Insert	
2.14.3	Characteristics			
2.14.3.1	Definite time delayed	Yes/no	Yes	
2.14.3.2	Normal inverse	Yes/No	Yes	
2.14.3.3	Very inverse	Yes/No	Insert	
2.14.3.4	Extremely inverse	Yes/No	Insert	
2.15	Multistage earth fault overcurrent protection			
2.15.1	Number of stages		Min. 2	
2.15.2	Setting range	% Ir	Insert	
2.15.3	Type of protection		Non-directional	
2.15.4	Characteristics			
2.15.4.1	Definite time delayed	Yes/no	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.15.4.2	Normal inverse	Yes/No	Yes	
2.15.4.3	Very inverse	Yes/No	Insert	
2.15.4.4	Extremely inverse	Yes/No	Insert	
2.16	Directional earth fault protection			
2.16.1	Number of stages		Insert	
2.16.2	Setting range	% Ir	Insert	
2.16.3	Type of protection		Insert	
2.16.4	Characteristics			
2.16.4.1	Definite time delayed	Yes/no	Insert	
2.16.4.2	Normal inverse	Yes/No	Insert	
2.16.4.3	Very inverse	Yes/No	Insert	
2.16.4.4	Extremely inverse	Yes/No	Insert	
2.16.5	Minimum polarizing voltage	% Ur	Insert	
2.16.6	Communication scheme logic		Insert	
2.17	Power system supervision			
2.17.1	Broken conductor check		Yes	
2.18	Disturbance recorder			
2.18.1	Number of digital signals		Min. 40	
2.18.2	Number of analogue signals		Min. 8	
2.18.3	External/manual initiation of recording		Insert	
2.18.4	Sampling rate	kHz	Insert	
2.18.5	Pre-fault time	ms	≥ 300	
2.18.6	Recording time	ms	≥ 2000	
2.18.7	Number of recorded disturbances		Min. 5	
2.18.8	Total recording time with max. analogue and binary signals	s	> 10	
2.18.9	Output file comtrade format		Yes	
2.19	Event recorder			
2.19.1	Max. number of events		Insert	
2.19.2	Time tagging resolution	ms	1	
2.20	Self-supervision		Yes	
2.21	Measurement			
2.21.1	Active power measurement		Yes	
2.21.2	Reactive power measurement		Yes	
2.21.3	Voltage measurement		Yes	
2.21.4	Current measurement		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.37 14008 - Automatic Voltage Regulation

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14008	**Automatic Voltage Regulation / Code number: 14008**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		1	
2.2.2	Rated current for 110 kV	A	1	
2.2.3	Permissive overload, continuous		3xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Voltage control function			
2.4.1	Set voltage range	% U_{r2}	Insert	
2.4.2	Set voltage dead-band range	% U_{r2}	Insert	
2.4.3	Upper limit busbar voltage range	% U_{r2}	Insert	
2.4.4	Lower limit busbar voltage range	% U_{r2}	Insert	
2.4.5	Line voltage drop compensation	Yes/No	Insert	
2.4.6	Regulation for capacitive load	Yes/No	Insert	
2.4.7	Undervoltage blocking range	% U_{r2}	Insert	
2.4.8	Overcurrent blocking range	% I_r	Insert	
2.4.9	Parallel operation		Yes	
2.4.10	Parallel operation principal		Insert	
2.5	Communication ports		Yes	
2.5.1	Port for front-connected PC			
2.5.1.1	Protocols supported		Insert	
2.5.1.2	Communication speed	Kbit/s	Insert	
2.5.1.3	PC side connector type		Insert	
2.5.2	System interface			
2.5.2.1	Number of rear ports		Min. 1	
2.5.2.2	Protocols supported		IEC 61850	
2.5.2.3	Communication speed	Mbit/s	Min. 100	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5.2.4	Connector type		RJ45 or FO	
2.5.3	External time synchronisation		Insert	
2.6	Tap changer, tap position		BCD code	
2.7	Self-supervision		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Automatic Voltage Regulator approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.38 14009 - Protection Terminal for Bus couplers 230 kV & 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14009	**Protection Terminal for Bus couplers 230 kV & 132 kV / Code number: 14009**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph Ur	V	100	
2.3.3	Permissive overload, continuous	% Ur	150	
2.3.4	Permissive overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Binary inputs		Min. 8	
2.4.1	Number of BI groups with common root		Insert	
2.4.2	Number of inputs per BI group with common root		Insert	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.5	Binary outputs		Min. 8	
2.5.1	Number of modules		Insert	
2.5.2	Number of outputs per group with common root		Max. 3	
2.5.3	Rated voltage	V d.c.	110 ±15 %	
2.5.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.5.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.5.6	Number of tripping contacts (high-speed output)	pcs.	6	
2.5.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.6	LED indications			
2.6.1	Number of LED's		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.6.2	Multi-colour LED's	Yes/No	Insert	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Multistage three-phase overcurrent protection			
2.10.1	Instantaneous overcurrent protection			
2.10.1.1	Setting range	% Ir	Insert	
2.10.1.2	Min. operating time at $I > 10*I_{set}$	ms	30	
2.10.2	Time delayed overcurrent protection			
2.10.2.1	Setting range	% Ir	Insert	
2.10.2.2	Type of protection		Non-directional	
2.10.2.3	Characteristics			
2.10.2.3.1	Definite time delayed	Yes/no	Yes	
2.10.2.3.2	Normal inverse	Yes/No	Yes	
2.10.2.3.3	Very inverse	Yes/No	Insert	
2.10.2.3.4	Extremely inverse	Yes/No	Insert	
2.11	Multistage earth fault overcurrent protection			
2.11.1	Instantaneous earth fault overcurrent protection			
2.11.1.1	Setting range	% Ir	Insert	
2.11.1.2	Min. operating time at $I > 10*I_{set}$	ms	30	
2.11.2	Time delayed earth fault overcurrent protection			
2.11.2.1	Setting range	% Ir	Insert	
2.11.2.2	Type of protection		Non-directional	
2.11.2.3	Characteristics			
2.11.2.3.1	Definite time delayed	Yes/no	Yes	
2.11.2.3.2	Normal inverse	Yes/No	Yes	
2.11.2.3.3	Very inverse	Yes/No	Insert	
2.11.2.3.4	Extremely inverse	Yes/No	Insert	
2.12	Directional earth fault protection			
2.12.1	Number of stages		Insert	
2.12.2	Setting range	% Ir	Insert	
2.12.3	Type of protection		Directional	
2.13.4	Characteristics			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.13.4.1	Definite time delayed	Yes/no	Yes	
2.13.4.2	Normal inverse	Yes/No	Yes	
2.13.4.3	Very inverse	Yes/No	Insert	
2.13.4.4	Extremely inverse	Yes/No	Insert	
2.13.5	Minimum polarising voltage	% Ur	3 %	
2.14	Current negative sequence protection			
2.14.1	Number of stages		Insert	
2.14.2	Setting range	% Ir	Insert	
2.14.3	Characteristic		Insert	
2.15	Disturbance recorder			
2.15.1	Number of digital signals		Min. 40	
2.15.2	Number of analogue signals		Min. 8	
2.15.3	External/manual initiation of recording		Insert	
2.15.4	Sampling rate	kHz	Insert	
2.15.5	Pre-fault time	ms	≥ 300	
2.15.6	Recording time	ms	≥ 2000	
2.15.7	Number of recorded disturbances		Min. 5	
2.15.8	Total recording time with max. analogue and binary signals	s	> 10	
2.15.9	Output file comtrade format		Yes	
2.16	Event recorder			
2.16.1	Max. number of events		Insert	
2.16.2	Time tagging resolution	ms	1	
2.17	Self-supervision		Yes	
3	**Additional requirements**			
3.1	Test socket		Yes	
3.2	Setting and configuration of Protection Terminal approved by Engineer		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.39 14010 - Busbar and Breaker Failure Protection for 230 and 132 kV Busbars

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14010	**Busbar and Breaker failure protection for 230 and 132 kV Busbars/Code number: 14010**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type of installation		Distributed	
1.4	Standards		IEC	
1.5	Central Unit (CU)			
1.5.1	Terminal type		Insert	
1.5.2	Terminal version (software version)		Insert	
1.5.3	Central unit for busbar protection must be supported for min. 16 bays		Yes	
1.6	Bay Unit (BU)			
1.6.1	Terminal type		Insert	
1.6.2	Terminal version (software version)		Insert	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	CU, BU Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	CU auxiliary supply redundant		Yes	
2.1.3	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	 ms s	 > 50 Insert	
2.2	a.c. current inputs BU			
2.2.1	Number of inputs		Min. 3	
2.2.2	Rated current Ir	A	1	
2.2.3	Permissive overload, continuous		4xIr	
2.2.4	Permissive overload, 1 s		100xIr	
2.2.5	Burden at Ir	VA	< 0.5	
2.3	Binary inputs CU, BU		Min. 20 / 8	
2.3.1	Number of modules		Insert	
2.3.2	Number of inputs per module		Insert	
2.3.3	Rated voltage	V d.c.	110 ±15 %	
2.4	Binary outputs CU, BU		Min. 6 / 4	
2.4.1	Number of modules		Insert	
2.4.2	Number of outputs per module		Insert	
2.4.3	Rated voltage	V d.c.	110 ±15 %	
2.4.4	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.4.5	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.4.6	Number of tripping contacts (high-speed out-put)	pcs.	Min. 3	
2.4.7	Current carrying capacity at rated voltage for tripping contacts, continuous	A	5	
2.5	LED indications CU, BU			
2.5.1	Number of LED's		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5.2	Multi-colour LED's	Yes/No	Insert	
2.6	Communication ports CU, BU			
2.6.1	Port for front-connected PC			
2.6.1.1	Protocols supported		Insert	
2.6.1.2	Communication speed	Kbit/s	Insert	
2.6.1.3	PC connector type		Insert	
2.6.2	CU, BU communication media		FO	
2.6.3	CU rear station (system) communication ports			
2.6.3.1	Number of rear ports		Insert	
2.6.3.2	Protocols supported		IEC 61850	
2.6.3.3	Communication speed	Mbit/s	Insert	
2.6.3.4	Connector type		RJ45	
2.6.4	Time synchronisation		SNTP	
2.7	Busbar differential protection			
2.7.1	Operating time	ms	< 20	
2.7.2	Internal CT radio adaptability		Yes	
2.7.3	Multiple tripping criteria, check and bus zone		Yes	
2.7.4	Current transformer supervision		Yes	
2.7.5	External signal of load transfer starting		Insert	
2.7.6	Busbar protection system should be suitable/adaptable for future switchgear extension or modification		Yes	
2.7.7	Bay-selective intertripping		Yes	
2.7.8	Phase-segregated measurement system		Yes	
2.8	Breaker failure protection			
2.8.1	Setting range	% Ir	Insert	
2.8.2	Re-trip time delay range	s	0-1	
2.8.3	Re-trip operation mode 1/3ph		Yes	
2.8.4	Back-up time delay range	s	0-1	
2.8.5	Trip operating time setting resolution	ms	1	
2.8.6	Trip delay range	s	0-1	
2.8.7	Single-phase with/without current		Yes	
2.8.8	2-stage operation bay trip repeat/trip busbar		Insert	
2.8.9	Selectable operation mode (current, unbalance, low current)		Insert	
2.8.10	Independent settable delay times for all operation modes		Yes	
2.8.11	Low current mode using the circuit breaker auxiliary contact		Yes	
2.8.12	End fault protection		Yes	
2.8.13	Independent breaker failure protection per bay unit		Yes	
2.9	Disturbance recorder CU, BU			
2.9.1	Number of digital signals		Insert	
2.9.2	Number of analogue signals		Insert	
2.9.3	External/manual initiation of recording		Insert	
2.9.4	Sampling rate	kHz	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.9.5	Pre-fault time	ms	≥ 300	
2.9.6	Recording time	ms	≥ 2000	
2.9.7	Number of recorded disturbances		Min. 5	
2.9.8	Total recording time with max. analogue and binary signals	s	> 10	
2.9.9	Output file comtrade format		Yes	
2.10	Event recorder CU, BU			
2.10.1	Max. number of events		Insert	
2.10.2	Time tagging resolution	ms	1	
2.11	Self-supervision CU, BU		Yes	
3	**Additional requirements**			
3.1	Test socket BU		Yes	
3.2	Setting and configuration approved by Engineer		Yes	
3.4	**Centralised, user-friendly configuration and all necessary software tools for full parameterization, and (re)configuration in case of extensions should be delivered**		**Yes**	
	Overall compliance with the requirements (yes/no)			

5.2.6.40 14011 - Trip Circuit Supervision Relay

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14011	**Trip Circuit Supervision Relay / Code number: 14011**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Binary outputs			
2.2.1	Number of outputs	NO/NC	Min. 2/2	
2.2.2	Rated voltage	V d.c.	110	
2.2.3	Breaking capacity at inductive load with L/R<40 ms, at rated voltage	A	0.1	
2.2.4	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.3	Supervised circuits			
2.3.1	Voltage range of supervised circuits	V d.c.	110 ±15 %	
2.3.2	Injected current of supervised circuits	mA	Insert	
2.3.3	Operating time range	s	Insert	
2.3.4	Resetting time range	s	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.41 14012 - Tripping Unit - High-Speed Tripping Relay

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14011	**Trip Circuit Supervision Relay / Code number: 14011**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type		Insert	
1.4	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.2	Binary outputs			
2.2.1	Number of outputs	NO/NC	Min. 2/2	
2.2.2	Rated voltage	V d.c.	110	
2.2.3	Breaking capacity at inductive load with L/R < 40 ms, at rated voltage	A	0.1	
2.2.4	Current carrying capacity at rated voltage for signalling contacts, continuous	A	Insert	
2.3	Supervised circuits			
2.3.1	Voltage range of supervised circuits	V d.c.	110 ±15 %	
2.3.2	Injected current of supervised circuits	mA	Insert	
2.3.3	Operating time range	s	Insert	
2.3.4	Resetting time range	s	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.42 14013 - Test Socket

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14013	**Test socket / Code number: 14013**			
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Type • Line main 1 and 2 • Line back-up and bus coupler • Transformer main 1 and 2 • Bay unit BBF • Distance protection (code 14007)		Insert	
1.4	Standards		IEC	
1.5	Each protection device must have its own test socket		Yes	
1.6	Test socket must obtain safe online protection testing and maintaining, and performing whole tripping test with following AR		Yes	
1.7	Test socket should have enough contacts to: • Short-circuit current inputs from CT's • Isolate voltage inputs from VT's • Isolate trip circuit for each phase separately • Isolate CB close command • Isolate signalling voltage • Inhibit breaker failure initialising • Inhibit sending of communication signal • Allow functional testing of protection		Yes	
1.8	Socket should be designed for 4 mm banana plugs access		Yes	
	Overall compliance with the requirements (yes/no)			

5.2.6.43 19001 - Battery

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
19001	**110 V & 48 V Battery units / Code number: 19001**			
1.1	Manufacturer		Insert	
1.2	Type designation		Insert	
1.3	Country of origin		Insert	
1.4	Standards		IEC	
1.5	Quality control		ISO 9001	
1.6	Rated voltage	V	110 (for 110 V DC) 48 (for 48 V DC)	
1.7	Number of cells per battery unit	pcs	92 (for 110 V DC) 40 (for 48 V DC)	
1.8	Type of cell		Ni-Cd	
1.9	Operating voltage per cell	V	1,2	
1.10	Floating voltage per cell	V	1,40 - 1,42	
1.11	Equalizing voltage per cell	V	1,55 - 1,65	
1.13	Rated capacity at 20°C			
	• For 3h discharge time	Ah	Insert	
	• For 5h discharge time	Ah	Insert	
	• For 10h discharge time	Ah	300 (for 110 V DC) 150 (for 48 V DC)	
1.14	Discharge voltage per cell	V	1,0	
1.15	Spec. gravity of electrolyte	1	1,2±0,02	
1.16	Positive plate	-	Tubular	
1.17	Negative plate	-	Pasted	
1.18	Type of container	-	Plastic polymer	
1.19	Cell condition	-	Pre-charged	
1.20	The battery stands steel frame		Yes	
1.21	The battery stands earth-quake endurance type		Yes	
1.22	Overall dimensions of one cell	mm	Insert	
1.23	Quantity of electrolyte per one cell	litre	Insert	
1.24	Length/width/height of assembled battery	mm	Insert	
1.25	Weight of battery and stands in service	kg	Insert	
	Overall compliance with the requirements (yes/no)			

5.2.6.44 19002 - Battery Charger

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
19002	**Battery Charger / Code number: 19003)**			
1.1	Manufacturer			
1.2	Type designation			
1.3	Type		Thyristor controlled	
1.4	Country of origin		-	
1.5	Standards		IEC	
1.6	Rated input voltage	V	3 x 400 / 230	
1.7	Rated input current (at rated output)	A	Insert	
1.8	Input voltage variation	%	±5	
1.9	Power factor	1	> 0,80	
1.10	Efficiency	%	> 85	
1.11	Degree of protection		IP42	
1.12	Noise level	dB	< 65 dB max	
1.13	Type of rectifiers		Modular with MCU	
1.14	Number of modules (n+2)	pcs	Insert	
1.15	Module rated output current	A	Insert	
1.16	MCU protocol		IEC 61850	
1.21	Charging characteristic		Both constant current & constant voltage	
1.22	Rated frequency	Hz	50	
1.23	Insulation - HV, between input and output/ground	V AC, min	1000 V AC, 1 min	
1.24	Insulation resistance	MW; V DC, min	10 MW, 500 V DC, 1 min	
1.25	Rated capacity	kVA	Insert	
1.26	Rated output voltage	V d.c.	110	
1.27	Rated output current	A	100	
1.28	Rated frequency	Hz	50	
1.29	Voltage & Frequency variation	%	±5	
1.30	Voltage ripple	%	±5	
1.31	Ripple frequency	Hz	±2	
1.32	Charge modes	-	3 levels: charge, float & boost	
1.33	Float voltage per cell	V	1.42	
1.34	Boost voltage per cell	V	1.53	
1.35	Float & Boost voltage adjustable	-	Yes	
1.36	Measurement		Input voltage Output voltage Output current Battery current Load current Earth-fault voltage	
	Overall compliance with the requirements (yes/no)			

5.2.6.45 Fibre Optic Multiplexer Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General:**			
	Manufacturer			
	Model No.			
	Type			
1.1	Type of multiplexer		SDH: ADM	
1.2	Complying to ITU-T rec.		Yes	
1.3	Transmission Capacity	Mbit/s	STM-4: 620	
1.4	Access capacity on 64 Kbit/s	channels	Minimum 200	
1.5	Access capacity on 2 Mbit/s	channels	Minimum 40	
1.6	Redundant central processor		Shall be available	
1.7	Digital cross connect function		Fully non-blocking	
2	**Available aggregates:**			
2.1	Optical aggregates (ITU-T G.957)		L-1.1, L-1.2	
3	**Available trunk interfaces:**			
3.1	HDB3, 2 Mbit/s interfaces per module	No.	Minimum 8	
3.2	Complying to ITU-T rec.		G.703, transparent G.704, selectable	
3.3	HDSL, 2Mbit/s interface: • no of copper wires • Capacity on 2Mbit/s or on 1Mbit/s • Capacity selectable	No. of channels channels / pair of wire	4 or 2 30 or 15 30 / 2 pairs 30 / 1 pair 15 / 1 pair	
4	**Available user interfaces**			
4.1	**Voice interfaces for trunk lines:**			
4.1.1	1 + 1 com path protection, available for all		yes	
4.1.2	Analogue, 4wire with E&M: • Input level • Output level	 dBr dBr	 +7.5 … -16.0 +7.0 … -16.5	
4.1.3	Analogue, 2wire with E&M: • Input level • Output level	 dBr dBr	 +6.5 … -12.5 -1.0 … -20.0	
4.1.4	Digital, 2Mbit/s CAS or PRI		yes	
4.2	**Voice interfaces for remote subscriber:**			
4.2.1	2wire, subscriber side	dBr	-5 ... +4 / -7.5 ... -1	
4.2.2	2wire, PABX side	dBr	-5 ... +4 / -7.5 ... -3	
4.3	**Integrated teleprotection**			
4.3.1	**Interface for Commands:**			
4.3.1.1	Number of independent commands	No.	4	
4.3.1.2	Transmission time max.	ms	6	
4.3.1.3	Signal voltage	V_{peak}	250	
4.3.1.4	1 + 1 com path protection		yes	
4.3.2	**Interface(s) for Differential Protection:**			
4.3.2.1	Electrical interface: G.703	Kbit/s	64	
4.3.2.2	Optical Interface	Kbit/s	Minimum 64	
4.4	**Data: channels per module**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4.1	1 + 1 com path protection, available for all		yes	
4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	No.	4	
4.4.3	V.11/X.24 (RS-422): 64kbit/s	No.	4	
4.4.4	V.35: 64kbit/s	No.	4	
4.4.5	V.36 (RS-449): 64kbit/s	No.	2	
4.4.6	G.703: 64kbit/s	No.	8	
4.4.7	Ethernet: • 10/100 BaseT • WAN capacity • Protocols	 No. Mbit/s -	 4 Min: 2x 2Mbit/s Min.: IP	
4.5	**Integrated alarm gathering module:**			
4.5.1	Number of external alarms per module	No.	Min. 20	
4.5.2	Auxiliary power supply for ext. contacts		Yes	
4.6	**Network Management System**			
4.6.1	Type/Name of configuration tool			
4.6.2	For fault / configuration management		Yes / yes	
4.6.3	For local / remote operation		Yes / yes	
4.6.4	Data communication network (DCN)		Ethernet / IP or Ethernet / OSI	
4.7	**Ambient Conditions:**			
4.7.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-5 ... + 55 / class 1.2	
4.7.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-5 ... + 70 / class 2.2	
4.7.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 … +45 / class 3.1E	
4.8	**Power Supply**			
4.8.1	Operation	V DC	48 / 60 (-15/+20%)	
4.8.2	Fully redundant power supply		yes	
	Overall compliance with the requirements (yes/no)			

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

5.2.7 Digital Fault and Disturbance Recorder (DFDR)

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Power supply	V, DC	DC 110 V	
1.6	Power supply - printer	V, Hz	AC 230 V, 50 Hz	
2	**Analogue inputs**			
2.1	Number of channels		Minimum 160	
2.1.1	Expandability		Minimum 32	
2.2	Nominal current	Amp	1A / 5A	
2.3.1	Nominal voltage	Vac/Vdc	Insert	
2.3.2	Nominal current	mA/Amp	Insert	
2.4	Frequency response		Insert	
2.5	Cut-off frequency			
2.5.1	Bandwidth	dB	insert	
2.5.2	Attenuation at	dB	Insert	
2.5.3	Auto adjusted anti-aliasing filters for chosen sampling rate	Yes/No	Yes	
2.5.4	Simultaneously programmable sampling rate for all feeders/inputs		Min 2 for FAST and SLOW Recording	
2.5.4.1	Locally changeable		Yes	
2.5.4.2	Remotely changeable		Yes	
2.5.5	Possible sampling rates			
2.5.5.1	Slow. 1Hz-500Hz	Samples / sec	Insert	
2.5.5.2	Fast: 0.5 kHz - 6kHz	Samples / sec	Insert	
2.5.5.3	Continuous (variable rate)	Samples / sec	Insert	
2.6	DC coupled inputs	Yes/No	Yes	
2.7	Resolution	bits	12 or better	
2.8	Accuracy	%	Min 0.5	
2.9	Burden			
2.9.1	• Current circuit	VA	Insert	
2.9.2	• Voltage circuit	VA	Insert	
2.10	Over load			
2.10.1	Current	% In	100% In continuously, min 600 % In for 1 sec.	
2.10.2	Voltage circuit	% Vn	2 Vn and max. 350 Vn	
3	**Digital inputs**			
3.1	Number of channels		Minimum 480	
3.1.1	Expandability		Minimum 96	
3.2	Selectable input level	Vdc	N/O or N/C, 110 VDC	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Type		Potential or potential free contact	
3.4	Resolution	ms	Insert	
4	**Memory**			
4.1	Size	MB	64 MB or higher	
4.2	Type		Solid state	
4.3	Pre-fault time (fast scanning rate)	sec	0.1-2 user programmable	
4.4	Post-fault (fast scanning rate	sec	0.1-2 user programmable	
4.5	Pre and post-fault time (slow scanning rate)	sec	min. 180 user programmable	
4.6	In-built hard disk (auto-maintained	GB	min. 4 GB	
5	**Sensors / Triggering criteria**			
	All sensors/triggers are preferable programmable and virtually recordable	Yes/No	Yes	
5.1.	Logical combination sensor	Yes/No	Yes	
5.2.	Three phase over or under voltage / current	Yes/No	Yes	
5.3.	Mono phase over or under voltage / current	Yes/No	Yes	
5.4.	*du/dt, dp/dt, dq/dt, [Single/3 Phases], df/dt. etc.	Yes/No	Yes	
5.5.	RMS [voltage / current]	Yes/No	Yes	
5.6.	Zero sequence	Yes/No	Yes	
5.7.	Negative, positive sequence	Yes/No	Yes	
5.8.	Frequency	Yes/No	Yes	
5.9.	DC Step	Yes/No	Yes	
5.10.	Pendling / swing	Yes/No	Yes	
5.11.	Digital level and edge	Yes/No	Yes	
5.12.	Sensor trigger	Yes/No	Yes	
5.13.	Event trigger	Yes/No	Yes	
5.14.	Manual trigger	Yes/No	Yes	
5.15.	Remote trigger	Yes/No	Yes	
6	**Clock System**			
6.1.	Internal clock	Yes/No	Yes	
6.2.	Accuracy		Insert	
6.3.	External synchronization	Yes/No	Yes	
6.4.	Time resolution between 2 synchronized pulses		Insert	
7	**Output Alarm Relay Contact**			
7.1.	Max. operation voltage DC/AC	Vac / Vdc	250 Vac or above, 60 Vdc or above	
7.2.	Make and carry for 0.5 sec	A	Min 8A	
7.3.	Carry continuously	A	Min 5A	
7.4.	Break (DC) - resistive	W	Insert	
8	**Interface for Data Communication**			
8.1.	Full definition compression	Yes/No	Yes	
8.2.	Maximum transmission rate	bits / sec	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.3.	Standard serial port (EIA-232-D)	Yes / No	Yes	
8.4.	Printer port	Yes/No	Yes	
8.5.	Dedicated serial port for modem	Yes/No	Yes	
9	**Printer Data**			
9.1.	Printer amplitude (scaling peak to peak)		Insert	
9.2.	Time scale	mm/s	Insert	
9.3.	Printer resolution	-	Insert	
9.4.	Auto printing	Yes/No	Yes	
9.5	Fault priority transmission	Yes/No	Yes	
9.6	Fault location (distance calculation)	Yes/No	Yes	
10	**Communication and remote analysing unit**			
10.1.	Processor Pentium	MHz	Minimum 450 MHz	
10.2.	Co-processor Pentium	Yes/No	Yes	
10.3.	Main memory capacity	Mb	Minimum 64 MB	
10.4.	Colour graphics board S-VGA	Yes/No	Yes	
10.5	Screen S-VGA	Yes/No	Yes	
10.6	Hard disk unit	GB	Minimum 40 GB	
10.7	Printer	Yes/No	Yes	
10.8	Modem	Yes/No	Yes.	
	Overall compliance with the requirements (yes/no)			

5.2.8 Technical information

5.2.8.1 Drawings and Other Technical Information to be provided

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
1	**Contractor's quality control system**		
1.1	• Copy of the QA system accreditation certificates		
1.2	• Quality system manual with typical procedures and quality control sheets		
1.3	• Environmental management manual		
1.4	• Occupational health and safety manual		
2	**Standards**		
2.1	• Copy of technical standards proposed for use instead of a relevant IEC or other international standard, with list of differences from relevant international standard, if any		
3	**Substation arrangement**		
3.1	• Substation Single Line Diagrams		
3.2	• Substation Layout drawing		
3.2	• Cross-section drawing		
4	**Circuit breakers**		
4.1	• Manufacturer's authorization letter		
4.2	• Manufacturer's quality assurance certif-icates		
4.3	• Technical data sheet		
4.4	• Drawing		
4.5	• List of performed type tests		
4.6	• Type test certificates		
4.7	• Descriptive catalogue		
4.8	• Reference list for the last five years for the offered type		
4.9	• List of mandatory special tools		
4.10	• List of mandatory spare parts		
4.11	• List of recommended spare parts		
4.12	• Training plan and program		
5	**Disconnectors**		
5.1	• Manufacturer's authorization letter		
5.2	• Manufacturer's quality assurance certif-icates		
5.3	• Technical data sheet		
5.4	• Drawing		
5.5	• List of performed type tests		
5.6	• Type test certificates		
5.7	• Descriptive catalogue		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
5.8	• Reference list for the last five years for the offered type		
5.9	• List of mandatory special tools		
5.10	• List of mandatory spare parts		
5.11	• List of recommended spare parts		
5.12	• Training plan and program		
6	**Current transformers**		
6.1	• Manufacturer's authorization letter		
6.2	• Manufacturer's quality assurance certificates		
6.3	• Technical data sheet		
6.4	• Drawing		
6.5	• List of performed type tests		
6.6	• Type test certificates		
6.7	• Descriptive catalogue		
6.8	• Reference list for the last five years for the offered type		
7	**Voltage transformers**		
7.1	• Manufacturer's authorization letter		
7.2	• Manufacturer's quality assurance certificates		
7.3	• Technical data sheet		
7.4	• Drawing		
7.5	• List of performed type tests		
7.6	• Type test certificates		
7.7	• Descriptive catalogue		
7.8	• Reference list for the last five years for the offered type		
8	**Surge arresters**		
8.1	• Manufacturer's authorization letter		
8.2	• Manufacturer's quality assurance certificates		
8.3	• Technical data sheet		
8.4	• Drawing		
8.5	• List of performed type tests		
8.6	• Type test certificates		
8.7	• Descriptive catalogue		
8.8	• Reference list for the last five years for the offered type		
9	**Control system**		
9.1	• Manufacturer's authorization letter		
9.2	• Manufacturer's quality assurance certificates		
9.3	• Technical data sheet		
9.4	• Drawing		
9.5	• List of performed type tests		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
9.6	• Type test certificates		
9.7	• Descriptive catalogue		
9.8	• Reference list for the last five years for the offered type		
9.9	• List of mandatory special tools		
9.10	• List of mandatory spare parts		
9.11	• List of recommended spare parts		
9.12	• Training plan and program		
10	**Relay Protection System**		
10.1	• Manufacturer's authorization letter		
10.2	• Manufacturer's quality assurance certificates		
10.3	• Technical data sheet		
10.4	• Drawing, system topology, block diagrams		
10.5	• General description of hardware		
10.6	• General description of software		
10.7	• Descriptive catalogue		
10.8	• Reference list for the last five years for the offered type		
10.9	• List of mandatory special tools		
10.10	• List of mandatory spare parts		
10.11	• List of recommended spare parts		
10.12	• Training plan and program		
11	**Metering System**		
11.1	• Manufacturer's authorization letter		
11.2	• Manufacturer's quality assurance certificates		
11.3	• Technical data sheet		
11.4	• Drawing		
11.5	• General description of hardware		
11.6	• General description of software		
11.7	• Descriptive catalogue		
11.8	• Reference list for the last five years for the offered type		
11.9	• List of mandatory special tools		
11.10	• List of mandatory spare parts		
11.11	• List of recommended spare parts		
12	**Communication System**		
12.1	• Manufacturer's authorization letter		
12.2	• Manufacturer's quality assurance certificates		
12.3	• Technical data sheet		
12.4	• Drawing, system topology		
12.5	• General description of hardware		
12.6	• General description of software		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
12.7	• Descriptive catalogue		
12.8	• Reference list for the last five years for the offered type		
12.9	• List of mandatory special tools		
12.10	• List of mandatory spare parts		
12.11	• List of recommended spare parts		
	Overall compliance with the requirements (yes/no)		

6. Schedule F: 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
11.	Design		
11.2	Civil works		
11.3	Electrical works / installation, testing and commissioning		
11.4	NLDC		
Name of Bidder:			
Signature of Bidder:			