Power Grid Company of Bangladesh Limited

Bidding Document for

Design, Supply, Installation, Testing and Commissioning of new 400/230/132 kV GIS Substation at Purbachal on turnkey basis (Package-6)

[Contract No.: PGCB/ADB/L3853/DWZTGEP/GIS/P6]

Volume 3 of 3

Project	:	**Dhaka and Western Zone Transmission Grid Expansion Project**
Employer	:	Power Grid Company of Bangladesh Ltd. (PGCB)
Country	:	The People's Republic of Bangladesh
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1. Schedule A: Scope of Works

1.1 Description of this Package

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

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

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

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

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

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

Generally, **land development** of the **substation** which has to be **extended/renovated** shall be made only for the **required substation area** and **extension** of the **boundary wall** shall be made only if it is required

The Contractor's responsibility is to provide that all parts of the works be completed in every respect for commercial operation, to the requirements of the Engineer.

All details, accessories etc. required for the complete installation and satisfactory operation of the works not specifically mentioned in this specification are deemed included in the contract price.

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

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

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

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

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

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

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

The bid price shall include all other miscellaneous works required.

The "Schedule of Requirements" for equipment, materials and services and the detailed technical specifications of equipment and materials as included in Volume 3 of the bidding documents shall be read in conjunction with the scope of works described herein.

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

The brief description of works under this contract is as follows.

Design, Supply, Installation, Testing and Commissioning of new 400/230/132 kV GIS Substation at Purbachal on turnkey basis (Package-6)

This includes the following:

1) NEW 400/230/132KV GIS SUBSTATION AT PURBACHAL

The approximate plot size of the above substations is as follow:

SL No.	Substation Description	Area (Acres)	Length (m)	Width (m)
1.	400/230/132 kV Purbachal GIS substation	14.10	268.54/ 230.78	231.04/ 220.02

The plot size, mentioned above, is very much tentative and subject to change as per actual land acquisition and site condition.

1.1.1 NEW 400/230/132KV GIS SUBSTATION AT PURBACHAL

A new 400/230/132 kV indoor GIS substation at Purbachal shall be constructed.

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

- Complete new 400/230/132kV indoor GIS substation.
- 400 kV GIS Switchgear with:
  - 400 kV double busbar system
  - Four (4) Nos. of 400 kV transmission line bays
  - Three (03) Nos. of 400 kV transformer bays
  - Two (2) Nos. of 400 kV bus coupler bay
  - Two (2) Nos. of 400 kV bus section bay for HV testing.
  - Three (3) Nos. of three phase power autotransformers 400/235/34.5 kV, 520/750 MVA.
- 230 kV GIS Switchgear, with:
  - 230 kV double busbar system
  - Two (2) Nos. of 230 kV transmission line bays
  - Six (6) Nos. of 230 kV transformer bays
  - Two (2) Nos. of 230 kV bus coupler bays
  - Two (2) Nos. of 230 kV bus section bays
  - Two (2) Nos. of three phase power autotransformers 230/135/34.5 kV, 350/450 MVA
- 132 kV GIS Switchgear, with:
  - 132 kV double busbar system
  - Six (6) Nos. of 132 kV transmission line bays
  - Two (2) Nos. of 132 kV transformer bays
  - Two (2) Nos. of 132 kV bus coupler bays
  - Two (2) Nos. of 132 kV bus section bays
- 33 kV AIS Switchgear:
  - Two (02) Nos. of 33 kV auxiliary/earthing transformer bays

- Two (02) Nos. of three phase, 33/0.415 kV, 500 kVA, auxiliary/earthing transformers.

- Space for future four (4) nos. of 230kV line bays
- Space for third three phase power autotransformers 230/135/34.5 kV, 350/450 MVA.
- Space for 400kV bus reactor
- SCADA Control for all bays at different voltage level.
- 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.

- Complete outdoor civil works, including 400 kV, 230 kV and 132kV gantry foundation, and 400 kV, 230 kV, 132 kV and 33 kV equipment foundation, power transformer and auxiliary transformer foundations, blast wall, substation main gate and guard house, security boundary wall and internal fencing, access road, internal roads and parking, 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 two new GIS building for 400kV & 230 kV/132 kV GIS and control building separately, including foundation works, super structure works, finishing works like rendering, painting, water supply, sanitary, floor finishing, rain water drainage system, lightning protection, etc.

- Complete water supply including deep tube well for drinking water, pump house, pump, water reservoir, water pipe lines, etc., sewage facilities including septic tank, etc.

- The equipment to be supplied, installed and commissioned is shown on the bid drawings as well as mentioned specification.

1.2 Requirement

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

Denomination	Description
A	420 kV Switchgear
B	245 kV Switchgear
D	33 kV Switchgear
E	Power Transformers
F	Control, Protection, Substation Automation and Metering etc.
G	DFDR
H	Power Cable & GIL
I	Multicore Cables
J	Earthing and Lightning Protection
K	Batteries, Chargers and DC Distribution
L	LVAC Distribution
M	Civil works, Building and Foundations
N	Lighting, Small power and Air Conditioning
O	Fibre Optic Multiplexer Equipment for Communication and Protection
P	SCADA System for Tele-control & Telemetering
R	Generator for Emergency Aux. Power
S	Other Equipment

1.2.1 Technical Requirements for 400/230/132KV GIS Substation at Purbachal

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item Description

All the Equipment shall comply with the particular requirements as detailed in the Technical Specification and Requirements (Appendix) in Volume 2 and shall comprise the following:

Item No.		Description of Equipment Requirement	Unit	Quantity
1A		**420 kV switchgear, equipment connection and steel structures (Technical data of CT & VT are referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
1A1		**420kV GIS Line Feeder bay each set comprises with:**	**Set**	**4**
	i.	420kV, 5000A, 50kA/3s, single phase Enclosure double busbar	Lot	1
	ii.	420kV, 4000A, 50kA/3s, three phase busbar Disconnector with earth switch,complete with motor operating mechanism	Set	2

Item No.	Description of Equipment Requirement		Unit	Quantity
	iii.	420kV, 4000A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism, CSD for CB as Phase switching control device	Set	1
	iv.	420kV, 4000A, 50kA/3s three phase high speed Earth Switch complete with motor operating mechanism	Set	1
	v.	420kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	1
	vi.	420kV, 4000A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	vii.	420kV, 50kA/3s multi-core, single phase, Current Transformer	No.	6
	viii.	Single phase GIS-to-Air bushing with all accessories for Line	No.	3
	ix.	Local Control Cubicle	Set	1
	x.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xi.	Partial Discharge monitoring internal sensor	Lot	1
1A2	**420kV GIS Autotransformer Feeder bay each set comprises with:**		**Set**	**3**
	i.	420kV, 5000A, 50kA/3s, single phase enclosure double busbar	Lot	1
	ii.	420kV, 4000A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iii.	420kV, 4000A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism, CSD for CB as Phase switching control device	Set	1
	iv.	420kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	v.	420kV, 4000A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	vi.	420kV, 50kA/3s multi-core, single phase, Current Transformer	No.	6
	2.	420kV single phase, Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	vii.	Single phase GIS-to-Air bushing with all accessories for Transformer.	No.	3
	ix.	Local Control Cubicle	Set	1
	x.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to	Lot	1

Item No.		Description of Equipment Requirement	Unit	Quantity
		adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate		
	xi.	Partial Discharge monitoring internal sensor	Lot	1
1A3	**420kV GIS bus coupler bay, each set comprises with:**		**Set**	**2**
	i.	420kV, 5000A, 50kA/3s, single phase enclosure double busbar	Lot	1
	i.	420kV, 5000A, 50kA/3s, three phase busbar Disconnector with earth switch complete with motor operating mechanism	Set	2
	iii.	420kV, 5000A, 50kA/3s, three phase, three pole operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iv.	420kV, 50kA/3s multi-core, single phase, Current Transformer	No.	6
	v.	Local Control Cubicle	Set	1
	vi.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	vii.	Partial Discharge monitoring internal sensor	Lot	1
1A4	**420kV GIS bus section bay, each set comprises with:**		**Set**	**2**
	i.	420kV, 5000A, 50kA/3s, single phase enclosure doublebusbar	Lot	1
	ii.	420kV, 5000A, 50kA/3s, three phase busbar Disconnector complete with motor operating mechanism	Set	2
	iii.	420kV, 5000A, 50kA/3s, three phase, three pole operation Circuit Breaker complete with spring / hydraulic / spring&hydraulic operating mechanism	Set	1
	iv.	420kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	v.	420kV, 50kA/3s multi-core, single phase, Current Transformer	No.	6
	vi.	Local Control Cubicle	Set	1
	vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	viii.	Partial Discharge monitoring internal sensor	Lot	1
1A5	**420 kV GIS type three phase LA, each set comprises with:**		**Set**	**4**
		420kV, 5000A, 50kA/3s, single phase encloserdouble busbars	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
		390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, Gas type, with externally operable Disconnecting Link and earth switch	No.	3
1A6	**420kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**4**
	i.	420kV, 5000A, 50kA/3s, single phase encloser double busbars	Lot	1
	ii.	420kV, 50kA/3s, three phase high speed Fast Earth Switch complete with spring operating mechanism	set	1
	iii.	420kV single phase, Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
	iv.	Local Control Cubicle	Lot	1
	3.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	v.	Partial Discharge monitoring internal sensor	Lot	1
1A7	**Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities for extensions without de-energization of complete GIS**		**Set**	**2**
1A8	**Standalone Partial Discharge measurement and analyzer system for Complete GIS**		**Lot**	**1**
	AIS Switchgear, Equipment & Structure			
1A9		390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	21
1A10		420kV CVT, Single-phase, 50Hz, 1425kVp BIL, 3 windings	No.	12
1A11		420kV, 4000A, single phase Wavetrap	No.	4
1A12	**400kV Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 400kV Switchyard including LA, CVT and WT connection**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
1A13	**Insulator and fittings including all necessary clamps and connectors as required for completing 400kV GIS Switchyard**			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector	Lot	1
	iii.	Nut-bolt	Lot	1

Item No.		Description of Equipment Requirement	Unit	Quantity
1A14	**Steel gantry each circuit of 400kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 400kV GIS Switchyard**			
	i.	Steel Structure for T/L with Nut & Bolts		
	a)	Gantry Column	No.	5
	b)	Beam	No.	4
	ii.	Equipment Structure		
	a)	LA	No.	21
	b)	420kV CVT	No.	12
	iii.	Nut-Bolt	Lot	1
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1

Item No.		Description of Equipment Requirement	Unit	Quantity
1B	**245 kV switchgear, equipment connection and steel structures (Technical data of CT & VT are referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**			
1B1	**245kV GIS Line Feeder Bays, comprises with:**		**Set**	**2**
	i.	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii.	245kV, 3150A, 50kA/3s, three phase, single pole operation Circuit Breaker complete with spring / hydraulic / spring&hydraulic operating mechanism	Set	1
	iii.	245kV, 3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	245kV, 50kA/3s three phase earthing switch complete with motor operating mechanism	Set	1
	vi.	245kV, 50kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	viii.	245kV single phase Voltage Transformer with externally operable Disconnector and earth switch	No.	3
	ix.	Single phase GIS-to-Air bushing with all accessories for Line	No.	3

Item No.	Description of Equipment Requirement		Unit	Quantity
	x.	Local Control Cubicle	Set	1
	xi.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIL, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xi.	Partial Discharge monitoring internal sensor	Lot	1
1B2	**245kV GIS Auto Transformer Feeder Bays, comprises with:**		**Set**	**6**
	i	245kV, 4000A, 50kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	245kV, 3150A, 50kA/3s, three phase, gang operated operation Circuit Breaker complete with spring / hydraulic / spring & hydraulic operating mechanism	Set	1
	iii.	245kV,3150A, 50kA/3s, three phase busbar Disconnector with earth switch, complete with motor operating mechanism	Set	2
	iv.	245kV, 3150A, 50kA/3s, three phase line Disconnector complete with motor operating mechanism	Set	1
	v.	245kV, 50kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	2
	vi.	245kV, 50kA/3s single phase, Current Transformer	No.	06
		245kV single phase Voltage Transformer with externally operable Disconnector and earth switch,	No.	3
	vii.	Single phase GIS-to-Air bushing with all accessories for TR	No.	3
	viii.	Local Control Cubicle	Set	1
	ix.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for single-core cables, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	x.	Partial Discharge monitoring internal sensor	Lot	1
1B3	**245kV Bus Coupler Bays, comprises with:**		**Set**	**02**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	245kV, 4000A, 50kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring&hydraulic operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phasebusbar Disconnectorwith Earth Switchcomplete with motor operating mechanism	Set	02

Item No.	Description of Equipment Requirement		Unit	Quantity
	v.	245kV, 50kA/3s single phase, Current Transformer	No.	06
	vi.	Local Control Cubicle	Set	01
	vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	viii.	Partial Discharge monitoring internal sensor	Lot	1
1B4	**245kV Bus Section Bays, comprises with:**		**Set**	**02**
	i	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbar	Lot	1
	ii	245kV, 4000A, 50kA/3s, three phase, gang operated Circuit Breaker complete with spring / hydraulic / spring&hydraulic operating mechanism	Set	01
	iii.	245kV, 4000A, 50kA/3s, three phasebusbar Disconnector with Earth Switch complete with motor operating mechanism	Set	02
	v.	245kV, 50kA/3s single phaseCurrent Transformer	No.	06
	vi.	Local Control Cubicle	Set	1
	vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	viii.	Partial Discharge monitoring internal sensor	Lot	1
1B5	**245kV GIS type Bus FES and Bus VT, each set comprises with:**		**Set**	**4**
	i.	245kV, 4000A, 50kA/3s, single/three phase enclosure double busbars	Lot	1
	ii.	245kV single phase Voltage Transformer withDisconnector and earth switch, externally operable	No.	3
	iii.	245kV, 50kA/3s, three phase, make proof type Earth Switches complete with spring operating energy storage Mechanism	Set	1
	iv.	Local Control Cubicle	Lot	1
		Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	v.	Partial Discharge monitoring internal sensor	Lot	1
1B6	**Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate**		**Set**	**2**

Item No.	Description of Equipment Requirement		Unit	Quantity
	disconnect facilities for extensions without de-energization of complete GIS			
	AIS Switchgear, Equipment & Structure			
1B7	198kV rated voltage, 158 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type		No.	24
1B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
1B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector	Lot	1
	iii.	Nut-bolt	Lot	1
1B10	**Steel gantry for each circuit of 245kV Transmission Line, Transformer& Equipment support Structure including all necessary accessories required for completing 230kV Switchyard**			
	i.	Steel Structure for T/L with Nut & Bolts		
	a)	Gantry Column	No.	3
	b)	Beam	No.	2
	ii	Steel Structure for 400/230kV& 230/132kV Transformers with Nut & Bolts		
	a)	Gantry Column	No.	14
	b)	Beam	No.	12
	iii.	Equipment Structure		
	a)	LA	No.	24
	iv.	Nut & Bolts	Lot	1
	v.	LV power & control cable tray including fitting, fixing accessories	Lot	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1C	**145 kV switchgear, equipment connection and steel structures (Technical data of CT & VT are referred to Schedule E:**		

Item No.		Description of Equipment Requirement	Unit	Quantity
		Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)		
1C1		**145kV GIS Line Feeder Bays, comprises with:**	**Set**	**6**
	i.	145kV, 3150A, 40kA/3s, single/three phase enclosure double busbar	Lot	1
	ii.	145kV, 2500A, 40kA/3s, three phase, single pole operation Circuit Breaker complete with spring operating mechanism	Set	1
	iii.	145kV, 2500A, 40kA/3s, three phase, three positions, busbar disconnector with earthing switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 2500A, 40kA/3s three phase, three positions, line disconnector with earthing switch, complete with motor operating mechanism	Set	1
	vi.	145kV, 40kA/3s, three pole, make proof (high speed) type earthing switch complete with motor operating mechanism	Set	1
	vii.	145kV, 40kA/3s single phase, Current Transformer	No.	3
		145kV single phase Voltage Transformer with externally operabledisconnector and earth switch	No.	3
		145kV, 2500A, 40kA/3s three phase GIS Cable compartment with externally operable isolation link	Set	1
	viii.	145kV, 2500A, 40kA/3s GIS Cable Termination (Plug in type)per phase with required accessories for line bays	No.	3
	ix.	Local Control Cubicle	Set	1
	x.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS Cable Termination, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	xi.	Partial Discharge monitoring internal sensor	Lot	1
1C2		**145kV GIS Auto Transformer Feeder Bays, comprises with:**	**Set**	**2**
	i	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii	145kV, 2500A, 40kA/3s, three phase, gang operated Circuit Breaker complete with springoperating mechanism	Set	1
	iii.	145kV, 2500A, 40kA/3s, three phase, three positions, busbar disconnector with earthing switch, complete with motor operating mechanism	Set	2
	iv.	145kV, 2500A, 40kA/3s three phase, three positions, line disconnector with earthing switch, complete with motor operating mechanism	Set	1
	v.	145kV, 40kA/3s, three phase Earth Switch complete with motor operating mechanism	Set	1

Item No.		Description of Equipment Requirement	Unit	Quantity
	vi.	145kV, 40kA/3s single phase, Current Transformer	No.	3
		145kV single phase Voltage Transformer with Disconnector and earth switch, externally operable	No.	3
		145kV, 2500A, 40kA/3s three phase GIS Cable compartment with externally operable isolation link	Set	1
	vii.	145kV, 2500A, 40kA/3s GIS Cable Termination (Plug in type)per phase with required accessories for transformer bays	No.	3
	viii.	Local Control Cubicle	Set	1
	ix.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for GIS Cable Termination, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	x.	Partial Discharge monitoring internal sensor	Lot	1
1C3	**145kV Bus Coupler Bays, comprises with:**		**Set**	**02**
	i.	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii.	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase, three positions, busbar disconnector with earth switch, complete with motor operating mechanism	Set	02
	v.	145kV, 40kA/3s single phase, Current Transformer	No.	03
	vi.	Local Control Cubicle	Set	01
	vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, busbar end covers or link to adjacent switchgear panel, cables, metal support structure, grounding, etc. as appropriate	Lot	1
	viii.	Partial Discharge monitoring internal sensor	Lot	1
1C4	**145kV Bus Section Bays, comprises with:**		**Set**	**02**
	i	145kV, 3150A, 40kA/3s, three phase Enclosure double busbar	Lot	1
	ii	145kV, 3150A, 40kA/3s, three phase, gang operated Circuit Breaker complete with spring operating mechanism	Set	01
	iii.	145kV, 3150A, 40kA/3s, three phase, three positions, busbar disconnector with earthing switch, complete with motor operating mechanism	Set	02
	v.	145kV, 40kA/3s single phaseCurrent Transformer	No.	03
	vi.	Local Control Cubicle	Set	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	vii.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	viii.	Partial Discharge monitoring internal sensor	Lot	1
1C5	**145kV GIS type Bus FES and Bus VT, each comprises with:**		**Set**	**4**
	i.	145kV, 3150A, 40kA/3s, single/three phase Enclosure double busbar	Lot	1
	ii.	145kV single phase Voltage Transformer with externally operableDisconnector and earth switch	No.	3
	iii.	145kV, 40kA/3s, three phase, make proof (high speed) type Earth Switches complete with motor operating mechanism	Set	1
	iv	Local Control Cubicle	Lot	1
	v.	Complete Set of miscellaneous items required for safe and efficient operation of the switchgear, terminal arrangements for multi-core cables, busbar end covers or link to adjacent switchgear panel as appropriate	Lot	1
	vi.	Partial Discharge monitoring internal sensor	Lot	1
1C6	**Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities for extensions without de-energization of complete GIS**		**Set**	**2**
	AIS Switchgear, Equipment & Structure			
1C7		120kV rated voltage, 102 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	24
1C8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
1C9	**Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard**			
	i.	Insulator	Lot	1
	ii.	Fittings & Clamps, Connector	Lot	1
	iii.	Nut-bolt	Lot	1
1C10	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**			

Item No.	Description of Equipment Requirement		Unit	Quantity
	i.	Steel Structure for T/Lwith Nut & Bolts		
	a)	Gantry Column	No.	8
	b)	Beam	No.	6
	ii.	Equipment Structure		
	a)	LA	No.	24
	iv.	Nut & Bolts	Lot	1
	v.	LV power & control Cable tray including fitting, fixing accessories	Lot	1
	vi.	HV power Cable tray including fitting, fixing accessories	Lot	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1D	**36kV Switchgears, equipment connection and steel structures (Technical data of CT & VT are referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
1D1	**36kV AIS Switchgears for Aux. Power Bays, each comprises with:**	**Set**	**2**
	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, VCB with spring operating mechanism	Set	1
	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single vertical break/horizontal, post type, motor operated Disconnector with Earth Switch	Set	2
	36kV, single-phase, 31.5kA/3sec, 50Hz, 170kVp BIL, Current Transformers	No.	3
	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	3
	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	3
1D1.x	**36kV AIS Switchgears for Unloaded tertiary Auto-Transformer Bays, each comprises with:**	Set	3
	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	3
	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	3

Item No.	Description of Equipment Requirement		Unit	Quantity
1D2	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 36kV Switchyard**			
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1
1D3	**Insulator and fittings including all necessary clamps and connectors as required for completing 36kV Switchyard**			
	i	Insulator, Post & Disk	Lot	1
	ii	Fittings & Clamps, Connector	Lot	1
	iii.	Nut-bolt	Lot	1
1D4	**Steel structure for each circuit of Aux. power TR and Auto.TR tertiary side connection including all necessary accessories required for completing 36kV Switchyard**			
	i.	Equipment Structure with Nut & Bolts	Lot	1
	ii.	LV power & control cable tray including fitting, fixing accessories	Lot	1
1D5	**33kV Power Cable with associated material**			
	i	33kV, single phase, 300 sqmm XLPE cable	meter	50
	ii.	33kV, single phase, outdoor cable termination with accessories	No.	12

Item No.	Description of Equipment Requirement	Unit	Quantity
1E	**Power Transformers and Auxiliary Transformer (Technical data of CT/BCT & VT are referred to Schedule E: Technical Particulars and Guarantees, volume 3 of 3 of the bidding document)**		
1E1	400/235/34.5 kV, 520/750 MVA (ONAN/ONAF), threephase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and Remote Tap Changer Control (RTCC) Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	3
1E2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for 400/235/34.5 kV auto transformers.	Set	3
1E3	230/135/34.5 kV, 350/450 MVA (ONAN/ONAF), three phase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and RTCC Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2
1E4	Potable dissolved gas monitoring system for transformer	Set	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1E5	33/0.415 kV, 500kVA, three phase outdoor type earthing/auxiliary Zig-Zag transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.	Set	2
1E6	CAFS of Fire Fighting System for transformer with water feeding equipment		
	i. 400/235/34.5 kV Auto-transformer	Set	3
	ii. 230/135/34.5 kV Auto-transformer	Set	2

Item No.	Description of Equipment Requirement	Unit	Quantity
1F	**Control, Protection, Substation Automation & Metering**		
400kV Circuit			
1F1	**Control, protection and Monitoring including SAS Function for Overhead Line circuits, along with Control & Protection Cubicles**	Set	4
	Each comprising		
	i. BCU and Backup Mimic panel with all accessories including monitoring		
	ii. Protection main relays, Main-1 & Main-2		
	iii. Auxiliary relays (TCS, Lockout etc.) & Accessories (TTB etc.)		
	iv. Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F2	**Control, protection and Monitoring including SAS Function for Auto-transformer circuits, along with Control & Protection Cubicles**	Set	3
	Each comprising		
	i. BCU and Backup Mimic panel with all accessories including monitoring		
	ii. Protection main relay (Main-1, Main-2)		
	iii. Auxiliary relays (TCS, Lockout etc.) & Accessories (TTB etc.)		
	iv. Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F3	**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**	Set	2
	Each comprising		
	i. BCU and Backup Mimic panel with all accessories including monitoring		

Item No.		Description of Equipment Requirement	Unit	Quantity
	ii.	Protection main relay, (67,67N, 50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F4		**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay(67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F5		**Busbar Protection including SAS Function (400kV Circuit)** [Main-1& Mian-2]	Set	2
		Each comprising		
	i.	Protection main relay (for all busbars)		
	a)	Bay unit with HMI		
	b)	Central unit with HMI		
	ii.	Selector switch for switching BBP, BFP, all function, Auxiliary relays (Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type)including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F6		**Tariff metering comprises with :**	Lot	1
	i.	Meters (Main & Check)	Set	7
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
230kV Circuits				
1F7		**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2)		

Item No.	Description of Equipment Requirement		Unit	Quantity
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F8	**Control, Protection, Monitoring including SAS Function for Auto transformer (750MVA) circuits, along with Control & Protection Cubicles**		Set	3
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection back-up relay (67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F9	**Control, protection and Monitoring including SAS Function for Auto transformer (450MVA) circuits, along with Control & Protection Cubicles**		Set	3
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay (Main-1, Main-2)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & Accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F10	**Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay, (67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F11	**Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles**		Set	2
		Each comprising		

Item No.		Description of Equipment Requirement	Unit	Quantity
	i.	BCU and Backup Mimic panel with all accessories including monitoring		
	ii.	Protection main relay(67,67N,50,50N,51,51N etc.)		
	iii.	Auxiliary relays(TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F12		**Busbar Protection including SAS Function (230kV Circuit)**	Set	1
		Each comprising		
	i.	Protection Relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit HMI		
	ii.	Selector switch for switching BBP, BFP, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F13		**Tariff metering comprises with:**	Lot	1
	i.	Meters (Main & Check)	set	8
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
132kV Circuits				
1F14		**Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles**	Set	6
		Each comprising		
	i.	BCU and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (Main, back-up)		
	iii.	Auxiliary relays (TCS, Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F15		**Control, Protection, Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU and Backup Mimic with all accessories including monitoring		

Item No.	Description of Equipment Requirement		Unit	Quantity
	ii.	Protection back-up relay (67,67N,50, 50N, 51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc) & accessories (TTB etc.)		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F16	**Control, Protection, Monitoring & SAS for Bus Coupler circuits, including Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay(67,67N,50 , 50N, 51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc) & accessories (TTB etc.)		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F17	**Control, Protection, Monitoring & SAS Function for Bus section circuits, including Control & Protection Cubicles**		Set	2
		Each comprising		
	i.	BCU and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (67,67N,50 , 50N, 51,51N etc.)		
	iii.	Auxiliary relays (TCS, Lockout etc) & accessories (TTB etc.)		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F18	**Busbar Protection including SAS Function (132kV Circuit)**		Set	1
		Each comprising		
	i.	Protection relay for BB-1 & BB-2		
	a)	Bay unit with HMI		
	b)	Central unit HMI		
	iii.	Selector switch for switching BBP, BFP, all function; Auxiliary relays (Lockout etc.) & accessories (TTB etc.)		
	iv.	Complete Protection Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F19	**Tariff metering comprises with :**		Lot	1
	i.	Meters (Main & Check)	Set	8
	ii.	Complete Panel including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1

Item No.		Description of Equipment Requirement	Unit	Quantity
36kV Circuit				
1F20		**Control, Monitoring, Protection & SAS function for 33kV station power system, including Control & Protection Cubicles**	Set	2
		Each comprising		
	i.	BCU and Backup Mimic with all accessories including monitoring		
	ii.	Protection main relay (as backup: 87T,67,67N,50,50N,51,51N,49)		
	iii.	Auxiliary relays (TCS, Lockout etc)		
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, Contactors, humidity controller, MCBs & other accessories		
1F21		**Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-transformer (can be merged with TR main/backup protection)**	Set	3
		Each comprising		
	i.	Voltage monitoring & overvoltage protection (59)		
	ii.	Auxiliary relays and accessories		
1F22		**Tariff metering comprises with:**	Lot	1
	i.	Meters (Main & Check)	set	2
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1
Substation Automation system comprises with			Lot	1
1F23	i.	Industrial Server PC cum Operator workstation(or separate PCs) with SAS & Engineering Software and including monitors& accessories	Set	2
	ii.	Ethernet Switch for SAS	Lot	1
	iii.	GPS system	Set	2
	iv.	Common alarm unit with hooter/buzzer for annunciation	Set	1
	v.	LCD Monitor, 75" or Larger	Set	1
	vi.	Printer, A3, A4 Laser (One black & White, Other Color)	Set	2
	vii.	Engineering PC latest version configuration	No.	1
	viii.	Cable (Fiber Optic, Ethernet, Copper etc.)	Lot	1
	ix.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	x.	Other Accessories (if any)	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
1G	**Digital Fault & Disturbance Recorder, each comprising**		**Lot**	**01**
1G1	i.	DFDR processor and Card for each bay including A/D Converter, Digital& Analog data acquisition system	Lot	01
	ii.	Ethernet Switch	Lot	01
	iii.	GPS system	set	01
	iv.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, MCBs & other accessories	set	01
	v.	Engineering PC latest version configuration	set	01
	vi.	Cables &Other Accessories	Lot	01

Item No.	Description of Equipment Requirement		Unit	Quantity
1H	**Power Cable & GIL**			
1H1	420kV Gas Insulated Line (GIL) for seven (7) feeders, single phase encloser, which consist of four (4) T/L & three (3) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (25 - 140 meter). Actual payment shall be as per final design. The Length given here is as single phase length.		m	1800
1H2	245kV Gas Insulated Line (GIL) for eight (8) feeders, single phase encloser, which consist of two (2) T/L &six (6) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (30 - 135 meter). Actual payment shall be as per final design. The Length given here is as single phase length		m	1800
1H3	**132kV, 2000sqmm (minimum), XLPE Power cable & termination**			
	i.	XLPE HV Power cable (Cable shall be laid in cable trench with flat formation arrangement)	m	1900
	ii.	Outdoor type Cable Sealing End per phase with required necessary accessories for line& transformer bays	Nos.	24
1H4	**Steel structure for each circuit of 132kV cable connection**			
	i.	Equipment Structure with Nut & Bolts		
	a)	Outdoor type Cable Sealing End	Nos.	24

Item No.	Description of Equipment Requirement		Unit	Quantity
1I	**Multicore Cables for control, protection, metering & power circuits**			
	i.	LV Control Cable	Lot	1
	ii.	LV Power Cable	Lot	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1J	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.		
1J1	Earthing system for complete substation(grounding mesh, grounding rod/ needle type grounding rod)including GIS Building	Lot	1
1J2	Lightning Protection System for complete substation (overhead, mast type)	Lot	1
1J3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2

Item No.	Description of Equipment Requirement		Unit	Quantity
1K	**Batteries, Chargers & DC distribution board** During execution stage the battery capacity shall be confirmed with calculation by the contractor considering the bays under scope of work and future bays. The battery with higher capability, if required after calculation, shall be supplied by the Contractor within the same Contract price. The DBs shall be suitable for control remotely; Multi-function meters, digital volt & Ammeter shall be available.			
1K1	**110V Ni-cad Batteries with chargers & distribution board**			
	i.	for 400kV system		
	a)	_110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2
	c)	_110V DC Distribution panel, MCC type (LV S.W room, SPR, control Room) with Digital Display & Controller	Lot	1
	d)	Inverter, Input- AC & DC, output -AC 230V 5kVA 60min	set	2
	ii.	for 230kV & 132kVsystem		
	a)	_110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2

Item No.	Description of Equipment Requirement		Unit	Quantity
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2
	c)	_110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller	Lot	1
1K2	**48V Ni-cad Batteries with chargers & distribution board**			
	i.	_48V battery Banks, minimum 200Ah at the 5-hours rate of discharge	Set	2
	ii.	_Charger (IGBT Type) each float charge shall not be less than 120A rating	Set	2
	iii.	_48V DC Distribution Panel with Digital Display & Controller	Lot	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1L	**LVAC Distribution** AC voltage status for each bus including coupling breaker on/off status, fail with alarm, status of AC MCB/MCCB at SPR with fail alarm etc. shall be incorporated in substation automation system. The DBs shall be suitable for control remotely. Multi-function meters, digital volt & Ammeter shall be available.		
1L1	AC 415V / 230V Distribution panels (MCC type, LV S.W room, Each Panel & Control room, Generator room etc) with Digital Display & Controller	Lot	1
	Station auxiliary power (415V) shall be comprised: From TR-1, TR-2 sides & Generator		
1L2	Tariff metering at LV side	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
1M	**Civil Works, Building and Foundation**			
1M1*	Complete land development			
	i.	Complete compacted land development with carried/dredged earth filling including approach road	CuM	378312
	ii.	Slope protection		
	a)	_Slope (1V:2H) protection with turfing	sqm	6675
	b)	_Slope (1V:2H) protection with CC block	sqm	6675
1M2*	Complete civil items required for outdoor works			
	i	Outdoor gantry foundation in 400kV switchyard		
	a)	_Gantry column	Nos	5
	ii	Outdoor equipment foundation in 400kV switchyard		
	a)	_SA/LA	Nos	21
	b)	_CVT	Nos	12
	c)	_Busduct support	Lot	1

	iii.	Outdoor gantry foundation in 230kV switchyard		
	a)	_Gantry column	Nos	17
	iv.	Outdoor equipment foundation in 230kV switchyard		
	a)	_SA/LA	Nos	24
	v.	Outdoor gantry foundation in 132kV switchyard		
	a)	_Gantry column	Nos	8
	vi.	Outdoor equipment foundation in 132kV switchyard		
	a)	_SA/LA	Nos	24
	vii.	Outdoor equipment foundation 33kV switchyard		
	a)	_CB	Set**	2
	b)	_DS	Set**	4
	c)	_CT	Nos	6
	d)	_IVT	Nos	15
	e)	_SA/LA	Nos	15
	f)	_Zigzag/auxilary transformer	Nos	2
	g)	_Tertiary bus connection	Nos	2
	viii.	Transformer foundation	Nos	5
	ix.	Blast wall with foundation	Nos	4
	x.	Property line demarkation	Meter	950
	xi.	Security boundary wall for overall plan	Meter	857
	xii.	Substation main gate	Nos	2
	xiii.	Approach road (pavement width 6m)	Meter	60
	xiv.	Internal road		
	a)	_6m wide road	Meter	400
	b)	_4.5m wide road	Meter	850
	c)	_3m wide road	Meter	50
	xv.	Surface drain	Meter	858
	xvi.	Cable trench/tunnel with soakpit		
	a)	_For LV control, communication, relay *etc.* cables	Lot	1
	b)	_For HV power cables	Meter	280
	xvii.	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	Lot	1
	xviii.	Gravelling in switchyard area	Lot	1
	xix.	Septic tank (capacity: 25users for 5 years) and soakpit	Nos	4
	xx.	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion *etc.*	Nos	4
	xxi.	Guard house	Nos	1
	xxii.	Sentry post	Nos	4
	xxiii.	Car port	Nos	1
	xxiv.	RCC box culvert	Nos	1
1M3	i.	Complete civil works for 420kV Indoor GIS Building including Protection & Metering Room, Control Room, 110V Battery Room, 48 Battery Room, Warehouse *etc.*		
	a)	_Foundation works	Lot	1

	b)	_Super structures	Lot	1
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture *etc.*	Lot	1
	d)	_10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1
	e)	_Warehouse_separate spare materials by installing shelves and labels.	Lot	1
	ii.	Complete civil works for 245kV cum 132kV Indoor GIS Building including Protection & Metering Room, 110V Battery Room *etc.*		
	a)	_Foundation works	Lot	1
	b)	_Super structures	Lot	1
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Lot	1
	d)	_10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1
	iii.	Emergency auxulary power room & water feeding room		
	a)	_Foundation works	Lot	1
	b)	_Super structures	Lot	1
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Lot	1
	d)	_Complete civil work for CAF system including pipe network	Lot	1
1M4	Testing of foundation			
	i	Compression test of pile	No	5
	ii	Uplift test of pile	No	3
	* actual payment shall be as per actual work at site ** set means three phase			

Item No.	Description of Equipment Requirement		Unit	Quantity
1N	**Lighting, small power, air conditioning and Ventilation, Fire Fighting System & CCTV** Complete lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building and local buildings including lighting (flood light; sodium/mercury) for security, roadway, switchyard. Necessary Sizing calculation shall have to be submitted for approval during execution stage. Fire Fighting System & CCTV			
1N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Batterys Rooms, other rooms, etc.) and emergency DC lighting for Indoor.		Lot	1
1N2	Lighting (LED type) for outside building for security, roadway, switchyard		Lot	1
1N3	Fire Fighting system for GIS Hall & Control Room			
	i)	Fire Fighting system For 230kV cum 132kV GIS Hall & Panel Room	Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
	ii)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	1
	iii)	Fire Fighting system For Control Room	Lot	1
1N4	Complete CCTV with motion sensor		Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
1O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations** - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system **Remote end Substations have following make multiplexer equipment** **SS name** / **Telecom Equipment**: Existing Basundhara 230 KV SS — ABB **All PLC terminal equipment at remote end substations are ABB make**			
1O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising			
	i.	ADM with TP unit without booster with Panels (Front opening, Swing Frame type) & accessories	Set	1
	ii.	IDF/SDF	Set	1
	iii.	Cables	Lot	1
	iv.	EOW telephone with board	Set	1
	v.	Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories	Lot	1
	vi.	All other Accessories not included above	Lot	1
1O2	Other Indoor equipment, at Local end SS			
	i.	PABX Card (FXO)	Set	1
	ii.	Primary phone (IP phone)	No.	2
	iii.	Secondary phone (2W phone)	No.	10
	iv.	Indoor MDF	Set	1
1O3	Outdoor equipment, at Local end SS			

Item No.	Description of Equipment Requirement		Unit	Quantity
	i.	Underground optical fiber cable, armoured, 48 core	Lot	1
	ii.	Pigtail cables	Lot	1
	iii.	Outdoor termination box	Set	1
1O4	Extension/Adaptation of Indoor Fibre Optic Multiplexer Equipment & system at remote end substations each comprising			
	i.	Optical STM-16 Card for each 400 kV line at remote end	Lot	1
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1
	iii.	Optical STM-4 Card for each 132 kV line at remote end	Lot	1
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1
	v.	Optical Booster, if required	Lot	1
	vi.	Outdoor termination box	Set	1
	vii.	Cables, ODF, MDF, panels as required	Lot	1
1O5	PLC equipment at Local end SS			
	i.	Indoor PLC Equipment with all accessories & Panels (Front opening, Swing Frame type)	Set	4
	ii.	Line matching unit	No.	8
	iii.	Cables & other accessories for complete PLCC system	Lot	1
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	01
1O6	Installation, testing & commissioning		Lot	1

Item No.	Description of Equipment Requirement		Unit	Quantity
1P	**SCADA system for Telecontrol and Telemetering**			
1P1	i.	Equipment at Substation		
	a)	Gateway (server, engineering software)	Set	2
	b)	Ethernet Switch	Set	2
	c)	Hardware Firewall	Set	1
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1
	e)	Cables	Lot	1
	f)	All Other Accessories	Lot	1
	ii.	Integration work with Master & Backup NLDC including Engineering & Commissioning	Lot	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1R	**Generator for Emergency Aux. Power (with smoke reduction device)**		
1R1	250kW, 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days' continuous operation • With Smoke reduction device	Set	1

Item No.	Description of Equipment Requirement	Unit	Quantity
1S	**Other equipment**		
1S1	Scissor Lift : Battery type for one person / Maximum working height greater than 10m	Set	1
1S2	Emergency Interphone (each room)	Lot	1

4. Schedule B: Bid Prices & Schedules

General

1. The Price Schedules are divided as follows:

   Schedule No. B1: Plant and Mandatory Spare Parts Supplied from Abroad
   Schedule No. B2: Plant and Mandatory Spare Parts Supplied from within the Employer's Country
   Schedule No. B3: Design Services
   Schedule No. B4: Installation and Other Services
   Schedule No. B5: Grand Summary
   Schedule No. B6: Recommended Spare Parts

2. *The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. To have comprehensive understanding of the technical specification of each equipment the bidder shall read technical specification in relevant sections in volume 02; Employer's Requirements & other sections of the Bidding Document (Requirement in Schedule A of Volume 03, GTP requirement in Appendix of Schedule A or Schedule E) and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices The entered rates and prices shall be deemed to cover the full scope as previously mentioned, including overheads and profit*.

3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

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

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

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

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

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

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

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

Notes

i. Items identified as lot in price schedule shall include all the materials required for proper completion of work against that item.
ii. Items identified as meters, such as Cable, GIL, GIB etc. shall be deemed to be tentative & based on preliminary design which shall be variable during detail design in execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.
iii. Items identified as Cubic feet or meters, such as land/earth filling etc. shall be deemed to be tentative & based on preliminary estimation which shall be variable during execution stage. Hence, payment shall be on actual basis, but the unit price shall remain constant throughout the contract.
iv. For Items under steel gantry, column & beam has been added as number basis so that payment can be made on actual basis if no. of column changes during detail engineering in Execution stage while unit price shall remain fixed.
v. Equipment support structure&foundation for Transformer, switchgear etc has been added on Number basis based on tentative & preliminary design so that payment can be made on actual basis if no. of structure changes during detail Engineering in Execution stage while unit price shall remain fixed.

Schedule B: Schedules of Rates and Prices

Schedule No. B1: Plant and Mandatory Spare Parts Supply from Abroad
Schedule No. B2: Plant and Mandatory Spare Parts Supplied from Within the Employer's Country
Schedule No. B3: Design Services
Schedule No. B4: Installation and Other Services
Schedule No. B5: Grand Summary
Schedule No. B6: Recommended Spare Parts
Please see the separate Excel file for the above.

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

Please use the attached excel file

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

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

3.1 Times for Delivery and Completion

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

Completion time for the scope of work under this project is **900 Days**. Construction Schedule exceeding **900 Days** shall be rejected.

The following dates shall be from the commencement date of the Contract.
Key dates to be provided as follows.

E - Target completion dates planned by the Contractor
D - Construction (delivery, erection and commissioning) date guaranteed by the Contractor.
C - Shipping completion dates guaranteed by the Contractor.
B - Date of arrival of first shipment guaranteed by the Contractor.
A - Earliest date by which access is required by the Contractor.

Site/Descriptions	A Earliest Access Permitted Months	B Months	C Months	D Months	E Months
NEW 400/230/132KV GIS SUBSTATION AT PURBACHAL: (1) Civil works (2) 400kV, 230kV & 132kV GIS Equipment (3) SAS (4) Protection (5) AC/DC (6) Tel/SCADA					

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

The following form shall be filled and attached to the bid.
Bidders are free to propose/list more than one Manufacturer for each item.
Quoted rates and prices shall be deemed to apply to whichever Manufacturer is appointed, and no adjustment of the rates and prices will be permitted.
Their participation shall be confirmed with the Manufacturer's Authorization letter(s), as required.
In case that more than one Manufacturer has been proposed, the Employer have right to choose one or more of them, or can ask for replacement

Manufacturers

A list of major items of Plant and Installation Services is provided below.
The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. Bidders are free to propose more than one for each item.

Sl. No.	Major Items of Plant and Installation Services	Manufacturer	Place of Manufacture	Place of Testing and Inspection	Country of Origin
1.	400kV GIS				
2.	230kV GIS				
3.	132kV GIS				
4.	400kV Air Insulated Switchgear Capacitor Voltage Transormer Surge Arrester Wave Trap Busbar conductor Flexible conductor Earth Wire Connectors Insulator - Post (silicon/composite) - Disc Fittings Steel Structures				
5.	230kV Air Insulated Switchgear Lightning Arrester Busbar conductor Flexible conductor Earth Wire Connectors Insulator - Post (silicon/composite) - Disc Fittings Steel Structures				

Sl. No.	Major Items of Plant and Installation Services	Manufacturer	Place of Manufacture	Place of Testing and Inspection	Country of Origin
6.	132kV Air Insulated Switchgear Lightning Arrester Busbar conductor Flexible conductor Earth Wire Connectors Insulator - Post (silicon/composite) - Disc Fittings Steel Structures				
7.	33kV Air Insulated Switchgear Lightning Arrester Busbar conductor Flexible conductor Earth Wire Connectors Insulator - Post (silicon/composite) - Disc Fittings Steel Structures				
8.	400/230/33 kV Auto Transformer Complete HV bushings LV bushings TV bushings Porcelain for insulators Tap changers Copper Core plates Tanks Radiators Fan motors Temperature indicators Oil valves Pressure relief device Motor control equip. Gas/Oil actuated relay Transformer oil Remote control panel Automatic voltage control Equipment Indicating instruments				
9.	230/132/33 kV Auto Transformer Complete HV bushings LV bushings TV bushings				

Sl. No.	Major Items of Plant and Installation Services	Manufacturer	Place of Manufacture	Place of Testing and Inspection	Country of Origin
	Porcelain for insulators Tap changers Copper Core plates Tanks Radiators Fan motors Temperature indicators Oil valves Pressure relief device Motor control equip. Gas/Oil actuated relay Transformer oil Remote control panel Automatic voltage control Equipment Indicating instruments				
10.	33/0.4 kV Auxiliary Transformer				
11.	33/0.4 kV Earthing Transformer				
12.	Protection, Metering & Control Control & Relay Panels Protective relays Substation Automation System DFDR Meters Transducers Energy meter				
13.	DC Equipment Batteries Charge Distribution Boards				
14.	415V Switch Board				
15.	MULTICORE CABLES XLPE Insulated Cables Cable trays				
16.	POWER CABLES 33 kV XLPE Cables 33 kV Cable termination kits				
17.	EARTHING Copper flat-bar / Copper conductor Insulated copper Conductor Earthing Rod				
18.	Fiber Optic Multiplexer Equipment				
19.	Power Line Carrier Equipment				
20.	PABX System				
21.	Site Erection and Commissioning by:- Civil Works				

Sl. No.	Major Items of Plant and Installation Services	Manufacturer	Place of Manufacture	Place of Testing and Inspection	Country of Origin
	Design to be performed by:- Constructed by:-				

7. Schedule E: Technical Particulars and Guarantees

General

The technical data schedules hereafter provide more details on the specific technical criteria and complement the Information given in the Bidding documents. The data in the "Minimum requirement" Column indicates Employers requirement and shall be read in conjunction with schedule of requirement Appendices in Volume 2. If discrepancy occurs between the values of "Drawings" and "Schedule of requirement Appendices" and "Minimum requirement" column of Technical data schedule mentioned here, the highest rating shall prevail. In that case, Bidders shall clarify and re-produce these data from the confirmed one. And Bidders shall submit all the Guaranteed Technical Particulars of all equipment and materials, which will be needed for this Construction project according to Volume 2 & Volume 3, even if these are not available in Schedule E forms.

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

Note:

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

1.2 Technical Data Schedules

Please find hereafter the following schedules:

1.2.1 A : Switchgear 400 kV

1.2.1.1 GIS Switchgear 400 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**Switchgear 400 kV - General**			
1-1	Manufacturer		Insert	
1-2	Type		Insert	
1-3	Model designation		Insert	
1-4	Country of origin		Insert	
1-5	Designed Lifetime	Years	Min 50	
1-6	MTBF		Insert	
1-7	MTTR		Insert	
1-8	Nominal system voltage	kV rms	400	
1-9	Highest voltage for equipment Um	kV rms	420	
1-10	Rated lightning impulse [1.2/50 µs] withstand voltage	kV peak	1425	
1-11	Rated switching impulse [250/2500 µs] withstand voltage	kV peak	1050	
1-12	Rated short-duration power-frequency withstand voltage	kV, 1 min	630	
1-13*	Rated short-duration power-frequency withstand voltage for equipment in service (Manufacturer recommend)			
1-13-1	After 5 years	kV, 1 min		
1-13-2	After 10 years	kV, 1 min		
1-13-3	After 20 years	kV, 1 min		
1-13-4	After 30 years	kV, 1 min		
1-13-5	After 40 years	kV, 1 min		
1-13-6	After 50 years	kV, 1 min		
1-14	Rated frequency fr	Hz	50	
1-15	**Rated current Ir**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-15-1	• Busbars	A	≥ 5000	
1-15-2	• Line bay	A	≥ 4000	
1-15-3	• Transformer bay	A	≥ 4000	
1-15-4	• Bus Coupler / bus section bay	A	≥5000	
1-16	Rated short-circuit withstand current Isc	kA rms	≥50	
1-17	Duration of short-circuit	s	≥3	
1-18	Rated peak withstand current Ip	kA	≥125	
1-19	Control voltage	V. DC	110	
1-20	Viewport	For each DS, ES & FES	Yes	
1-21	GIS Nameplate as per IEEE		Yes	
1-21.1	GIS Gas SLD as per IEEE		Yes	
1-22	Type of busbars	-	Double busbar	
1-23	Allowable maximum temperature and allowable temperature rise			
1-23-1	Allowable maximum temperature			
1-23-1.1	Points contacted during routine operation and inspection specifically the local control cabinet	°C		
1-23-1.2	Which are expected to be contacted in normal operation and routine maintenance	°C		
1-23-1.3	Which need not to be contacted in normal operation	°C		
1-23-2	Allowable Temperature Rise			
1-23-2.1	Points contacted during routine operation and inspection specifically the local control cabinet	K		
1-23-2.2	Which are expected to be contacted in normal operation and routine maintenance	K		
1-23-2.3	Which need not to be contacted in normal operation	K		
1-24	**Enclosure**			
1-24-1	Material		Al	
1-24-2	Diameter	mm		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-24-3	Enclosure Design Type	Phase	1-p	
1-24-4	Busbar	Phase	1-p	
1-24-5	Bay	Phase	1-p	
1-24-6	Feeder Connection	Phase	1-p	
1-24-7	Enclosure Construction	Continuous/Non-continuous	Continuous	
1-24-8*	Discontinuity in Enclosure	Mention locations	Insert	
1-24-9	Temperature at RCCR [Rated Continuous Current Rating]	Deg ℃		
1-24-10*	Connection to adjacent enclosures	Bolted/other (mention)	Insert	
1-24-11	Bellows/ **Compensators** between enclosures	Yes/No	Yes	
1-24-12	Location		Insert	
1-24-13	Electrical segregation		Insert	
1-24-14	Shunting varistor	Yes/No	Yes	
1-25	**Induced current in Enclosure in Percent of Rated current**			
1-25-1	Busbar	% Ir	Insert	
1-25-2	Line bay	% Ir	Insert	
1-25-3	Transformer bay	% Ir	Insert	
1-25-4	Bus Coupler	% Ir	Insert	
1-25-5	Bus section	% Ir	Insert	
1-26	**Grounding Philosophy**			
1-26-1	Proposed Grounding Locations with readily accessible connectors		[Insert]	
1-26-2	Size of Grounding Conductor at each location		[Insert]	
1-26-3	Sufficient mechanical strength to withstand electromagnetic forces and normal abuse	Yes/No	Yes	
1-26-4	Manufacturer to provide Main Grounding Bus	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-26-5	Subassembly-to-subassembly bonding	Yes/No	Yes	
1-26-6	Grounding of GIS-to-Cable Termination ---- Separate	Yes/No	Yes	
1-26-7	Recommendation by Manufacturer for proper procedures of Grounding connections during execution	Yes/No	Yes	
1-27	Gas-Tight Seals	Years	Min 50	
1-28	**Conductor**			
1-28-1	Material		Al	
1-28-2	Diameter	mm	[Insert]	
1-28-3	Temperature at RCCR [Rated Continuous Current Rating]	Deg C	[Insert]	
1-28-4	Connection type	[Insert]	Removable/Fixed/ bolted-type/ Spring Loaded	
1-28-5	Connection has prevention of particle generation	Yes/No	Yes	
1-28-6	Length of maximum section	mm	[Insert]	
1-28-7	No. of support insulator in maximum section	No.	[Insert]	
1-28-8	Support insulator			
1-28-9	Three phase/Single phase	1p/3p	[Insert]	
1-28-10	Time required for 1p fault to convert into 3p fault	ms	[Insert]	
1-28-11	Access for operations and maintenance [Access to all viewports, gas sample ports, density monitors etc]	Yes/No	Yes	
1-28-12	Moveable ladders or platforms	Yes/No	Yes	
1-28-13	Bus expansion joints		At both end	
1-29	**Interface Points Design**			
1-29-1	Busbar Enclosure	Bolted/Welded flange design	Bolted	
1-29-2	Busbar conductor	Bolted/Sliding design	Insert	
1-30	**Expansion Modules**			
1-30-1	At both end of busbar		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-30-2	Isolating Distance Arrangement at Extension module		Yes	
1-30-3	Interface Drawing at detailed Engineering		Yes	
1-31	**Gas zones**			
1-31-1	No. of independent Gas zones in each bay & associated Busbar	No.	[Insert]	
1-31-2	No. of Gas compartments in each bay & associated Busbar	No.	[Insert]	
1-31-3	Desiccant material for absorption of water vapor and gaseous breakdown products in each switching compartments	Yes/No	Yes	
1-31-4	Gas in each zone/compartment			
1-31-4.1	BB/CB/DS/others(insert)	kg	Insert	
1-32	**Gas Partitions/ Compartment and Separate Gas Buffer Zone for MRE requirement**		Yes	
	Separate Gas Buffer Zone for MRE requirement at Following locations			
1-32-1	At Busbar side of CB		Yes	
1-32-2	At Busbar for maintenance	Insert	After each Bay section	
1-32-3	At Busbar end for expansion	At Both end	Yes	
1-32-4	Interface with different make possible		Yes	
1-33	**Gas Partitions/ Compartment at Following locations**		Yes	
1-33-1	At Busbar After Each Bay		Yes	
1-33-2	CB		Yes	
1-33-3	Maintenance DS-ES		Yes	
1-33-4	Busbar DS-ES		Yes	
1-33-5	CT		No, integrated in CB zone	
1-33-6	Feeder VT/ Bus VT		As per design [Insert]	
1-33-7	HES		As per design [Insert]	
	Cable joining terminal		Yes	
1-34	**Rated pressure at each compartment**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-34-1	CB +CT	MPa	[Insert]	
1-34-2	Busbar DS -ES	MPa	[Insert]	
1-34-3	Line DS -ES	MPa	[Insert]	
1-34-4	Bus compartment	MPa	[Insert]	
1-34-5	VT	MPa	[Insert]	
1-34-6	FES	MPa	[Insert]	
1-34-6	Others, if any	MPa	[Insert]	
1-35	**Pressure Coordination inside partitions at following sequence [High to Low]**			
1-35-1	Bursting pressure	MPa	Insert	
1-35-2	Type test pressure	MPa		
1-35-3	Routine test pressure	MPa		
1-35-4	Design pressure	MPa		
1-35-5	Rated filling pressure	MPa		
1-35-6	Alarm pressure	MPa		
1-35-7	Minimum functional pressure	MPa		
1-36	**Accessories in Each gas Compartment**			
1-36-1	Density sensor		Yes/make	
1-36-1.1	Temperature correction		Yes	
1-36-1.2	Type		Digital for CB & Analog for others	
1-36-1.3	Digital		Meter & Transmitter	
1-36-1.4	Sensor at same temp. as Enclosure		Yes	
1-36-2	SF6 Valve		Yes/make	
1-36-3	Moisture absorber		Yes/make	
1-36-3.1	Adsorption surface		20-800 sq. m/g	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1-36-3.2	Adsorption ratio		10-20% by mass	
1-36-4	Pressure relief Device		Yes/make	
1-36-4.1	Heat-resistant deflectors		Yes	
1-36-4.2	Location in Gas Compartment		Opposite to Personnel access	
1-36-5	PD Monitoring		At strategic Location, not less than 03 for one bay	
1-36-5.1	PD Detection Functional type		Internal sensor & Externally by user	
1-36-5.2	PD Detection Method Employed	UHF/Optical/Ultrasonic/Pulse Current/ Chemical	UHF	
1-36-5.3	Portable External PD Sensor		Yes/make	
1-37	Bus section CB for MRE [only required if there is no Bus section CB as per scope of work/requirement/BoQ]		In Live Bus (during Maintenance) only	
1-37-1	CT (at Both side)		Yes	
1-37-2	DS-ES (at Both side)		Yes	
1-38	Endoscope	No.	2 No.'s for whole SS	
2	**Circuit Breaker**			
2-1	General			
2-2	Manufacturer			
2-3	Country of Origin			
2-4	Model			
2-5	Type of circuit breaker		GIS / Indoor	
2-6	Isolating and quenching medium		SF6	
2-7	**Design**			
2-7-1	Interrupter Design		Single/Double breaking	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-7-2	Operating mechanism		Spring/Hydraulic/Spring & Hydraulic	
2-7-3	Number of poles	pcs.	3	
2-8	**Number of operating mechanisms per circuit breaker**			
2-8-1	• Line CB	pcs.	3	
2-8-2	• Transformer CB	pcs.	1 or 3	
2-8-3	• Bus Coupler CB	pcs.	1 or 3	
2-9	D.C. component of the rated short-circuit breaking current	%	> 45	
2-10	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2-11	**Auto reclosing**			
2-11-1	• Line CB		1p+3p	
2-11-2	• Transformer or Reactor or Bus Coupler or bus section CB		3p	
2-11-3	Number of successive auto-Reclosing operations without derating		Insert	
2-12	**Rated supply pressure of gas for interruption**			
2-12-1	Maximum	MPa (g)	Insert	
2-12-2	Normal	MPa (g)	Insert	
2-12-3	Minimum	MPa (g)	Insert	
2-12-4	Low Pressure Alarm	MPa (g)	Insert	
2-12-5	Lockout Alarm	MPa (g)	Insert	
2-12-6	Limits for correct operation			
2-12-6-1	Max	MPa (g)	Insert	
2-12-6-2	Normal	MPa (g)	Insert	
2-12-6-3	min	MPa (g)	Insert	
2-12-7	Maximum pressure rise in circuit breakers due to the making or breaking of rated current	MPa	Insert	
2-12-8	Is lockout facility fitted?	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-12-9	Whether Lockout will trip CB	Yes/No	No	
2-12-10	Trip free/or fixed trip		Trip Free	
2-12-11	Is circuit-breaker re-strike free	Yes/No	Yes	
2-12-12	Restrike performance during capacitive current switching	Class	C2	
2-13	**Number of operations without maintenance**			
2-13-1	• CO at no-load		≥ 10000	
2-13-2	• CO at rated current		≥ 2500	
2-13-3	• CO at rated breaking current Isc		≥ 10	
2-13-4	Number of operation Curve for above CB to be attached to CB		Yes	
2-13-5	The frequency of mechanical operations	Class	M2	
2-13-6	Rated electrical endurance	Class	Min E1	
2-14	**Interrupter Chamber**			
2-14-1	No. of Interrupter		1	
2-14-2	Type	Self-Blast/Puffer	Auto-Puffer	
2-14-3	Model Designation			
2-14-4	Material of Male-Female part		Insert	
2-14-5	Length of each break	mm	Insert	
2-14-6	Length of stroke	mm	Insert	
2-15	**Operating Mechanism**			
2-15-1	Type		Motor Wound Spring/Hydraulic/hydraulic-Spring	
2-15-2	Make			
2-15-3	Country of Manufacturer			
2-15-4	Model Designation			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-15-5	Motor - auxiliary supply voltage	V. AC		
2-15-6	Rated power of motor	W	Insert	
2-15-7	Current required at rated supply voltage to open circuit-breaker	A	Insert	
2-15-8	Number of making coils	pcs.	1	
2-15-9	Rated Operating Voltage	V.DC	110	
2-15-10	Power	W		
2-15-11	Number of breaking coils	pcs.	2	
2-15-12	Rated Operating Voltage	V.DC	110	
2-15-13	Power	W		
2-15-14	Minimum number of available contacts (NO/NC)		16NO+16NC	
2-15-15	Hearer & No.	Yes- Min 1		
2-15-16	Rated Voltage	V.AC/50 HZ	230V	
2-15-17	Power	W		
2-15-18	Operating mechanism material			
2-15-19	Water-tight corrosion-resistant housing		AL	
2-15-20	A crank for manual spring loading	Yes/No	Yes	
2-15-21	Whether there is provision for manual spring charging. (in case of hydraulic manual operation, to build oil pressure)	Yes/No	Yes	
2-15-22	Whether facility to close / open the CB manually in the Absence of DC control supply to the operating mechanism	Yes/No	Yes	
2-15-23	Whether suitable facility is available for bleeding the hydraulic Circuit in order to remove the trapped gas if any in the Hydraulic mechanism	Yes/No	Yes	
2-15-24	Whether anti pumping facility is provided in the Circuit breaker mechanism	Yes/No	Yes	
2-15-25	Type of transmission of mechanical energy from the operating mechanism to the interrupter unit i.e. whether single mechanism coupled to three phases or three independent mechanisms		Insert	
2-15-26	Number of close-open operations possible without recharging		O-CO	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-15-27	Emergency Trip Switch	Yes/No	Yes	
2-16	**Characteristics & Performance**			
2-16-1	Rated Voltage	KVrms	420	
2-16-2	Rated lightning impulse withstand voltage	kVpeak		
2-16-2.1	Phase to ground	kVp	1425	
2-16-2.2	Across interrupting chamber	KVp	1425+	
2-16-2.3	Between phases	kVp	1425+	
2-16-3	Rated Power frequency withstand voltage (dry), 1 minute	kVrms		
2-16-3.1	Phase to ground	kVrms	Insert	
2-16-3.2	Across interrupting chamber	kVrms	630+	
2-16-3.3	Between phases	kVrms	630+	
2-16-4	Rated Switching impulse withstand voltage	kVpeak		
2-16-4.1	Phase to ground	kVp	1050	
2-16-4.2	Across interrupting chamber	KVp	1050+	
2-16-4.3	Between phases	kVp	1050+	
2-17	**Maximum TRV (transient recovery voltage) withstand capability of the CB**			
2-17-1	During Opening of Fault, T100	kV	[Insert]	
2-17-1.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-17-2	During Opening of Cable	kV	[Insert]	
2-17-2.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-17-3	During Opening of capacitor bank	kV	[Insert]	
2-17-3.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-17-4	During Opening of line	kV	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-17-4.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-17-5	During Opening of Transformer	kV	[Insert]	
2-17-5.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-17-6	During Opening of Reactor	kV	[Insert]	
2-17-6.1	Rate of rise of recovery voltage	kV/µs	[Insert]	
2-18	Maximum switching surge per unit value	p.u	2.5	
2-19	Corona extinction voltage with CB open or close	kV rms		
2-20	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/√3)	µV		
2-21	First-pole-to-clear factor			
2-21-1	Terminal fault		1.3	
2-21-2	Short-line fault		1	
2-21-3	Out-of-phase		2	
2-22	**Short Circuit Rating**			
2-22-1	Rated short-circuit breaking currents, Isc (equal to short circuit withstand current):	kA rms	50	
2-22-2	Three phase Symmetrical breaking currents	kA rms	50	
2-22-3	Three phase Asymmetrical breaking currents	kA rms	Insert	
2-22-4	Single phase Symmetrical breaking current for line to ground	kA rms	Insert	
2-22-5	Single phase Asymmetrical breaking current for line to ground	kA rms	Insert	
2-22-6	D.C. component of the rated short-circuit breaking current	%	>45	
2-22-7	Rated short line fault breaking current capability			
2-22-7.1	Percentage of rated breaking current	%	Insert	
2-22-7.2	Surge Impedance	Ohms	Insert	
2-22-7.3	Amplitude factor		Insert	
2-22-7.4	Critical percentage of rated breaking current	%	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-22-7.5	Maximum arc duration	ms	Insert	
2-22-8	Rated capacitive switching capability (breaking currents):			
2-22-8.1	Line charging	A rms	Insert	
2-22-8.2	Cable charging	A rms	Insert	
2-22-8.3	Capacitor Bank breaking current	A rms	Insert	
2-22-9	Rated inductive switching/ breaking capability:	A	Insert	
2-23	**Timing Performance**			
2-23-1	Maximum total break time (trip initiation to final arc extinction) (3.7.135 acc. to IEC 62271-100)	ms	≤40	
2-23-2	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	
2-24	**Opening time (trip initiation to contact separation)**	ms		
2-24-1	Without current	ms	[Insert]	
2-24-2	With 100 % rated current	ms	[Insert]	
2-24-3	With 100 % rated breaking current	ms	[Insert]	
2-25	**Closing time**	ms	65	
2-25-1	Without current	ms	[Insert]	
2-25-2	With 100 % rated current	ms	[Insert]	
2-25-3	With 100 % rated breaking current	ms	[Insert]	
2-25-4	Maximum time interval between opening interrupters between first & last phases	ms	Insert	
2-25-5	Maximum time interval between opening of interrupters in same phases		NA	
2-25-6	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	Insert	
2-26	**Mechanical time staggering in Gang Pole CB**			
2-26-1	First-to-Second phase	ms	Insert	
2-26-2	Second-to-Third Phase	ms	Insert	
2-27	**Minimum time for auto reclosing (dead time)**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-27-1	Single phase	ms	Insert	
2-27-2	Three Phase	ms	Insert	
2-27-3	Pole discrepancy for the closing operation of CB i.e, Maximum difference in closing Time between first contact touch and Last phase to close.	ms	Insert	
2-28	**Force**			
2-28-1	Dynamic horizontal force, longitudinal Fwx	N	Insert	
2-28-2	Dynamic horizontal force, transversal	N	Insert	
2-30	CB Contact Resistance	μΩ	Insert±20%	
2-31	CB Open Resistance	MΩ		
2-29*	**Accessories in central control panel/ LCC**			
2-29-1	Anti-pumping relay	Yes/No	Yes	
2-29-2	Local/remote control selector switch	Yes/No	Yes	
2-29-3	Single Pole/Gang operation switch	Yes/No	Yes	
2-29-4	Local operation push buttons	Yes/No	Yes	
2-29-5	Minimum pressure lock-out and alarm relays	Yes/No	Yes	
2-29-6	Operation counter	Yes/No	Yes	
2-29-7	DC MCB for Control Circuit	Yes/No	Yes	
2-29-8	NO/NC Contact in MCB for signaling	Min 02	Insert	
2-29-9	AC MCB	Yes/No	Yes	
2-29-10	NO/NC Contact in MCB for signaling		Yes	
2-29-11	Service outlet socket	Min 01, 10A	Insert	
2-29-12	Cu -earthing rails inside control cabinet	Yes/No	Yes	
2-29-13	Detachable plates, the bottom of control cabinet	Yes/No	Yes	
2-29-14	Set of cables for connection of operating mechanism and central control panel of circuit breaker	Yes/No	Yes	
2-29-15	Time phase discrepancy relay	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2-29-16	Weather proof, corrosion resistance enclosure		IP55	
2-29-17	Mimic		Yes	
2-29-18	Enclosure Material		Al or stainless steel	
3	**Disconnector**			
3-1	General			
3-2	Manufacturer			
3-3	Country of Origin			
3-4	Model Designation			
3-5	Type		GIS / Indoor	
3-6	**Design and Construction**			
3-6-1	Type of disconnector			
3-6-1.1	Three pole, three position (closed/open/earthed), motor operated, insulated, with earthing switch			
3-6-1.2	• Three pole, make-proof, motor operated earthing switch			
3-6-1.3	• Three pole, Disconnector ,motor operated, insulated, without earthing switch			
3-6-2	Number of poles	pcs.	3	
3-6-3	Number of breaks per pole	pcs	01	
3-6-4	Type of Contacts			
	DS-ES		[Insert]	
	HSES		[Insert]	
3-6-5	Material of contact surfaces			
	DS-ES		[Insert]	
	HSES		[Insert]	
3-7	**Operating Mechanism & Drive Box**			
3-7-1	Number of operating mechanism	pcs.	01 or 03	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3-7-2	Type of operating mechanism			
3-7-3	• Three position		Motor driving	
3-7-4	• Make-proof		Motor-wound spring	
3-7-5	• Disconnector Link		Manual/lever	
3-7-6	Making and breaking busbar transfer current		1600A	
3-7-7	• Operating time			
3-7-8	• For opening		≤ 2 sec	
3-7-9	• For closing		≤ 4 sec	
3-7-10	No. of auxiliary contact		16NO+16NC, 1NO early	
3-7-11	Hand operating facilities		Yes	
3-7-12	Mechanical number of guaranteed operation		10.000 (M2)	
3-7-13	Power requirement		INSERT	
3-7-14	Anti-condensation heater inside the operating mechanism cabinet			
3-7-15	Total heater power	W		
3-7-16	Heater- supply voltage		230 V, 50 Hz	
3-7-17	Control Voltage	V.DC	110V	
3-7-19	Water-tight corrosion-resistant housing		IP55	
3-7-20	Drive housing Material		AL or Stainless Steel	
3-7-21	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	
3-7-22	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment		Yes	
3-8*	**Accessories in LCC for DS**			
3-8-1	Voltage presence Contactor	Yes/No	Yes	
3-8-2	Other Contactors	Yes/No	Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3-8-3	Motor AC MCB (miniature circuit breakers)		Min 01	
3-8-4	Heater AC MCB (miniature circuit breaker)		Min 01	
3-8-5	Control Circuit DC MCB		Min 01	
3-8-6	Selection switch (local/neutral/remote)	Yes/No	Yes	
3-8-7	Manual closing button	Yes/No	Yes	
3-8-8	Manual opening button	Yes/No	Yes	
3-8-9	MTBF of DS		Insert	
3-8-10	MTBF of HSES			
3-8-11	MTTR of DS			
3-8-12	MTTR of HSES			
3-9	**Rating & Characteristics**			
3-9-1	Rated lightning impulse withstand voltage of DS-ES/HSES	kVpeak		
3-9-1-1	Phase to ground		1425	
3-9-1-2	Across Isolating Gap		1425+240	
3-9-1-3	Between phases		1425	
3-9-2	Rated Switching impulse withstand voltage of DS-ES/HSES	kVpeak		
3-9-2-1	Phase to ground		1050	
3-9-2-2	Across Isolating Gap		1050+	
3-9-2-3	Between phases		1050+	
3-9-3	Rated Power frequency withstand voltage (dry), 1 minute of DS-ES/HSES	kVrms		
3-9-3-1	Phase to ground		520	
3-9-3-2	Across Isolating Gap		610	
3-9-3-3	Between phases		Insert	
3-9-4	Corona extinction voltage	kV rms	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3-9-5	Load Switching capability	A		
3-9-5-1	Capacitive Current	A		
3-9-5-2	Cable charging current	A		
3-9-5-3	Small inductive current	A		
3-9-8	Rated Current	A	Same as GIS/CB	
3-9-9	Rated bus-transfer voltage and current			
3-9-9.1	Rated Bus-transfer voltage for DS	V	300	
3-9-9.2	Rated bus-transfer current	A	1600	
3-9-12	Rated induced current and voltage for grounding switches			
3-9-12-1	Electromagnetic coupling			
a	Induced Voltage	kV (rms)	Insert	
b	Induced Current	A (rms)	Insert	
3-9-12-2	Electrostatic coupling			
a	Induced Voltage	kV (rms)	Insert	
b	Induced Current	A (rms)	Insert	
3-9-13	FES special rating			
3-9-13-1	Closing time	ms	100	
3-9-13-2	Opening time	ms	200	
3-9-13-3	No. of closing operation without Maintenance	No.	2	
3-9-14	Maintenance DS-ES Timings			
3-9-14-1	Closing	s		
3-9-14-2	Opening	s		
3-9-14-3	Earthing	s		
3-9-15	Contact Resistance			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3-9-15-1	DS	μΩ	70±20%	
3-9-15-2	DS-ES	μΩ	70±20%	
3-9-16	Open Resistnce			
3-9-16-1	ES	MΩ		
3-9-16-2	FES	MΩ		
4	**Current Transformer**			
4-1	General			
4-1-1	Manufacturer			
4-1-2	Country of Origin			
4-1-3	Type		GIS / Indoor	
4-2	**Design & Construction**			
4-2-1	CT on both sides of CB		Yes	
4-2-2	**No. of cores in Each CT**			
4-2-2-1	**Line/Transformer Feeder CT**			
i)	Bus side CT		04	
ii)	Feeder side CT		02	
4-2-2-2	**Bus Coupler CT**			
i)	BB 01 side		04	
ii)	BB 02 side		04	
4-2-2-3	**Bus section CT**			
i)	BB section-01 side		04	
ii)	BB section-02 side		04	
4-2-3	**Ratings**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4-2-3-1	**Accuracy class:**			
4-2-3-1-1	**Line/Transformer Feeder CT**			
i)	**Bus side CT**			
	Core- I		5P20	
	Core- II		5P20	
	Core- III		5P20	
	Core- IV		0.2S	
ii)	**Feeder side CT**			
	Core- I		5P20	
	Core- II		5P20	
4-2-3-1-2	**Bus Coupler CT**			
i)	BB 01 side			
	Core- I		0.2S	
	Core- II		5P20	
	Core- III		5P20	
	Core- IV		5P20	
ii)	BB 02 side			
	Core- I		0.2S	
	Core- II		5P20	
	Core-III		5P20	
	Core- IV		5P20	
4-2-3-1-3	**Bus section CT**			
i)	BB section-01 side			
	Core- I		0.2S	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Core- II		5P20	
	Core-III		5P20	
	Core- IV		5P20	
ii)	BB section-02 side			
	Core- I		0.2S	
	Core- II		5P20	
	Core-III		5P20	
	Core-IV		5P20	
4-2-3-2	**Ratio & Burden**			
4-2-3-2-1	**Line/Transformer Feeder CT**			
i)	**Bus side CT**			
	Core- I	A, VA	4000-2000/1A, 30VA	
	Core- II	A, VA	4000-2000/1A, 30VA	
	Core- III	A, VA	4000-2000/1A, 30VA	
	Core- IV	A, VA	4000-2000/1A, 10VA	
ii)	**Feeder side CT**			
	Core- I	A, VA	4000-2000/1A, 30VA	
	Core- II	A, VA	4000-2000/1A, 30VA	
4-2-3-2-2	**Bus Coupler CT**			
i)	BB 01 side			
	Core- I	A, VA	5000-2500/1 A, 10VA	
	Core- II	A, VA	5000-2500/1 A, 30VA	
	Core- III	A, VA	5000-2500/1 A, 30VA	
	Core- IV	A, VA	5000-2500/1 A, 30VA	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
ii)	BB 02 side			
	Core- I	A, VA	5000-2500/1 A, 10VA	
	Core- II	A, VA	5000-2500/1 A, 30VA	
	Core- III	A, VA	5000-2500/1 A, 30VA	
	Core- IV	A, VA	5000-2500/1 A, 30VA	
4-2-3-2-3	**Bus section CT**			
i)	BB section-01 side			
	Core- I	A, VA	5000-2500/1 A, 10VA	
	Core- II	A, VA	5000-2500/1 A, 30VA	
	Core- III	A, VA	5000-2500/1 A, 30VA	
	Core- IV	A, VA	5000-2500/1 A, 30VA	
ii)	BB section-02 side			
	Core- I	A, VA	5000-2500/1 A, 10 VA	
	Core- II	A, VA	5000-2500/1 A, 30VA	
	Core- III	A, VA	5000-2500/1 A, 30VA	
	Core- IV	A, VA	5000-2500/1 A, 30VA	
Burden rating of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design during execution to prove the adequacy of the Burden proposed, which will be subject of the PGCB's approval. If required by design calculation, higher burden CT shall be provided within the Bid price.				
4-2-3-3	**Rated continuous thermal current (40°C):**			
4-2-3-3-1	• Metering Core	% In	200	
4-2-3-3-2	• Protection Core	% In	120	
4-2-3-4	**Instrument Security Factor:**			
4-2-3-4-1	• Metering Core		Fs<5	
5	**Voltage Transformer**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5-1	General			
5-2	Type			
5-3	Model			
5-4	**Design & Construction**		GIS / Indoor	
5-4-1	Impulse Voltage to earth			
5-4-1-1	Lightning	kVp	1425 for Bay, 1550 for Bus	
5-4-1-2	Switching	kVp	1050 for bay, 1155 for Bus	
5-4-2	Power Frequency Voltage to earth	kVrms	630	
5-4-3	Externally operable Disconnector & Earth Switch		Yes	
5-4-4	Damping resistor		Yes	
5-4-4-1	Ohm	kΩ		
5-4-5	Suitable for Long line DC voltage discharge through VT winding	Yes/NO	Yes	
5-4-6	VFTO suppression		Yes	
5-4-7	Secondary Box			
5-4-7-1	Secondary Box Material		AL or Stainless steel	
5-4-7-2	Secondary Box IP rating		IP55	
5-4-7-3	MCB for each core	Yes/NO	Yes	
5-4-7-4	NO/NC contact in MCB for signaling	Yes/NO	Yes	
5-4-8	Rated primary voltage	kV	400/√3	
5-4-9	Rated secondary voltage			
5-4-9-1	• I winding	V	110/√3	
5-4-9-2	• II winding	V	110/√3	
5-4-9-3	• III winding	V	110/√3	
5-4-10	Accuracy class:			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5-4-10-1	• I winding		0.2	
5-4-10-2	• II winding		3P	
5-4-10-3	• III winding		3P	
5-4-11	Rated power:			
5-4-11-1	• I winding	VA	10	
5-4-11-2	• II winding	VA	25	
5-4-11-3	• III winding	VA	25	
5-4-12	Load		Simultaneously	
5-4-13	Voltage factor			
	continuous		1.2	
	others		Insert, s	
6	**Surge Arresters, GIS type**			
6-1	Type & Make		GIS / Indoor, Insert	
	Model			
6-2	Quantity, Position & Characteristic of Surge Arresters are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design, which will be subject of the PGCB's approval		Yes	
6-3	Rated voltage of surge arrester Ur	kV rms	390	
6-4	Max. continuous operating voltage Uc	kV rms	312	
6-5	Nominal discharge current In (8/20 μs)	kA peak	10	
6-6	High current impulse of an arrester (4/10 μs)	kA peak	100	
6-7	Line discharge class	Class	3	
6-8	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 8	
6-9	Long duration current impulse (2000 μs)	A	≥ 850	
6-10	Maximum residual voltage Ures			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6-10-1	For switching impulse current 30/60 µs at 0,5 kA	kV peak	≤ 375	
6-10-2	For switching impulse current 30/60 µs at 1 kA	kV peak	≤ 385	
6-10-3	For switching impulse current 30/60 µs at 2 kA	kV peak	≤ 405	
6-10-4	For lightning impulse current 8/20 µs at 5 kA	kV peak	≤ 862	
6-10-5	For lightning impulse current 8/20 µs at 10 kA	kV peak	≤ 916	
6-10-6	For lightning impulse current 8/20 µs at 20 kA	kV peak	≤ 990	
6-11	Arrester reference Voltage	kV		
6-11-1	Arrester reference current for above Voltage	mA		
6-12	Arrester leakage current			
6-12-1	New, test acceptance value	µA		
6-12-2	During operation, 40 deg C	µA		
6-12-3	Critical value, maximum allowable	µA		
6-13-	Resistor Block			
6-13-1	No. of Resistor Block in series	No.		
6-13-2	Diameter of each block	mm		
6-13-3	No. of Block electrically parallel	No.		
6-11	Externally operable Disconnecting Link & Earth Switch		Yes	
6-12	Surge counter make		Insert	
6-12.1	Surge counter model		Insert	
7*	**LCC**			
7-1	Type		Standalone	
7-2	Dimension	mm		
7-3	Housing Material		AL or Stainless Steel with Glass Door	
7-4	Thickness	mm	2	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7-5	IP rating		IP55	
7-6	**Accessories**			
7-6-1	DC MCBs	Yes/No	Yes	
7-6-2	Control Voltage	V.DC	110	
	Dual connection-DC		Yes	
7-6-3	AC MCBs	Yes/No	Yes	
7-6-4	Voltage	V.AC	230V/415V, 50Hz	
	Dual connection-AC		Yes	
7-6-5	Heater	Yes/No	Yes	
7-6-6	Rated Voltage	V.AC	230V, 50Hz	
7-6-7	Rated Power	W		
7-6-8	Humidity Controller	Yes/No	Yes	
7-6-9	GFI Socket	Yes/No	Yes	
7-6-10	Rating, A	A		
7-6-11	LED Light with ON/OFF switch			
7-6-12	Rated Power	W		
7-6-13	Rated Voltage	V		
7-6-14	L/R switch [with gang/single pole operation for CB]			
7-6-14-1	CB			
7-6-14-2	DS			
7-6-14-3	HSES			
7-6-14-4	ES			
7-6-15	Operation Switch [Close/Open/Neutral]			
7-6-15-1	CB			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7-6-15-2	DS			
7-6-15-3	HSES			
7-6-15-4	ES			
7-6-15-5	VT			
7-6-16	Mimic/line diagram with semaphore & switch			
7-6-17	LED with semaphore			
7-6-18	Line diagram color			
7-6-19	Hardware Interlock at LCC	Yes/No	Yes	
7-6-20	Manual operation of the disconnect and grounding switches is only possible under electrical interlock release conditions.	Yes/No	Yes	
7-6-21	Mechanical and electrical interlock between disconnect and grounding switch operation is provided.	Yes/No	Yes	
7-6-22	The electrical interlock scheme is fail-safe to prevent loss of interlock function upon loss of control voltage.	Yes/No	Yes	
7-6-23	Electrical interlock between the line PT secondary voltage and respective high speed grounding switch operation is provided through under voltage relay contacts.	Yes/No	Yes	
7-6-24	The feeder grounding switch is interlocked with the corresponding circuit breaker and disconnect switch.	Yes/No	Yes	
7-6-25	The bus bar grounding switch is interlocked with all disconnect switches on the same busbar section.	Yes/No	Yes	
7-6-26	The high speed grounding (fast-acting grounding) switch is interlocked with the associated circuit breaker open.	Yes/No	Yes	
7-6-27	No switching of the earthing switch when the bus bar or equipment is energized.			
7-6-28	No paralleling of buses by dis-connectors when bus coupler is open.	Yes/No	Yes	
7-6-29	Only local mode operation for CB when dis-connectors are open.	Yes/No	Yes	
7-6-30	No closing of dis-connector when a load is connected.	Yes/No	Yes	
7-6-31	No switching of the earthing switch when the bus bar or equipment is energized [It shall not be possible to override this interlock]	Yes/No	Yes	
7-6-32	Interlock Override switch [A key switch for overriding interlocks between disconnect and grounding switches associated with circuit breakers during maintenance]			
7-6-33	SYNC bypass switch			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
7-6-34	Locking Padlock for switchgear	Yes/No	Yes	
7-6-35	Separate Terminal Board (TB) Block for CB/DS/HSES etc.	Yes/No	Yes	
7-6-36	Shielded Control cable upto LCC	Yes/No	Yes	
7-6-37	Grounding of control cable shield at both the equipment and the LCC ends at the location where the control cable first enters the cabinet.	Yes/No	Yes	
7-6-38	Grounding Material		either coaxial ground bushings or short connections to the cabinet walls	
7-6-39	Minimum Alarm			
7-6-40	Loss of DC supply to circuit breaker motor.			
7-6-41	SF6 gas pressure Low–Low, Stage 1 alarm for each gas zone/section (in the case of a single phase, an alarm is provided for each phase)			
7-6-42	SF6 gas pressure Low–Low, Stage 2 alarm for each gas zone/section (in case of a single phase, the alarm is grouped for all phases)			
7-6-43	Excess run time of the motor for the circuit breaker, disconnecting switch, and ground switch			
7-6-44	Spring overcharged for the circuit breaker mechanism			
7-6-45	Loss of DC for the trip and close circuit			
7-6-46	Circuit breaker trip			
7-6-47	VT supply fail (VT MCB trip)			
7-6-48	Loss of AC supply			
7-6-49	Circuit breaker mechanism failure			
7-6-50	Local/remote switch			
7-6-51	Pole discrepancy operated (for single-phase breaker)			
7-6-52	Trip circuit failure			
7-6-53	BCU in LCC		As per design	
8	**Termination Connection**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8-1	Type: GIL – Gas Insulated Line, Outdoor & Indoor		Yes	
8-2	Type: Single phase or Three phase, according to the design		Yes	
8-3	Insulator, Single phase, SF6 / Air		Yes	
8-4	Insulating material		Composite/Silicon	
8-5	Minimum external housing insulation creepage distance	mm/kV	≥ 31 mm/kV	
8-6	Rated continuous Current	A	Same as feeder	
8-7	Minimum centerline phase-to-phase spacing	mm		
8-8	Length of longest GIL sections	mm		
8-9	Outside diameter	(mm)		
8-10	Wall thickness	(mm)		
8-11	SF6 gas pressure at 20^0C	KPa		
9	**MRE Requirement**			
9-1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays		Yes	
9-2	Repair of any circuit breaker shall be possible without interruption of adjacent bays		Yes	
9-3	Extension of any bay shall be possible without interruption of adjacent bays		Yes	
9-4	HV testing in any bay shall be possible without complete “Out of service” of the GIS		Section wise	
9-5	Separate HV Test Bushing (for cable connected feeder)		NA	
10*	**Dimensions**			
10-1	Length			
10-1-1	Line Bay	mm	[Insert]	
10-1-2	Transformer Bay	mm	[Insert]	
10-1-3	Bus-coupler bay	mm	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10-1-4	Bus-section Bay	mm	[Insert]	
10-2	Width	mm	[Insert]	
10-2-1	Line Bay	mm	[Insert]	
10-2-2	Transformer Bay	mm	[Insert]	
10-2-3	Bus-coupler bay	mm	[Insert]	
10-2-4	Bus-section Bay	mm	[Insert]	
10-3	Height			
10-3-1	Line Bay	mm	[Insert]	
10-3-2	Transformer Bay	mm	[Insert]	
10-3-3	Bus-coupler bay	mm	[Insert]	
10-3-4	Bus-section Bay	mm	[Insert]	
	Overall compliance with the requirements (yes/no)			

1.2.1.2: 400kV Capacitive Voltage Transformer

No.	Description	Unit	Minimum Requirements	Guaranteed
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 61869-1&3	
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	400	
2.2	Highest voltage for equipment Un	kV rms	420	

No.	Description	Unit	Minimum Requirements	Guaranteed
2.3	Rated lightning impulse withstand voltage	kV peak	1425	
2.4	Rated switching impulse withstand voltage	kV	1050	
2.5	Rated Power frequency withstand voltage (dry), 1 minute	kV rms	520	
2.6	Power frequency withstand tests on secondary windings, 1 min	kV rms	3	
	Power frequency withstand voltage between LV terminal and earth, 1min	kV rms	4 (10 if the low voltage terminal is exposed)	
2.7	Rated primary voltage	kV	400/√3	
2.8	Rated secondary voltage			
	a) I winding	V	110/√3	
	b) II winding	V	110/√3	
	c) III winding	V	110/√3	
2.9	Corona extinction voltage	kV rms	320	
2.10	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/√3)	µV	1000	
2.11	Rated frequency fr	Hz	50	
2.12	Rated short-time thermal current I_{th}, 1 s	kA	Insert	
2.13	Rated dynamic current I_{dyn}	kV peak	Insert	
2.14	Accuracy class:			
	a) I winding		0.2	
	b) II winding		3P	
	c) III winding		3P	
2.15	Rated power:			
	a) I winding	VA	10-30	
	b) II winding	VA	20-50	
	c) III winding	VA	20-50	
			Calculation is required during design stage	
2.16	Rated Total thermal Burden			
	a) I winding	VA	200	
	b) II winding	VA	200	
	c) III winding	VA	200	
			The accuracy of 0.2 on winding I shall be maintained upto Rated total Thermal burden (200VA).	
2.17	Load		Simultaneously	
2.18	Voltage factor	p.u./s	1.2 continuous 1.5/30	
2.19	Rated mechanical strength	Class	Min. Class II	
2.20	Capacitor value: Capacitance C1 Capacitance C2	pF	 Insert Insert	

No.	Description	Unit	Minimum Requirements	Guaranteed
2.21	High frequency capacitance for entire carrier frequency range		Within 80% to 150% of rated capacitance	
2.22	Phase angle error	minutes	20	
2.23	Equivalent series resistance over the entire carrier frequency range or temperature range	ohms	<40	
2.24	Stray capacitance and stray conductance of low voltage terminal over the entire capacitance		As per IEC 60358-1	
2.25	Standard reference range of frequencies for which the accuracies are valid		-97% to 103% for protection -99% to 101% for metering	
2.26	Maximum temperature rise	°C	Insert	
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. > 31 mm/kV	
3.4	a) Test voltage 1.2*Um/V3	pC	Max. < 5	
	b) Test voltage Um	pC	< 10	
3.5	Min. LV enclosure protection		IP55	
3.6	HV terminals			
3.6.1	Shape		Flat	
3.6.2	Position		Vertical or horizontal	
3.6.3	Dimensions	mm x mm	Min 200 x 100	
3.6.4	Number of holes		Min 8	
3.6.5	Dimensions of holes	mm	Insert	
3.6.6	Distance between holes	mm	Insert	
3.6.7	Material suitable for		Al terminal	
3.7	Oil drain cock and sampling device		Yes	
3.8	Enable sealing after accuracy class checks (sealing possibilities)		Yes	
3.9	Outdoor metal part made of aluminium or stainless steel		Yes	
3.10	Mass and dimensions			
3.10.1	Total mass	kg	Insert	
3.10.2	Height	mm	Insert	
4	**Others**			
4.1	Type test certificate date/reference	Required	Yes	
4.2	Period of time equipment has been in commercial operation	years	Insert	
4.3	Number of the same type of CTs supplied to date	Nos.	Insert	
	Overall compliance with the requirements (yes/no)			

1.2.1.3 Surge Arresters 400 kV-AIS

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	400	
2.2	Highest voltage for equipment Um	kV rms	420	
2.4	Rated voltage of surge arrester Ur	kV rms	390	
2.5	Max. continuous operating voltage Uc	kV rms	312	
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	≥ 8	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Long duration current impulse (2000 µs)	A	≥ 850	
3.4	Maximum residual voltage Ures			
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	≤ 862	
3.4.5	For lightning impulse current 8/20 µs at 10 kA	kV peak	≤ 916	
3.4.6	For lightning impulse current 8/20 µs at 20 kA	kV peak	≤ 990	
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 (Fdyn)	N	≥ 2250	
3.6.2	Specified long-term load SSL (Fstat)	N	≥ 1550	
3.7	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
3.8.	Housing insulating material		Composite/Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	
3.11	Surge arrester weight	kg	Insert	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	Min 100 x 100	
3.14.3	Number of holes		Min 4	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.1.4 Wave Trap: 400kV

No	Description	Unit	Minimum Requirements	Guaranteed
1.	**Wave Trap - General**			
2.	Type of Line Trap Installation		To be inserted into high voltage A.C transmission line phase in series	
3.	Type of mounting		Pedestal	
4.	Suitable for system Frequency	**Hz**	50	
5.	Nominal System Voltage	**kV**	400	
6.	Highest System Voltage	**kV**	420	
7.	Rated Continuous Current	**A**	4000	
8.	Rated Short time current for 1 second	**k**A	50	
9.	Asymmetrical peak value of the First half wave of the rated short Time current	**k**A	125	
10.	Rated inductance	mH	1.0	
11.	Type of Tuning		Band tuned line trap	
12.	Blocking Band frequency range	kHz kHz	Band-I: 56 to 124 Band-II: 76 to 500	
13.	Minimum Guaranteed resistive Component of impedance in Blocking Frequency Rang	Ohm	500	
14.	Protective device		a) Non-linear resistive type Gapped lightning arresters for A.C system. b) Polymer housed Metal oxide surge arrester without Gaps for A.C system.	

No	Description	Unit	Minimum Requirements	Guaranteed
15.	Nominal discharge current of protective device	kA	10 kA However, Co-ordination shall be done by taking 20kA, 8/20 micro-sec discharge into consideration.	
16.	Rated voltage of protective device	kV rms	>15.72	
17.	Minimum value of power frequency spark over voltage (Dry & wet) of protective device	kV rms	>23.58	
18.	Visual Corona Extinction Voltage	kV rms	320 kV rms	
19.	Radio influence Voltage (RIV)	µV	<500 @280 kV	
20.	Attention in tuned frequency band	dB	<7.5 dB	
21.	Maximum tapping loss over blocking Band I & II stated above	dB	2.6 dB	
22.	Insulation class	**Class**	F	
23.	Maximum working stress		Twice the weight of wave trap+500 kgs.	

1.2.1.5 Post Insulator 400 kV (If needed)

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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.7	Design		Solid core, Composite, outdoor	
2	**Post Insulators - Characteristics**			
2.1	Nominal system voltage	kV rms	400	
2.2	Highest voltage for equipment Um	kV rms	420	
2.3	Rated lightning impulse withstand voltage	kV peak	1425	
2.4	Rated short duration power frequency voltage	kV	630	
2.5	Rated frequency fr	Hz	50	
2.6	Minimum creepage distance	mm/kV	Min. ≥ 31 mm/kV	
2.7	Failing load bending (p0) (C10)	N	≥ 12500	
2.8	Failing load torsion	Nm	≥ 4000	
3	**Post Insulators - Design and Construction**			
3.1	Insulation material		Porcelain	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	Insulator height	mm	Insert	
3.4	Max. diameter of insulating part	mm	Insert	
3.5	Diameter of upper base	mm	Insert	
3.6	Number of holes on upper base		Insert	
3.7	Diameter distance between holes on upper base	mm	Insert	
3.8	Hole type on upper base		Insert	
3.9	Diameter on lower base	mm	Insert	
3.10	Number of holes on lower base		Insert	
3.11	Diameter distance between holes on lower base	mm	Insert	
3.12	Hole type on lower base		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.13	Insulator weight	kg	Insert	
	Overall compliance with the requirements (yes/no)			

1.2.2 B : Switchgear 230 kV & 132kV

1.2.2.1 GIS Switchgear 230 kV & 132kV

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1	**General Information & Rating**					
1.1.1	Manufacturer					
1.1.2	Type		Indoor	Indoor		
1.1.3	Model designation		Insert	Insert		
1.1.4	Country of Make					
1.1.5	Designed Lifetime	Years	Min 50	Min 50		
1.1.5.1	MTBF		Insert	Insert		
1.1.5.2	MTTR		Insert	Insert		
1.1.6	Nominal system voltage	kV rms	132	230		
1.1.6.1	Highest voltage for equipment U_n	kV rms	145	245		
1.1.7	Rated lightning impulse [1.2/50 µs] withstand voltage	kV peak	650	1050		
1.1.7.1	Rated Switching impulse [250/2500 µs] withstand voltage	kV peak	NA	NA		
1.1.8	Rated short duration power frequency Voltage					
1.1.8.1	For New Equipment	kV, 1 min	275	460		
1.1.8.2*	For Equipment in Service [Manufacturer to Recommend the data]					
1.1.8.2.1	After 5 years	kV, 1 min	[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.1.8.2.2	After 10 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.3	After 20 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.4	After 30 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.5	After 40 years	kV, 1 min	[Insert]	[Insert]		
1.1.8.2.6	After 50 years	kV, 1 min	[Insert]	[Insert]		
1.1.9	Rated frequency f_r	Hz	50	50		
1.1.10	Rated current I_r					
1.1.10.1	· Busbars	A	≥ 3150	≥4000		
1.1.10.2	· Line bay	A	≥ 2500	≥ 3150		
1.1.10.3	· Transformer bay	A	≥ 2500	≥3150		
1.1.10.4	· Bus Coupler bay	A	≥ 3150	≥ 4000		
1.1.10.5	· Bus Section bay	A	≥ 3150	≥ 4000		
1.1.10.6	· Maintenance Bus Section bay					
1.1.11	Rated short-circuit breaking current I_{sc}	kA rms	≥ 40	50		
1.1.12	Duration of short-circuit	s	≥ 3	≥ 3		
1.1.13	Rated peak withstand current I_p (equals to short-circuit making current)	kA	≥ 100	≥ 125		
1.1.14	Control & Auxiliary Voltage					
1.1.14.1	Control voltage	V. DC	110	110		
1.1.14.2	Motor - auxiliary supply voltage	V. AC, Hz	230,50	230,50		
1.1.14.3	Motor Rated Current / Starting current	A/A	Insert	Insert		
1.1.14.4	Heater supply voltage	V. Hz	230, 50	230, 50		
1.2	**Design & Construction**					
1.2.1	Type of busbars	-	Double, sectionalize	Double, sectionalize		
1.2.2	**Enclosure**					
1.2.2.1	Material		Al	Al		
1.2.2	Diameter	mm	[Insert]	[Insert]		
1.2.2.2	Enclosure Design Type	1/3Phase	3Phase	1p/3p		
1.2.2.2.1	Busbar		3Phase	1p/3p		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.2.2.2.2	Bay		3Phase	1p/3p		
1.2.2.2.3	Feeder Connection		3Phase	1p/3p		
1.2.2.3	Enclosure Construction	Continuous/ Non-continuous	Continuous	Continuous		
1.2.2.3.1*	Discontinuity in Enclosure	Mention locations	[Insert]	[Insert]		
1.2.2.4	Temperature at RCCR [Rated Continuous Current Rating]	Deg C	[Insert]	[Insert]		
1.2.2.5	Connection to adjacent enclosures	Bolted/other (mention)	[Insert]	[Insert]		
1.2.2.5.1	Bellows/ **Compensators** between enclosures	Yes/No	Yes	Yes		
1.2.2.5.2	Location		[Insert]	[Insert]		
1.2.2.5.3	Electrical segregation		[Insert]	[Insert]		
1.2.2.6	Shunting varistor	Yes/No	Yes	Yes		
1.2.2.7	Induced current in Enclosure in Percent of Rated current					
1.2.2.7.1	Busbar	% Ir	[Insert]	[Insert]		
1.2.2.7.2	Line bay	% Ir	[Insert]	[Insert]		
1.2.2.7.3	Transformer bay	% Ir	[Insert]	[Insert]		
1.2.2.7.4	Bus Coupler	% Ir	[Insert]	[Insert]		
1.2.2.7.5	Bus section	% Ir	[Insert]	[Insert]		
1.2.2.8	**Grounding Philosophy**					
1.2.2.8.1	Proposed Grounding Locations with readily accessible connectors		[Insert]	[Insert]		
1.2.2.8.2	Size of Grounding Conductor at each location		[Insert]	[Insert]		
1.2.2.8.3	Sufficient mechanical strength to withstand electromagnetic forces and normal abuse	Yes/No	Yes	Yes		
1.2.2.8.4	Manufacturer to provide Main Grounding Bus	Yes/No	Yes	Yes		
1.2.2.8.5	Subassembly-to-subassembly bonding	Yes/No	Yes	Yes		
1.2.2.8.6	Grounding of GIS-to-Cable Termination ---- Separate	Yes/No	Yes	Yes		
1.2.2.8.7	Recommendation by Manufacturer for proper procedures of Grounding connections during execution	Yes/No	Yes	Yes		
1.2.2.9	Gas-Tight Seals	Years	Min 50	Min 50		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.2.3	**Conductor**					
1.2.3.1	Material		Al	Al		
1.2.3.2	Diameter	mm	[Insert]	[Insert]		
1.2.3.3	Temperature at RCCR [Rated Continuous Current Rating]	Deg C	[Insert]	[Insert]		
1.2.3.4	Connection type	Removable/ Fixed/ bolted-type/ Spring Loaded	[Insert]	[Insert]		
1.2.3.4.1	Connection has prevention of particle generation	Yes/No	Yes	Yes		
1.2.3.5	Length of maximum section	mm	[Insert]	[Insert]		
1.2.3.6	No. of support insulator in maximum section	No.	[Insert]	[Insert]		
1.2.3.7	Support insulator					
1.2.3.7.1	Three phase/Single phase	1p/3p	[Insert]	[Insert]		
1.2.3.8	Time required for 1p fault to convert into 3p fault	ms	[Insert]	[Insert]		
1.2.4	Access for operations and maintenance [Access to all viewports, gas sample ports, density monitors etc]	Yes/No	Yes	Yes		
1.2.5	Moveable ladders or platforms	Yes/No	Yes	Yes		
1.2.6	Bus expansion joints		At both end	At both end		
1.2.7	Interface Points Design					
1.2.7.1	Busbar Enclosure	Bolted/ Welded flange design	Bolted	Bolted		
1.2.7.2	Busbar conductor	Bolted/Sliding design	Insert	Insert		
1.2.8	**Expansion Modules**					
1. 2.8.1	At both end of busbar		Yes	Yes		
1. 2.8.2	Isolating Distance Arrangement at Extension module		Yes	Yes		
1.2.9	**Gas zones**					
1.2.9.1	No of independent Gas zones in each bay & associated Busbar	No.	[Insert]	[Insert]		
1.2.9.2	No of Gas compartments in each bay & associated Busbar	No.	[Insert]	[Insert]		
1.2.9.3	Desiccant material for absorption of water vapor and gaseous breakdown products in each switching compartments	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.2.9.4	**Gas Partitions/ Compartment and Separate Gas Buffer Zone for MRE requirement**		Yes	Yes		
1.2.9.4.1	Separate Gas Buffer Zone for MRE requirement at Following locations					
1.2.9.4.1.1	At Busbar side of CB		Yes	Yes		
12.9.4.1.2	At Busbar for maintenance		After each Bay section	After each Bay section		
1.2.9.4.1.3	At Busbar end for expansion		At Both end	At Both end		
1.2.9.4.2	**Gas Partitions/ Compartment at Following locations**					
1.2.9.4.2.1	CB		Yes	Yes		
1.2.9.4.2.2	Maintenance DS-ES		As per Design	As per Design		
1.2.9.4.2.3	Bubar DS-ES		Yes	Yes		
1.2.9.4.2.4	CT		No, integrated in CB zone	No, integrated in CB zone		
1.2.9.4.2.5	Feeder VT/ Bus VT		As per Design	As per Design		
1.2.9.4.2.6	HSES		As per Design	As per Design		
1.2.9.4.2.7	Cable joining terminal		Yes	Yes		
1.2.10	**Rated pressure at each compartment**					
1.2.10.1	CB +CT	MPa	[Insert]	[Insert]		
1.2.10.2	Busbar DS -ES	MPa	[Insert]	[Insert]		
1.2.10.3	Line DS -ES	MPa	[Insert]	[Insert]		
1.2.104	Bus compartment	MPa	[Insert]	[Insert]		
1.2.10.5	VT	MPa	[Insert]	[Insert]		
1.2.10.6	FES	MPa	[Insert]	[Insert]		
1.2.11	**Pressure Coordination inside partitions at following sequence [High to Low]**					
1.2.11.a	Bursting pressure		Yes	Yes		
1.2.11.b	Type test pressure					
1.2.11.c	Routine test pressure					
1.2.11.d	Design pressure					
1.2.11.e	Rated filling pressure					

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.2.11.f	Alarm pressure					
1.2.11.g	Minimum functional pressure					
1.2.12	**Accessories in Each gas Compartment**					
1.2.12.1	Density sensor		Yes/make	Yes/make		
1.2.12.1.1	Temperature correction		Yes	Yes		
1.2.12.1.2	Type		Digital for CB & Analog for others	Digital for CB & Analog for others		
1.2.12.1.3	Digital		Meter & Transmitter	Meter & Transmitter		
1.2.12.1.4	Sensor at same temp. as Enclosure		Yes	Yes		
1.2.12.2	SF6 Valve		Yes/make	Yes/make		
1.2.12.3	Moisture absorber		Yes/make	Yes/make		
1.2.12.3.1	Adsorption surface		20-800 sq. m/g	20-800 sq. m/g		
1.2.12.3.2	Adsorption ratio		10-20% by mass	10-20% by mass		
1.2.12.4	Pressure relief Device		Yes/make	Yes/make		
1.2.12.4.1	Heat-resistant deflectors		Yes	Yes		
1.2.12.4.2	Location in Gas Compartment		Opposite to Personnel access	Opposite to Personnel access		
1.2.13	PD Monitoring		Yes	Yes		
1.2.13.1	Internal PD terminal		Yes	Yes		
1.2.13.2	PD Detection Method Employed	UHF/Optical/ Ultrasonic/P ulse Current/ Chemical	UHF	UHF		
1.2.13.3	Type		Offline Externally	Offline Externally		
1.2.14	Bus section CB for MRE [only required if there is no. Bus section CB as per scope of work/requirement/BoQ]		In Live Bus (during Maintenance) only	In Live Bus (during Maintenance) only		
1.2.14.1	CT (at Both side)		Yes	Yes		
1.2.14.2	DS-ES (at Both side)		Yes	Yes		
1.2.15	Viewport	For each DS, ES & FES	[Insert]	[Insert]		
1.2.16.1	GIS Nameplate as per IEEE		Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
1.2.16.2	GIS Gas SLD as per IEEE		Yes	Yes		
1.2.17	Allowable maximum temperature and allowable temperature rise					
1.2.17.1	Allowable maximum temperature					
1.2.17.1.1	Points contacted during routine operation and inspection specifically the local control cabinet	°C	[Insert]	[Insert]		
1.2.17.1.2	Which are expected to be contacted in normal operation and routine maintenance	°C	[Insert]	[Insert]		
1.2.17.1.3	Which need not to be contacted in normal operation	°C	[Insert]	[Insert]		
1.2.17.2	Allowable Temperature Rise					
1.2.17.2.1	Points contacted during routine operation and inspection specifically the local control cabinet		[Insert]	[Insert]		
1.2.17.2.2	Which are expected to be contacted in normal operation and routine maintenance		[Insert]	[Insert]		
1.2.17.2.3	Which need not to be contacted in normal operation		[Insert]	[Insert]		
1.2.18	Endoscope		2 No.'s for whole SS	2 No.'s for whole SS		
2	**Circuit Beaker**					
2.1	**General**					
2.1.1	Manufacturer		[Insert]	[Insert]		
2.1.2	Country of Make		[Insert]	[Insert]		
2.1.3	Model		[Insert]	[Insert]		
2.1.4	Type of circuit breaker		GIS , Indoor	GIS , Indoor		
2.1.5	Isolating and quenching medium		Same as GIS	Same as GIS		
2.2	**Design & Construction**					
2.2.1	Interrupter Design		Single breaking	Single breaking		
2.2.2	Operating mechanism		Motor-wound spring	Motor-wound spring		
2.2.3	Rated operating sequence		O-0.3 s-CO-3 min-CO	O-0.3 s-CO-3 min-CO		
2.2.4	Number of operating mechanisms per circuit breaker					
a)	Line bay	pcs.	As per design	3		
b)	Transformer bay	pcs.	1	1		
c)	Bus Coupler bay	pcs.	1	1		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
d)	Bus section Bay	pcs.	1	1		
2.2.5	Auto reclosing					
i)	· Line bay		1p+3p	1p+3p		
ii)	· Transformer bay		3p	3p		
2.2.6	Number of successive auto-Reclosing operations without derating		Insert	Insert		
2.2.7	Rated supply pressure of gas for interruption					
i)	Maximum	MPa (g)	Insert	Insert		
ii)	Normal	MPa (g)	Insert	Insert		
iii)	Minimum	MPa (g)	Insert	Insert		
iv)	Low Pressure Alarm	MPa (g)	Insert	Insert		
v)	Lockout Alarm	MPa (g)	Insert	Insert		
2.2.8	Limits for correct operation					
i)	Max	MPa (g)	Insert	Insert		
ii)	Normal	MPa (g)	Insert	Insert		
iii)	min	MPa (g)	Insert	Insert		
	Maximum pressure rise in circuit breakers due to the making or breaking of rated current		Insert			
2.2.9	Is lockout facility fitted?	Yes/No	Yes	Yes		
2.2.9.1	Whether Lockout will trip CB	Yes/No	No	No		
2.2.10	Trip free/or fixed trip		Trip Free	Trip Free		
2.2.11	Is circuit-breaker re-strike free	Yes/No	Yes	Yes		
2.2.12	Restrike performance during capacitive current switching	Class	C2	C2		
2.2.13	Number of operations without maintenance					
a)	CO at no-load		≥ 10000	≥ 10000		
b)	CO at rated current		≥ 2500	≥ 2500		
c)	CO at rated breaking current Isc		≥ 8	≥ 8		
d)	Curve for above attached to CB		Yes	Yes		
2.2.14	The frequency of mechanical operations	Class	M2	M2		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
2.2.15	Rated electrical endurance	Class	Min E1	Min E1		
2.2.16	**Interrupter**					
2.2.16.1	No. of Interrupter		1	1		
2.2.16.2	Type	Self-Blast/Puffer	Auto-Puffer	Auto-Puffer		
2.2.16.3	Model Designation		[Insert]	[Insert]		
2.2.16.4	Material of Male-Female part		[Insert]	[Insert]		
2.2.16.5	Length of each break	mm	[Insert]	[Insert]		
2.2.16.6	Length of stroke	mm	Insert	[Insert]		
2.2.17.1	**Type**		Motor Wound Spring	Motor Wound Spring		
2.2.17.2	Make		[Insert]	[Insert]		
2.2.17.3	Country of Manufacturer		[Insert]	[Insert]		
2.2.17.4	Model Designation		[Insert]	[Insert]		
2.2.17.5	Motor - auxiliary supply voltage	V. AC	[Insert]	[Insert]		
2.2.17.6	Rated power of motor	W	Insert	[Insert]		
2.2.17.7	Current required at rated supply voltage to open circuit-breaker	A	Insert	[Insert]		
2.2.17.8	Number of making coils	pcs.	1	1		
2.2.17.8.1	Rated Operating Voltage	V.DC	110	110		
2.2.17.8.2	Power	W	[Insert]	[Insert]		
2.2.17.9	Number of breaking coils	pcs.	2	2		
2.2.17.9.1	Rated Operating Voltage	V.DC	110	110		
2.2.17.9.2	Power	W	[Insert]	[Insert]		
2.2.17.10	Minimum number of available contacts (NO/NC)		12NO+ 12NC	16NO+ 16NC		
2.2.17.11	Hearer & No.		Yes- Min 1	Yes- Min 1		
2.2.17.11.1	Rated Voltage	V.AC/50HZ	230V	230V		
2.2.17.11.2	Power	W	[Insert]	[Insert]		
2.2.17.12	Operating mechanism material		[Insert]	[Insert]		
2.2.17.13	Water-tight corrosion-resistant housing		AL	AL		
2.2.17.14	A crank for manual spring loading	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
2.2.17.15	Whether there is provision for manual spring charging. (in case of hydraulic manual operation, to build oil pressure)	Yes/No	Yes	Yes		
2.2.17.16	Whether facility to close / open the CB manually in the Absence of DC control supply to the operating mechanism	Yes/No	Yes	Yes		
2.2.17.17	Whether suitable facility is available for bleeding the hydraulic Circuit in order to remove the trapped gas if any in the Hydraulic mechanism	Yes/No	Yes	Yes		
2.2.17.18	Whether anti pumping facility is provided in the Circuit breaker mechanism	Yes/No	Yes	Yes		
2.2.17.19	Type of transmission of mechanical energy from the operating mechanism to the interrupter unit i.e. whether single mechanism coupled to three phases or three independent mechanisms		Insert	Insert		
2.2.17.20	Number of close-open operations possible without recharging		O-CO	O-CO		
2.2.17.21	Emergency Trip Switch	Yes/No	Yes	Yes		
2.2.17.22	MTBF of CB		Insert	Insert		
2.2.17.23	MTTR of CB		Insert	Insert		
2.3	**Characteristics & Performance**					
2.3.1	Voltage					
2.3.1.1	Rated lightning impulse withstand voltage	kVpeak				
a)	Phase to ground		Insert	Insert		
b)	Across interrupting chamber		Insert	Insert		
c)	Between phases		Insert	Insert		
2.3.1.2	Rated Power frequency withstand voltage (dry), 1 minute	kVrms				
a)	Phase to ground		Insert	Insert		
b)	Across interrupting chamber		Insert	Insert		
c)	Between phases		Insert	Insert		
2.3.1.3	Maximum TRV (transient recovery voltage) withstand capability of the CB					
a.1	During Opening of Fault , T100	kV	[Insert]	[Insert]		
a.2	Rate of rise of recovery voltage	kV/µs	[Insert]	[Insert]		
b.1	During Opening of Cable	kV	[Insert]	[Insert]		
b.2	Rate of rise of recovery voltage	kV/µs	[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
c.1	During Opening of capacitor bank	kV	[Insert]	[Insert]		
c.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
d.1	During Opening of line	kV	[Insert]	[Insert]		
d.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
e.1	During Opening of Transformer	kV	[Insert]	[Insert]		
e.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
f.1	During Opening of Reactor	kV	[Insert]	[Insert]		
f.2	Rate of rise of recovery voltage	kV/μs	[Insert]	[Insert]		
g.1	Maximum switching surge per unit value	p.u	[Insert]	[Insert]		
2.3.1.4	Corona extinction voltage with CB open or close	kV rms	[Insert]	[Insert]		
2.3.1.5	Radio interference voltage for frequency between 0.5MHz and 2MHz (at 1.1*Um/ √3)	μV	[Insert]	[Insert]		
2.3.1.6	First-pole-to-clear factor					
a)	Terminal fault		1.3	1.3		
b)	Short-line fault		1	1		
c)	Out-of-phase		2	2		
2.3.2	**Ampacity Rating**					
2.3.2.1	Rated Current	A				
a)	Line Bay	A	Same As GIS bay Rating Above	Same As GIS bay Rating Above		
b)	Transformer Bay	A	Same As GIS bay Rating Above	Same As GIS bay Rating Above		
c)	Bus Coupler Bay	A	Same As GIS bay Rating Above	Same As GIS bay Rating Above		
d)	Bus Section Bay	A	Same As GIS bay Rating Above	Same As GIS bay Rating Above		
2.3.2.2	Rated short-circuit breaking currents, Isc (equal to short circuit withstand):	kA rms				
i.	Three phase Symmetrical breaking currents	kA rms	40	50		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
ii.	Three phase Asymmetrical breaking currents	kA rms	[Insert]	[Insert]		
iii.	Single phase Symmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]		
iv.	Single phase Asymmetrical breaking current for line to ground	kA rms	[Insert]	[Insert]		
2.3.2.3	D.C. component of the rated short-circuit breaking current	%	> 45	> 45		
2.3.2.4	Rated short-time withstand currents, Ith					
.	Three phase	kA,3s	> 40	> 50		
i.	Single phase	kA,3s	[Insert]	[Insert]		
2.3.2.5	Rated short line fault breaking current capability					
a)	Percentage of rated breaking current	%	Insert	Insert		
b)	Surge Impedance	Ohms	Insert	Insert		
c)	Amplitude factor		Insert	Insert		
d)	Critical percentage of rated breaking current	%	Insert	Insert		
e)	Maximum arc duration	ms	Insert	Insert		
2.3.2.6	Rated capacitive switching capability (breaking currents):					
a)	Line charging	A rms	Insert	Insert		
b)	Cable charging	A rms	Insert	Insert		
c)	Capacitor Bank breaking current	A rms	Insert	Insert		
2.3.2.7	Rated inductive switching/ breaking capability:	A	Insert	Insert		
2.3.3	**Timing Performance**					
2.3.3.1	Maximum total break time (trip initiation to final arc extinction) (3.7.135 acc. to IEC 62271-100)	ms	60	60		
2.3.3.2	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	20 ± 5		
2.3.3.3	Opening time (trip initiation to contact separation)					
a)	Without current	ms	[Insert]	[Insert]		
b)	With 100 % rated current	ms	[Insert]	[Insert]		
c)	With 100 % rated breaking current	ms	[Insert]	[Insert]		
2.3.3.4	Closing time					

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
a)	Without current	ms	[Insert]	[Insert]		
b)	With 100 % rated current	ms	[Insert]	[Insert]		
c)	With 100 % rated breaking current	ms	[Insert]	[Insert]		
2.3.3.5	Maximum time interval between opening interrupters between first & last phases	ms	[Insert]	[Insert]		
2.3.3.6	Maximum time interval between opening of interrupters in same phases		NA	NA		
2.3.3.7	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	Insert	[Insert]		
2.3.3.8	Mechanical time staggering in Gang Pole CB					
a)	First-to-Second phase	ms	Insert	Insert		
b)	Second-to-Third Phase	ms	Insert	Insert		
2.3.3.9	Minimum time for auto reclosing (dead time)					
a)	Single phase	ms	insert	Insert		
b)	Three Phase	ms	insert	Insert		
2.3.3.10	Pole discrepancy for the closing operation of CB i.e, Maximum difference in closing Time between first contact touch and Last phase to close.	ms	Insert	[Insert]		
2.3.3.11	**Force**					
a)	Dynamic horizontal force, longitudinal Fwx	N	Insert	[Insert]		
b)	Dynamic horizontal force, transversal	N	Insert	[Insert]		
2.4*	**Accessories in central control panel/ LCC**					
2.4.1	Anti-pumping relay	Yes/No	Yes	Yes		
2.4.2	Local/remote control selector switch	Yes/No	Yes	Yes		
2.4.3	Single Pole/Gang operation switch	Yes/No	Yes	Yes		
2.4.4	Local operation push buttons	Yes/No	Yes	Yes		
2.4.5	Minimum pressure lock-out and alarm relays	Yes/No	Yes	Yes		
2.4.6	Operation counter	Yes/No	Yes	Yes		
2.4.7	DC MCB for Control Circuit	Yes/No	Yes	Yes		
2.4.7.1	NO/NC Contact in MCB for signaling	Min 02	Insert	Insert		
2.4.8	AC MCB	Yes/No	Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
2.4.8.1	NO/NC Contact in MCB for signaling					
2.4.9	Service outlet socket	Min 01, 10A	Insert	Insert		
2.4.10	Cu -earthing rails inside control cabinet	Yes/No	Yes	Yes		
2.4.11	Detachable plates, the bottom of control cabinet	Yes/No	Yes	Yes		
2.4.12	Set of cables for connection of operating mechanism and central control panel of circuit breaker	Yes/No	Yes	Yes		
2.4.13	Time phase discrepancy relay	Yes/No	Yes	Yes		
2.4.14	Weatherproof, corrosion resistance enclosure		IP55	IP55		
2.4.15	Enclosure Material		Al or stainless steel	Al or stainless steel		
3	**Disconnect Switch**					
3.1	General					
3.1.1	Manufacturer		[Insert]	[Insert]		
3.1.2	Country of Make		[Insert]	[Insert]		
3.1.3	Model Designation		[Insert]	[Insert]		
3.1.4	Type		GIS / Indoor	GIS / Indoor		
3.2	**Design & Construction**					
3.2.1	Type of Disconnector					
a)	Three pole, three position (close/open/earthed), motor operated,		Yes	Yes		
	insulated, with earthing switch					
b)	Three pole, make-proof, motor operated earthing switch with operating mechanism		Yes	Yes		
c)	Three pole, Disconnector Link with earthing switch , hand operated		Yes	Yes		
3.2.2	Number of poles	pcs.	3	3		
3.2.3	Number of breaks per pole	pcs	1	1		
3.2.4	Type of Contacts					
a)	DS-ES		[Insert]	[Insert]		
b)	HSES		[Insert]	[Insert]		
3.2.5	Material of contact surfaces					

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
a)	DS-ES		[Insert]	[Insert]		
b)	HSES		[Insert]	[Insert]		
3.2.6	**Operating Mechanism & Drive Box**					
3.2.6.1	Number of operating mechanism	pcs.	1	As per Design		
3.2.6.2	Type of operating mechanism					
a)	· Three position		Motor driven	Motor driven		
b)	· Make-proof		Motor-wound spring	Motor-wound spring		
c)	· Disconnector Link		Manual/ lever	Manual/ lever		
3.2.6.3	Motor- auxiliary supply voltage	AC,50Hz	230V	230V		
3.2.6.4	Rated power of motor					
a)	· Three position	W	[Insert]	[Insert]		
b)	· Make-proof	W	[Insert]	[Insert]		
3.2.6.5	Anti-condensation heater inside the operating mechanism cabinet					
3.2.6.5.1	Total heater power	W	[Insert]	[Insert]		
3.2.6.5.2	Heater- supply voltage		230 V, 50 Hz	230 V, 50 Hz		
3.2.6.6	Control Voltage	V.DC	110V	110V		
3.2.6.7	Minimum number of available contacts (NO/NC/V)		12NO+ 12NC	16NO+ 16NC		
3.2.6.8	Water-tight corrosion-resistant housing		IP55	IP55		
3.2.6.9	Drive housing Material		AL or Stainless Steel	AL or Stainless Steel		
3.2.6.10	Whether locking facilities are provided to Padlock the disconnectors in both open &Close positions	Yes/No	Yes	Yes		
3.2.6.11	Whether the insertion of handle for manual Operation will cut off the control supply to the concerned equipment		Yes	Yes		
3.2.7*	**Accessories in LCC for DS**					
3.2.7.1	Voltage presence Contactor	Yes/No	Yes	Yes		
3.2.7.2	Other Contactors	Yes/No	Yes	Yes		
3.2.7.3	Motor AC MCB (miniature circuit breakers)	Min 01	[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
3.2.7.4	Heater AC MCB (miniature circuit breaker)	Min 01	[Insert]	[Insert]		
3.2.7.5	Control Circuit DC MCB	Min 01	[Insert]	[Insert]		
3.2.7.6	Selection switch (local/neutral/remote)	Yes/No	Yes	Yes		
3.2.7.7	Manual closing button	Yes/No	Yes	Yes		
3.2.7.8	Manual opening button	Yes/No	Yes	Yes		
3.2.8	· MTBF of DS		[Insert]	[Insert]		
3.2.8.1	· MTBF of HSES		[Insert]	[Insert]		
3.2.9	· MTTR of DS		[Insert]	[Insert]		
3.2.9.1	· MTTR of HSES		[Insert]	[Insert]		
3.3	**Rating & Characteristics**					
3.3.1	Rated lightning impulse withstand voltage of DS-ES/HSES	kVpeak				
a)	Phase to ground		Insert	Insert		
b)	Across Isolating Gap		Insert	Insert		
c)	Between phases		Insert	Insert		
3.3.2	Rated Power frequency withstand voltage (dry), 1 minute of DS-ES/HSES	kVrms				
a)	Phase to ground		Insert	Insert		
b)	Across Isolating Gap		Insert	Insert		
c)	Between phases		Insert	Insert		
3.3.3	Corona extinction voltage	kV rms	Insert			
3.3.4	Load Switching capability					
a)	Capacitive Current	A	[Insert]	[Insert]		
b)	Cable charging current	A	[Insert]	[Insert]		
c)	Small inductive current	A	[Insert]	[Insert]		
3.3.5	Rated Current	A	Same as GIS/CB	Same as GIS/CB		
3.3.6	Rated Short Circuit Withstand current	kA	Same as CB	Same as CB		
3.3.7	Rated bus-transfer voltage and current					
a)	Rated Bus-transfer voltage for DS	V	10	20		
b)	Rated bus-transfer current	A	1600	1600		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
3.3.8	Rated induced current and voltage for grounding switches					
a)	Electromagnetic coupling					
.	Induced Voltage	kV (rms)	[Insert]	[Insert]		
i.	Induced Current	A (rms)	[Insert]	[Insert]		
b)	Electrostatic coupling					
.	Induced Voltage	kV (rms)	[Insert]	[Insert]		
i.	Induced Current	A (rms)	[Insert]	[Insert]		
3.3.9	FES special rating					
a)	Closing time	ms	As per Design	As per Design		
b)	Opening time	ms	As per Design	As per Design		
c)	No. of closing operation without Maintenance	No.	Min 02	Min 02		
3.3.10	Maintenance DS-ES Timings					
a)	Closing	s	[Insert]	[Insert]		
b)	Opening	s	[Insert]	[Insert]		
c)	Earthing	s	[Insert]	[Insert]		
4	**Current Transformer**					
4.1	**General**					
4.1.1	Manufacturer		[Insert]	[Insert]		
4.1.2	Country of Manufacture		[Insert]	[Insert]		
4.1.3	Model Designation		[Insert]	[Insert]		
4.1.4	Type		Toroidal-ring-type/ As per Design	Toroidal-ring-type/ As per Design		
4.2	**Design & Construction**					
4.2.1	Location of Primary winding in GIS-External/Internal to GIS		[Insert]	[Insert]		
4.2.2	Location of Primary in GIS-External/Internal to GIS		[Insert]	[Insert]		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
4.2.3	Method of Voltage control		[Insert]	[Insert]		
4.2.4	Pressure adjustment for dynamic condition like Short circuit		[Insert]	[Insert]		
4.2.5	Maintenance Free		Yes	Yes		
4.2.6	Secondary terminal Box		Yes	Yes		
4.2.6.1	Shorting link		Yes	Yes		
4.2.6.2	Earthing link		Yes	Yes		
4.2.7	CT on both sides of CB		No	Yes		
4.2.8	**No. of cores in Each CT**					
i)	**Line/Transformer Feeder CT**					
a)	Bus side CT		NA	3		
b)	Feeder side CT		4	2		
ii)	**Bus Coupler CT**					
a)	BB 01 side		2	3		
b)	BB 02 side		2	3		
iii)	**Bus section CT**					
a)	BB section-01 side		2	3		
b)	BB section-02 side		2	3		
4.3	**Ratings**					
4.3.1	**Accuracy class:**					
4.3.1.1	**Line/Transformer Feeder CT**					
a)	**Bus side CT**					
	Core- I		NA	Protection/5 P20		
	Core- II		NA	Protection/5 P20		
	Core- III		NA	Protection/5 P20		
	Core- IV		NA	NA		
b)	**Feeder side CT**					
	Core- I		Metering/ 0.2S	Metering/ 0.2S		
	Core- II		Protection /5P20	Protection /5P20		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
	Core- III		Protection /5P20	NA		
	Core- IV		Protection /5P20	NA		
	Core- V		NA	NA		
4.3.1.2	**Bus Coupler CT**					
a)	BB 01 side					
	Core- I		Measuring/ 0.2s	Measuring/ 0.2s		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
b)	BB 02 side					
	Core- I		Protection /5P20	Measuring/0. 2s		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
4.3.1.3	**Bus section CT**					
a)	BB section-01 side					
	Core- I		Measuring/ 0.2s	Measuring/0. 2s		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
b)	BB section-02 side					
	Core- I		Protection /5P20	Measuring/0. 2s		
	Core- II		Protection /5P20	Protection /5P20		
	Core-III		NA	Protection /5P20		
4.3.2	**Ratio & Burden**					
4.3.2.1	**Line/Transformer Feeder CT**					
1A	**Bus side CT**					
	Core- I	A, VA	NA	3200-1600/1, 30VA		
	Core- II	A, VA	NA	3200-1600/1, 30VA		
	Core- III	A, VA	NA	3200-1600/1, 30VA		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
	Core- IV	A, VA	NA	NA		
1B	**Feeder side CT**					
	Core- I	A, VA	2400-1600/1, 10VA	3200-1600/1, 10VA		
	Core- II	A, VA	2400-1600/1, 30VA	3200-1600/1, 30VA		
	Core- III	A, VA	2400-1600/1, 30VA	NA		
	Core- IV	A, VA	2400-1600/1, 30VA	NA		
	Core- V	A, VA	NA	NA		
4.3.2.2	**Bus Coupler CT**					
	BB 01 side					
	Core- I	A, VA	3200-2000/1, 10VA	4000-2000/1, 10VA		
	Core- II	A, VA	3200-2000/1, 30VA	4000-2000/1, 30VA		
	Core-III	A, VA	NA	4000-2000/1, 30VA		
	BB 02 side					
	Core- I	A, VA	3200-2000/1, 30VA	4000-2000/1, 10VA		
	Core- II	A, VA	3200-2000/1, 30VA	4000-2000/1, 30VA		
	Core-III	A, VA	NA	4000-2000/1, 30VA		
4.3.2.3	**Bus section CT**					
	BB section-01 side					
	Core- I	A, VA	3200-2000/1, 10VA	4000-2000/1, 10VA		
	Core- II	A, VA	3200-2000/1, 30VA	4000-2000/1, 30VA		
	Core-III	A, VA	NA	4000-2000/1, 30VA		
	BB section-02 side					
	Core- I	A, VA	3200-2000/1, 30VA	4000-2000/1, 10VA		
	Core- II	A, VA	3200-2000/1, 30VA	4000-2000/1, 30VA		
	Core-III	A,VA	NA	4000-2000/1, 30VA		
Burden rating of Current Transformers are preliminary and for Tender purpose only. The Contractor has to make Engineering and to provide detail calculation and detail design during execution to prove the adequacy of the Burden proposed, which will be subject of the PGCB's approval. If required by design calculation, higher burden CT shall be provided within the Bid price.						

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
4.3.4	Rated continuous thermal current (40°C):					
	• Metering Core	% In	200	200		
	• Protection Core	% In	120	120		
4.3.5	Security factor for Metering Core:					
	• Metering Core		Fs<5	Fs<5		
5	**Voltage Transformer**					
	General					
5.1.1	Type		GIS / Indoor	GIS / Indoor		
5.1.2	Model					
5.2	**Design & Construction**					
5.2.1	Impulse Voltage					
	-to earth	kVp	[Insert]	[Insert]		
5.2.2	Power Frequency Voltage	KVrms	[Insert]	[Insert]		
	-to earth					
5.2.3	Isolation lever with earthing facility from Primary Circuit		Yes	Yes		
5.2.4	Damping resistor		As per Design	As per Design		
5.2.4.1	Ohm		As per Design , Insert	As per Design , Insert		
5.2.5	Suitable for Long line DC voltage discharge through VT winding	Yes/NO	Yes	Yes		
5.2.6	VFTO suppression		Yes	Yes		
5.2.7	Secondary Box					
i)	Secondary Box Material		AL or Stainless steel	AL or Stainless steel		
ii)	Secondary Box IP rating		IP55	IP55		
ii)	MCB for each core	Yes/NO	Yes	Yes		
v)	NO/NC contact in MCB for signaling	Yes/NO	Yes	Yes		
5.3	Rating					
5.3.1	Rated primary voltage	kV	132/√3	230/√3		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
5.3.2	Rated secondary voltage					
	· I winding	V	110/√3	110/√3		
	· II winding	V	110/√3	110/√3		
5.3.3	Accuracy class:					
	· I winding		0.2s	0.2s		
	· II winding		3P	3P		
5.3.4	Rated power:					
	· I winding	VA	10	10		
	· II winding	VA	25	25		
5.3.5	Load		Simultaneously	Simultaneously		
6*	**LCC**					
6.1	Type		Integrated	Separate		
6.2	Dimension					
6.3	Housing Material		AL or Stainless Steel with Glass Door	AL or Stainless Steel with Glass Door		
6.3.1	Thickness		Insert	Insert		
6.3.2	IP rating		IP55	IP55		
6.4	**Accessories**					
6.4.1	DC MCBs	Yes/No	Yes	Yes		
6.4.1.1	Control Voltage	V.DC	110	110		
6.4.2	AC MCBs	Yes/No	Yes	Yes		
6.4.2.1	Voltage	V.AC	230V, 50Hz	230V, 50Hz		
6.4.3	Heater	Yes/No	Yes	Yes		
6.4.3.1	Rated Voltage	V.AC	230V, 50Hz	230V, 50Hz		
6.4.3.2	Rated Power	W	Insert	Insert		
6.4.4	Humidity Controller	Yes/No	Yes	Yes		
6.4.5	GFI Socket	Yes/No	Yes	Yes		
6.4.5.1	Rating	A	Insert	Insert		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
6.4.6	LED Light with ON/OFF switch					
6.4.6.1	Rated Power	W	Insert	Insert		
6.4.6.2	Rated Voltage	V	Insert	Insert		
6.4.7	L/R switch [with gang/single pole operation for CB]					
	CB		Yes	Yes		
	DS		Yes	Yes		
	HSES		Yes	Yes		
	ES		Yes	Yes		
6.4.8	Operation Switch [Close/Open/Neutral]					
	CB		Yes	Yes		
	DS		Yes	Yes		
	HSES		Yes	Yes		
	ES		Yes	Yes		
6.4.9	Mimic/line diagram with semaphore & switch					
6.4.9.1	LED with semaphore		Yes	Yes		
6.4.9.2	Line diagram color					
	Primary Circuit		Red	Green		
	Earth		Black	Black		
6.4.10	Hardware Interlock at LCC	Yes/No	Yes	Yes		
	Manual operation of the disconnect and grounding switches is only possible under electrical interlock release conditions.	Yes/No	Yes	Yes		
	Mechanical and electrical interlock between disconnect and grounding switch operation is provided.	Yes/No	Yes			
				Yes		
	The electrical interlock scheme is fail-safe to prevent loss of interlock function upon loss of control voltage.	Yes/No	Yes			
				Yes		
	Electrical interlock between the line PT secondary voltage and respective high speed grounding switch operation is provided through under voltage relay contacts.	Yes/No	Yes			

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
				Yes		
	The feeder grounding switch is interlocked with the corresponding circuit breaker and disconnect switch.	Yes/No	Yes	Yes		
	The bus bar grounding switch is interlocked with all disconnect switches on the same busbar section.	Yes/No	Yes	Yes		
	The high speed grounding (fast-acting grounding) switch is interlocked with the associated circuit breaker open.	Yes/No	Yes	Yes		
	No switching of the earthing switch when the bus bar or equipment is energized.					
	No paralleling of buses by dis-connectors when bus coupler is open.	Yes/No	Yes	Yes		
	Only local mode operation for CB when dis-connectors are open.	Yes/No	Yes	Yes		
	No closing of dis-connector when a load is connected.	Yes/No	Yes	Yes		
	No switching of the earthing switch when the bus bar or equipment is energized [It shall not be possible to override this interlock]	Yes/No	Yes	Yes		
6.4.11	Interlock Override switch [A key switch for overriding interlocks between disconnect and grounding switches associated with circuit breakers during maintenance]		Yes	Yes		
6.4.12	SYNC bypass switch		Yes	Yes		
6.4.13	Locking Padlock for switchgear	Yes/No	Yes	Yes		
6.4.14	Separate Terminal Board (TB) Block for CB/DS/HSES etc.	Yes/No	Yes	Yes		
6.4.15	Shielded Control cable upto LCC	Yes/No	Yes	Yes		
6.4.15.1	Grounding of control cable shield at both the equipment and the LCC ends at the location where the control cable first enters the cabinet.	Yes/No	Yes	Yes		
6.4.15.2	Grounding Material		either coaxial ground bushings or short connections to the cabinet walls	either coaxial ground bushings or short connections to the cabinet walls		
6.4.16	Minimum Alarm					
	Loss of DC supply to circuit breaker motor.		Yes	Yes		
	SF6 gas pressure Low–Low, Stage 1 alarm for each gas zone/section (in the		Yes	Yes		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
	case of a single phase, an alarm is provided for each phase)					
	SF6 gas pressure Low–Low, Stage 2 alarm for each gas zone/section (in case of a single phase, the alarm is grouped for all phases)		Yes	Yes		
	Excess run time of the motor for the circuit breaker, disconnecting switch, and ground switch		Yes	Yes		
	Spring overcharged for the circuit breaker mechanism		Yes	Yes		
	Loss of DC for the trip and close circuit		Yes	Yes		
	Circuit breaker trip		Yes	Yes		
	VT supply fail (VT MCB trip)		Yes	Yes		
	Loss of AC supply		Yes	Yes		
	Circuit breaker mechanism failure		Yes	Yes		
	Local/remote switch		Yes	Yes		
	Pole discrepancy operated (for single-phase breaker)		Yes	Yes		
	Trip circuit failure		Yes	Yes		
6.4.16	BCU in LCC		As per design	As per design		
7	**Termination Connection**					
7.1	Type: GIL – Gas Insulated Line, Outdoor & Indoor		Yes	Yes		
7.2	Type: Three/Single phase, according to the design					
7.3	Insulator, Single phase, SF6 / Air		Yes	Yes		
7.4	Insulating material		Composite/ Silicon	Composite/ Silicon		
7.5	Minimum external housing insulation creepage distance	mm/kV	≥ 31 mm/kV	≥ 31 mm/kV		
7.6	Rated continuous Current	A	Same as feeder	Same as feeder		
7.7	Minimum centerline phase-to-phase spacing	mm	NA	[Insert]		
7.8	Length of longest bus sections	mm	[Insert]	[Insert]		
7.9	Outside diameter	(mm)	[Insert]	[Insert]		
7.1	Wall thickness	(mm)	[Insert]	[Insert]		
7.11	Insulating Media		SF6 gas	SF6 gas		

No.	Description	Minimum Requirements			Guaranteed	
		Unit	Data			
			132kV	230kV	132kV	230kV
7.12	SF6 gas pressure at 20^0C	KPa	[Insert]	[Insert]		
8	**MRE Requirement**					
8.1	Maintenance of any circuit breaker shall be possible without interruption of adjacent bays		Yes	Yes		
8.2	Repair of any circuit breaker shall be possible without interruption of adjacent bays		Yes	Yes		
8.3	Extension of GIS bay shall be possible without interruption of adjacent bays		Yes	Yes		
8.4	HV testing in any bay shall be possible without complete “Out of service” of the GIS		Yes	Yes		
8.5	Separate HV Test Bushing (required only if any cable connected feeder as per scope of work)		1 set for each Voltage level	1 set for each Voltage level		
9*	**Dimensions**					
9.1	**Length**					
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
9.2	**Width**	mm	[Insert]	[Insert]		
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
9.3	**Height**					
	Line Bay	mm	[Insert]	[Insert]		
	Transformer Bay	mm	[Insert]	[Insert]		
	Bus-coupler bay	mm	[Insert]	[Insert]		
	Bus-section Bay	mm	[Insert]	[Insert]		
	Overall Compliance		**Yes**	**Yes**		

1.2.2.2 Surge Arrester 230 kV & 132 kV (AIS)

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
1	**Surge Arresters - General**					
1.1	Manufacturer		Insert	Insert		
1.2	Type		SM	SM		
1.3	Model designation		Insert	Insert		
1.4	Country of origin		Insert	Insert		
1.5	Standards		IEC 60099-4	IEC 60099-4		
1.6	Quality control		ISO 9001	ISO 9001		
1.7	Design		Metal oxide, gapless, outdoor	Metal oxide, gapless, outdoor		
1.8	Short circuit testing authority		Insert authority	Insert authority		
1.9	Type Test Report Reference		Insert	Insert		
2	**Surge Arresters - Characteristics**					
2.1	**Voltage**					
2.1.1	Nominal System Voltage	kV rms	230	132		
2.1.2	Highest voltage for equipment Um	kV rms	245	145		
2.1.3	Rated voltage of surge arrester Ur	kV rms	198	120		
2.1.4	Max. continuous operating voltage Uc	kV rms	158	102		
2.1.5	Reference Voltage	KVrms	Insert	Insert		
2.1.6	Gap between Vref & MCOV	% of MCOV	Insert	Insert		
2.1.7	TOV [Curve to be attached]					
a)	0.1s	pu [of MCOV]	Insert	Insert		
b)	1s	pu [of MCOV]	Insert	Insert		
c)	3s	pu [of MCOV]	Insert	Insert		
d)	10s	pu [of MCOV]	Insert	Insert		

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
2.1.8	Maximum residual voltage Ures					
a)	For switching impulse current 30/60 µs at 0,5 kA	kV peak	≤ 390	≤ 235		
b)	For switching impulse current 30/60 µs at 1 kA	kV peak	≤ 400	≤ 240		
c)	For switching impulse current 30/60 µs at 2 kA	kV peak	≤ 415	≤ 255		
d)	For lightning impulse current 8/20 µs at 5 kA	kV peak	≤ 455	≤ 280		
e)	For lightning impulse current 8/20 µs at 10 kA	kV peak	≤ 480	≤ 300		
f)	For lightning impulse current 8/20 µs at 20 kA	kV peak	≤ 535	≤ 320		
2.1.9	Dielectric endurance of arrester housing					
a)	Lightning impulse withstand voltage of arrester housing up (1.2/50 µs)	kV	Insert	Insert		
b)	Power frequency withstand voltage of arrester housing (1 min wet)	kV	Insert	Insert		
2.1.10	Arrester Protection Margin/level					
i)	Lightning Impulse Protection Margin/level		Min 2.2	Min 2.1		
ii)	Switching Impulse Protection Margin/level		Min 1.5	Min 1.4		
iii)	steep current impulse protection Margin/level		Min 2.0	Min 2.0		
2.2	**Current**					
2.2.1	Reference Current	mA	Insert	Insert		
2.2.2	Long duration current impulse (2000 µs)	A	≥ 850	≥ 850		
2.2.3	Nominal discharge current In (8/20 µs)	kA peak	10	10		
2.2.4	High current impulse of an arrester (4/10 µs)	kA peak	100	100		
2.3	Others					
2.3.1	Line discharge class	Class				
2.3.2	Energy dissipation capacity (per kV of rated voltage)	kJ/kV	≥ 7	≥ 6		
2.3.3	Thermal Charge Transfer Rating, Qth	Coulombs	Insert	Insert		
2.3.4	Repetitive Charge Transfer Rating, Qrs		Insert	Insert		
2.3.5	Rated frequency	Hz				
2.3.6	Partial Discharge Level	pC	≤ 10	≤ 10		
3	**Surge Arresters - Design and Construction**					

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
3.1	Designed Life	Years	Insert	Insert		
3.2	MTBF		Insert	Insert		
3.3	MTTR		Insert	Insert		
3.4	**Resistor Block**					
3.4.1	Diameter	mm	Insert	Insert		
3.4.2	No. of ZnO Block in series at One unit	No.	Insert	Insert		
3.4.3	No. of separately housed arrester unit	No.				
3.4.4	Housing design					
i)	A. Open or Case Design B. Closed or Wrap Design C. Hollow Tube Design		Insert	Insert		
ii)	Pressure relief device No. & Location		Insert	Insert		
iii)	Highest pressure developed during rated discharge current	kPa	Insert	Insert		
iv)	Highest pressure developed during rated pressure Relief Class	kPa	Insert	Insert		
v)	Alternate shed housing	Yes/No	Insert	Insert		
vi)	Color of housing		Insert	Insert		
vii)	Material of housing	SIR	Insert	Insert		
viii)	Volcanizing Technology		Insert	Insert		
3.4.5	Design Considerations					
i)	Designed for Ambient Temperature	℃	-40 to +40	-40 to +40		
ii)	Solar Radiation	kW/m2	≥1.1	≥1.1		
iii)	Altitude	m	1000	1000		
iv)	Frequency of AC Power Supply	Hz	48-62	48-62		
v)	Wind Velocity	m/s	≤ 34 m/s	≤ 34 m/s		
3.4.6	Similar Model that passed Short Circuit Test					
i)	100% fault current	kA	Insert	Insert		
ii)	50% fault current	kA	Insert	Insert		
iii)	25% fault current	kA	Insert	Insert		
3.6.	Mechanical requirements					

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
3.6.1	Specified short-term load SSL (Fdyn)	N	Insert	Insert		
3.6.2	Specified long-term load SSL (Fstat)	N	Insert	Insert		
3.6.3	Maximum cantilever strength	Nm	Insert	Insert		
3.6.4	Maximum force due to wind (at maximum specified gust speed)	Nm	Insert	Insert		
3.7	Minimum creepage distance	mm/kV	≥ 31 mm/kV	≥ 31 mm/kV		
3.8.	Housing insulating material		Composite/ Silicon	Composite/ Silicon		
3.9	Insulating basement		Yes			
3.10	Surge arrester height	mm	Insert	Insert		
a)	Total leakage distance across outer insulator shedding for the complete arrester	mm	Insert	Insert		
b)	Protected leakage distance across outer insulator shedding for the complete arrester	mm	Insert	Insert		
c)	Clearance					
i)	phase to earth (from center line)	mm	Insert	Insert		
ii)	phase to phase (center line to center line)	mm	Insert	Insert		
3.11	Surge arrester weight	kg	Insert	Insert		
3.12	Voltage distribution ring present	Yes/No	Yes	Yes		
3.12.1	Ring Diameter	mm				
3.14	**HV terminal**					
3.14.1	Shape		Flat	Flat		
3.14.2	Dimension	mm x mm	Min 100 x 100	Min 100 x 100		
3.14.3	Number of holes		Min 4	Min 4		
3.14.4	Distance between holes	mm x mm	50 x 50	50 x 50		
3.14.5	Material suitable for		Al terminal	Al terminal		
3.15	Arrester Grounding	Yes/No	Yes	Yes		
3.16	**Surge Counter**		Insert	Insert		
3.16.1	Manufacturer		Insert	Insert		

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
3.16.2	Type		Insert	Insert		
3.16.3	Model designation		Insert	Insert		
3.16.4	Country of origin		Insert	Insert		
3.16.5	Leakage Current Measurement		Insert	Insert		
3.16.5	Range of Measurement	uA-mA	Insert	Insert		
3.16.6	Sensitivity of surge counter peak at a wave shape of micro sec		Insert	Insert		
3.16.7	Minimum counted Surge Ampere		Insert	Insert		
3.16.8	Error		Insert	Insert		
3.16.9	Grounding of Counter		Insert	Insert		
i)	Separate Insulated (from Counter housing) terminal at bottom of Counter		Insert	Insert		
ii)	Separate Insulated (from Counter housing) terminal at top of Counter		Insert	Insert		
iii)	Counter Body Earthing		Insert	Insert		
iv)	Earthing Conductor Material		Copper	Copper		
v)	Conductor Size	mm^2	Insert	Insert		
vi)	Conductor Insulation		Insert	Insert		
3.16.10	Short Circuit Test of Counter		Yes	Yes		
3.16.10.1	Test Authority		Insert	Insert		
4	**Drawings**					
4.1	GA Drawing with All dimension & clearance clearly marked		Yes	Yes		
4.2	Sectional Drawing to show internal blocks, PRD etc.		Yes	Yes		
4.3	HV terminal Drawing		Yes	Yes		
4.4	Surge Counter Drawing		Yes	Yes		
4.5	Surge Counter installation Drawing		Yes	Yes		
4.6	Earthing Terminal Drawing		Yes	Yes		
4.7	Quality & FAT/Routine Test Plan Attached		Yes	Yes		

No.	Description	Minimum requirements			Guaranteed	
		Unit	Data			
			230	132	230	132
Overall compliance with the requirements (yes/no)						

1.2.2.3 230kV XLPE Cable

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
1	General			
	Manufacturer		Insert	
	Type		Insert	
	Model Designation		Insert	
	Country of Origin		Insert	
	Standards		EC 62067	
	Quality Control		ISO 9001 ISO 14001 ISO 18001	
	Type of conductor		Copper	
	Type of Insulation		XLPE	
	Ambient temperature for calculation - Average daily temperature - maximum daily temperature	 °C °C	 40 50	
2	Voltage			
	Rated Voltage	kV	230kV	
	Maximum System Voltage	kV	245kV	
	Impulse withstand voltage	kV	1050	
	Power frequency withstand voltage	kV	460	
3	**Cores**			
	Number of cores		1 (one)	
4	**Conductor**			
	Standard		IEC 60228	
	Nominal Current	A	≥ 2000	
	Cross sectional area	mm^2	≥ 2000	
	Nominal Diameter	mm	Insert	
	Material		Annealed Copper	
	Design (standard of segmental)		Milliken (4/5 segment)	
5	**Conductor Screen**			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
	Thickness (approx.)	mm		
	Nominal Diameter over semi-conducting layer	mm		
6	**Insulation**			
	Material		XLPE	
	Process		Triple simultaneous extrusion	
	Type of curing (dry)		Dry Curing (VCV)	
	Average Thickness		23-25 mm	
	Minimum Thickness		Insert	
	Nominal Diameter over insulation		Insert	
7	**Insulation screen**			
	Material		Extruded semi conducting compound, cross linked	
	Thickness approx.			
	Nominal Diameter over semi conducting layer			
8	**Metallic Screen/Sheath**			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
9	**Longitudinal water tightness**			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.			
10	**Radial moister barrier**			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	
11	**Outer Covering**			
	Material		MDPE	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
12	**Completed Cable**		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
13	**Continuous Current carrying capacity based on**		SPB * & Trefoil	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
	the conditions special laid in the ground.			
	One circuit		Insert	
	Two circuit		Insert	
	Three circuit		Insert	
	Drawn into ducts (One Cable in duct)		Insert	
	One circuit			
	Two circuit		Same as mentioned above provided the length of into the duct shall not exceed 5 % of route	
	Three Circuit		Insert	
	In Air		Insert	
14	**Max Conductor temperature**			
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
15	Permissible overload in service condition		2 hrs in a day 100 hrs in a month 500 hrs in total life	
16	Conductor short circuit current cable loaded as above prior to short circuit	KA/1sec	Insert	
	Carrying capacity for three second cable loaded	KA/3sec	Insert	
	Final conductor temperature	°C		
17	Sheath Earth Fault Current Carrying capacity for three second cable loaded as above prior to each fault	KA/1sec	50	
	Final Conductor temperature	°C	250°	
18	Max. Dielectric stress	kV/meter	Insert	
	• on the conductor screen (assumed smooth)	kV/meter	Insert	
	• on the insulation	kV/meter		
19	**Minimum radius of bend around which cable can be laid**		20 x overall diameter of cable in meters	
	Laid direct		Insert	
	In ducts		Insert	
	In air		Insert	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
20	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One cable in duct)		Insert	
21	**Maximum DC resistance per km of cable at 20°C**	ohm/km		
	Of conductor	ohm/km	Insert	
	Of metallic layer	ohm/km	Insert	
22	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
23	**Insulation Resistance per km of cable per core**			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
24	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	
25	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
26	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	
27	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
28	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
29	**Maximum dielectric Dissipation factor of charging of cable when laid direct in the ground at nominal voltage Uo, normal frequency at**			
	Conductor temperature of 20°C		Insert	
	Maximum conductor temperature of 90°C		Insert	
30	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
31	Cree page	Mm	Insert	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
	Total creepage distance of outdoor sealing approx. mm and porcelain.			
32	Earth continuity copper Conductor (IF REQD)	mm^2	Insert	
33	**Condition on which current carrying capacity are based**			
	Soil thermal resistivity	°C-cm/W	Insert	
	Ground temperature	°C	Insert	
	Air temperature	°C	Insert	
	Burial depth	M	Insert	
	Axial spacing between phase cables	Mm	Insert	
	Axial spacing between circuits	Mm	Insert	
	Type of earth bonding.		Insert	

1.2.2.4 132kV XLPE Cable

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
34	General			
	Manufacturer		Insert	
	Type		Insert	
	Model Designation		Insert	
	Country of Origin		Insert	
	Standards		EC 62067	
	Quality Control		ISO 9001 ISO 14001 ISO 18001	
	Type of conductor		Copper	
	Type of Insulation		XLPE	
	Ambient temperature for calculation - Average daily temperature - maximum daily temperature	 °C °C	 30 45	
35	Voltage			
	Rated Voltage	kV	132kV	
	Maximum System Voltage	kV	145kV	
	Impulse withstand voltage	kV	650	
	Power frequency withstand voltage	kV	275	
36	**Cores**			

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
	Number of cores		1 (one)	
37	**Conductor**			
	Standard		IEC 60228	
	Nominal Current	A	≥ 2000	
	Cross sectional area	mm^2	≥ 2000	
	Nominal Diameter	mm	Insert	
	Material		Annealed Copper	
	Design (standard of segmental)		Milliken (4/5 segment)	
38	**Conductor Screen**			
	Material		Semi conducting tape & Extruded semiconducting compound, cross linked	
	Thickness (approx.)	mm	Insert	
	Nominal Diameter over semi-conducting layer	mm	Insert	
39	**Insulation**			
	Material		XLPE	
	Process		Triple simultaneous extrusion	
	Type of curing (dry)		Dry Curing (VCV)	
	Average Thickness		23-25 mm	
	Minimum Thickness		Insert	
	Nominal Diameter over insulation		Insert	
40	**Insulation screen**			
	Material		Extruded semi conducting compound, cross linked	
	Thickness approx.		Insert	
	Nominal Diameter over semi conducting layer		Insert	
41	**Metallic Screen/Sheath**			
	Type		Corrugated Seamless Aluminium Sheath	
	Thickness (nominal)			
	Nominal Diameter over semi Metallic sheath	mm	Insert	
42	**Longitudinal water tightness**			
	Material		Semi-conducting swellable tape	
	Nominal thickness and width approx.		Insert	
43	**Radial moister barrier**			
	Material		Laminated plastic coated aluminium tape / lead/copper	
	Nominal thickness and width approx.		Insert	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
44	**Outer Covering**			
	Material		HDPE (Latest generation)	
	Colour		Black	
	Minimum average thickness		Insert	
	Type of termite repellent		Insert	
45	**Completed Cable**		Insert	
	Overall diameter (approx.)	mm	Insert	
	Weight per meter (approx.)	kg	Insert	
46	**Continuous Current carrying capacity based on the conditions special laid in the cable trench**		SPB * & Trefoil	
	One circuit		Insert	
	Two circuit		Insert	
	Three circuit		Insert	
	Drawn into ducts (One Cable in duct)		Insert	
	One circuit			
	Two circuit		Same as mentioned above provided the length of into the duct shall not exceed 5 % of route	
	Three Circuit		Insert	
	In Air		Insert	
	Calculation as per IEC		During Execution	
47	**Max Conductor temperature**			
	Laid direct ground	°C	Insert	
	Draw into ducts	°C	Insert	
	Elected in air	°C	Insert	
48	Permissible overload in service condition		Min 2 hrs in a day Min 100 hrs in a month Min 500 hrs in total life	
49	Conductor short circuit current cable loaded as above prior to short circuit	kA/1sec	Insert	
	Carrying capacity for three second cable loaded	kA/3sec	Insert	
	Final conductor temperature	°C	Insert	
	Calculation as per IEC		During Execution	
50	Sheath Earth Fault Current Carrying capacity	kA/1sec	Min 90% of conductor capacity	
	Final Conductor temperature	°C	Insert	
51	Max. Dielectric stress	kV/meter	Insert	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
	• on the conductor screen (assumed smooth)	kV/meter	Insert	
	• on the insulation	kV/meter	Insert	
52	**Minimum radius of bend around which cable can be laid**		20 x overall diameter of cable in meters	
	Laid direct		Insert	
	In ducts		Insert	
	In air		Insert	
53	Nominal Internal diameter of pipes on ducts through which cable may be pulled (One cable in duct)		Insert	
54	**Maximum DC resistance per km of cable at 20°C**	ohm/km		
	Of conductor	ohm/km	Insert	
	Of metallic layer	ohm/km	Insert	
55	Maximum ac resistance per km of cable at maximum conductor temperature	ohm/km	Insert	
56	**Insulation Resistance per km of cable per core**			
	At 20°C	mega ohm-km	Insert	
	At maximum rated temperature	mega ohm-km	Insert	
57	Equivalent star Reactance per meter of 1 - phase circuit at nominal frequency	ohm/km	Insert	
58	Maximum electrostatic capacitance per meter of cable approx.	µF/km	Insert	
59	Maximum charging current per core per meter pf cable at nominal voltage, Uo	A/km	Insert	
60	Maximum dielectric loss cable per uncle of 3 phase circuit when laid direct in the ground ay nominal	W/m/phase	Insert	
61	Maximum induced voltage on metal sheath under fault condition (single core only)		Insert	
62	**Maximum dielectric Dissipation factor of charging of cable when laid direct in the ground at nominal voltage Uo, normal frequency at**			
	Conductor temperature of 20°C		Insert	
	Maximum conductor temperature of 90°C		Insert	

Sl No.	Description	Unit	Minimum Requirements	Guaranteed
63	Sheath loss of cable per meter of phase circuit at nominal voltage Uo, normal frequency.	W/m/phase	Insert	
64	Cree page	Mm	Insert	
	Total creepage distance of outdoor sealing approx. mm and porcelain.			
65	Earth continuity copper Conductor (IF REQD)	mm^2	Insert	
66	**Condition on which current carrying capacity are based**			
	Soil thermal resistivity	°C-cm/W	Insert	
	Ground temperature	°C	Insert	
	Air temperature	°C	Insert	
	Burial depth	M	Insert	
	Axial spacing between phase cables	Mm	Insert	
	Axial spacing between circuits	Mm	Insert	
	Type of earth bonding.		Insert	

1.2.3 C : Switchgear 36kV

1.2.3.1 Circuit Breaker 36kV

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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
			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 Um	kV rms	36	
2.3	Rated lightning impulse withstand voltage	kV peak	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency fr	Hz	50	
2.6	Rated current Ir	A	≥630	
2.7	Rated short-circuit breaking current Isc	kA rms	≥ 31.5	
2.8	Rated peak withstand current Ip (equal short-circuit making current)	kA peak	78	
2.9	D.C. component of the rated short-circuit breaking current	%	>45	
2.10	First-pole-to-clear factor			
	• Terminal fault	p.u.	1.3	
	• Short-line fault	p.u.	N.A.	
	• Out-of-phase	p.u.	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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.14	Duration of short-circuit	s	≥ 3	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		3p	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 80	
2.18	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms		
2.19	Opening time (trip initiation to contact separation)			
	• Without current	ms	Insert	
	• With 100 % rated breaking current	ms	Insert	
2.20	Maximum time interval between opening interrupters	ms	Insert	
2.21	Maximum time interval between opening of first and last phase of three-phase circuit breakers	ms	3	
2.22	Time for making (trip initiation to contact touch)			
	• Without current	ms	Insert	
	• 100 % making current	ms	Insert	
2.23	Minimum dead time	ms	Insert	
2.24	Restrike performance during capacitive current switching	Class	C2	
2.25	Number of operations without maintenance			
	• CO at no-load	No.	≥ 10000	
	• CO at rated current		≥ 2500	
	• CO at rated breaking current Isc		≥ 5	
2.26	The frequency of mechanical operations	Class	M1	
2.27	Rated electrical endurance	Class	E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF6 gas in a circuit breaker	kg	Insert	
2.30	Rated mechanical terminal loads			
2.30.1	Static horizontal force, longitudinal FthA	N	Insert	
2.30.2	Static horizontal force, transversal FthB	N	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.30.3	Static vertical force Ftv	N	Insert	
2.30.4	Dynamic horizontal force, longitudinal Fwx	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. ≥ 31	
3.1.3	HV terminal	pcs.	6	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/wiping)		12NO+12NC+2w	
3.2.15	Water-tight corrosion-resistant housing		IP55W	
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)			

1.2.3.2 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 Um	kV rms	36	
2.3	Rated lightning impulse withstand voltage	kV peak	170	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency fr	Hz	50	
2.7	Rated current Ir	A	≥ 630	
2.8	Rated short circuit withstand current Ik	kA rms	≥ 31.5	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 78	
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	M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static Fb	N	Insert	
2.17.3	Vertical force Fc	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3	**Disconnector - Design and Construction**			
3.1	Disconnector			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/kV	Min. ≥ 31	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		IP55W	

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

1.2.3.2.1 Disconnector 33 kV with ES

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 Earth Switch	
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 with ES- Characteristics**			
2.1	Nominal system voltage	kV rms	33	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2	Highest voltage for equipment Um	kV rms	36	
2.3	Rated lightning impulse withstand voltage	kV peak	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency fr	Hz	50	
2.7	Rated current Ir	A	≥ 630	
2.8	Rated short withstand current Ik	kA rms	≥ 31.5	
2.9	Rated duration of short-circuit	s	3	
2.10	Rated maximum withstand current Ip	kA	≥ 78	
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	M1	
2.17	Rated mechanical terminal loads of terminals			
2.17.1	Direct loading, static Fa	N	Insert	
2.17.2	Transversal loading, static Fb	N	Insert	
2.17.3	Vertical force Fc	N	Insert	
2.17.4	Direct loading, dynamic	N	Insert	
2.17.5	Transversal loading, dynamic	N	Insert	
3	**Disconnector with ES- 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. ≥ 31	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.6	Total heater power	W	Insert	
3.2.7	Water-tight corrosion-resistant housing		IP55W	
3.2.8	Housing of Al or stainless steel		Yes	
3.2.9	Equipotential bonding rails		Yes	
	Overall compliance with the requirements (yes/no)			

1.2.3.3 Current Transformer 33 kV

Sl no.	Description	Minimum Requirements		Guaranteed
		Unit	Unit	
1.	**Current Transformer-General**			
1.1	Manufacturer		*insert*	
1.2	Country of Manufacturing		*insert*	
1.3	Type		Post type vertical mounting, Single Phase, Free Standing, Oil immersed / Resin encapsulated	
1.4	Model designation		*insert*	
1.5	Country of Origin		EU/UK/USA/Japan/ Turkey/Equivalent	
1.6	Standards		IEC 61869-1 IEC 61869-2	
1.7	Quality Control		ISO 9001	
1.8	Installation type		Outdoor, Post type	
1.9	Service Condition: Ambient air temperature	°C	-5 to +40	

Sl no.	Description	Minimum Requirements		Guaranteed
		Unit	Unit	
1.10	Service Condition: Altitude	m	≤1000	
1.11	Service Condition: System Earhing		Effectively earthed	
1.12	Service Condition: Seismic Condition	g	0.1	
2.	**Current Transformer-Characteristics**			
2.1	Nominal System Voltage	kV_{rms}	33	
2.2	Highest voltage for equipment, U_m	kV $_{rms}$	36	
2.3	Rated lightning impulse withstand voltage	kV_{peak}	170	
2.4	Rated Short duration power frequency voltage	kV $_{rms}$	70	
2.5	Rated frequency	Hz	50	
2.6	Rated short-time thermal current, I_{th}, 1s	kA	31.5	
2.7	Rated dynamic current, I_{dyn}	kA	80	
2.8.1	Rated primary current	A	400	
2.8.2	Rated secondary current	A	1	
2.8.3	Primary reconnection		No	
2.9	Electrical dissipation factor at power frequency test voltage		*insert*	
2.10	Capacitance	pF		
2.11	Maximum Allowable winding temperature	°C	*Insert*	
2.12	Normal current density of primary winding		*Insert*	
2.13	Rated continuous thermal current (40°C): • Core-I • Core-II • Core-III • Core-IV	 % In % In % In % In	 200 200 120 120	
2.14	Rated Transformer ratio: • Core-I • Core-II • Core-III • Core-IV	 A/A A/A A/A A/A	 400-200-800/1 400-200-800/1 400-200-800/1 400-200-800/1	
2.15	Accuracy Class: • Core-I • Core-II • Core-III		 0.2s 0.2s	

Sl no.	Description	Minimum Requirements		Guaranteed
		Unit	Unit	
	• Core-IV		5P 5P	
2.16	Rated Burden: • Core-I • Core-II • Core-III • Core-IV	 VA VA VA VA	 10 10 30 30	
2.17	Rated Knee Point Voltage, V_k (Min) at highest ratio • Core-I • Core-II • Core-III • Core-IV	V	*insert* *insert* *insert* *insert*	
2.18	Max. magnetizing current guaranteed at knee point voltage, I_{Exc} at V_k at highest ratio • Core-I • Core-II • Core-III • Core-IV	mA	*insert* *insert* *insert* *insert*	
2.19	Max. magnetizing current guaranteed at half of knee point voltage, I_{Exc} at $V_k/2$ at highest ratio • Core-I • Core-II • Core-III • Core-IV	mA	*insert* *insert* *insert* *insert*	
2.20	Max. magnetizing current guaranteed at one fourth of knee point voltage, I_{Exc} at $V_k/4$ at highest ratio • Core-I • Core-II • Core-III • Core-IV	mA	*insert* *insert* *insert* *insert*	
2.21	Rated Accuracy limit Factor, ISF/ALF: • Core-I • Core-II • Core-III • Core-IV		≤5 ≤5 20 20	
2.22	Max. resistance of primary winding at 75 ^{0}C, R_{CT} for each rating:	Ohms	*insert*	
2.23	Max. resistance of secondary winding at 75^{0}C, R_{CT} for each rating:	Ohms	*insert*	

Sl no.	Description	Minimum Requirements		Guaranteed
		Unit	Unit	
	• Core-I • Core-II • Core-III • Core-IV			
3.	**Current Transformers – Design & Constructions**			
3.1	External Insulator material		Porcelain/Cast resin	
3.2	Internal Insulating medium		Oil paper/Cast resin	
3.3	Type of cast resin (if applicable)		*Insert*	
3.4	Type including Brand		*Insert*	
3.5	Quantity of insulating oil		*Insert*	
3.6	Porcelain Breaking Strength	kN	*Insert*	
3.7	Minimum creepage distance	mm/kV	≥31	
3.8	In case of resin type, production process type		vacuum	
3.9	Partial discharge level; test voltage U_m test voltage 1.2 $U_m/\sqrt{3}$	pC pC	≤10 (non-solid)/50 (solid) ≤5(non-solid)/20 (solid)	
3.10	Min. LV enclosure protection		IP55	
3.11	Insulation Class		Class A/Class E	
3.12	Insulation test tapping data		Yes/No.	
3.13.	MV terminals: Shape		Flat	
3.13.	MV terminals: Position		Horizontal	
3.13.	MV terminals: Material Suitable for		Al terminal	
3.13.	MV terminals: Adjustable holes		Yes	
3.13.	MV terminals: Admissible Static Load	KN	*Insert*	
3.13.	MV terminals: Admissible Dynamic Load	KN	*Insert*	
3.13.	MV terminals: Cantilever test Load	KN	*Insert*	
3.14	Total weight	kg	*insert*	
3.15	Total Height	mm	*insert*	
3.16	Ten delta test terminal provided		Yes	
4.	**Reliability Data**			
4.1	Mean Time to Failure in yrs		*insert*	
4.2	Expected Operating Life in Yrs		*insert*	
4.3	Mean time to repair in Hrs		*insert*	

Sl no.	Description	Minimum Requirements		Guaranteed
		Unit	Unit	
4.4	Mean time between preventive maintenance in Yrs		*insert*	
4.5	Mean Time to (perform) preventive maintenance in Hrs		*insert*	
4.0	**Overall compliance with the requirements (yes/no)**		Yes/No.	

Note:

1) The oil immersed Type CT shall be hermetically sealed to eliminate breathing and to prevent ingression of air and moisture from the environment. Following accessories / fittings shall, but not restricted to, be supplied along with the Current Transformers.
   (i) Pressure release device.
   (ii) Oil level indicator.
   (iii) Lifting lugs.
   (iv) The CT shall be so constructed that it can be easily transported to the site within the allowable transport limitations even in horizontal position, if the transport limitations so demand.

2) The pressure relief device shall be designed to relieve any internal abnormal pressures before the likelihood of fracture of any external component of the transformer. The relief device shall be positioned near the top and oriented to prevent the possibility of injury or damage to persons or other equipment.

1.2.3.4 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 Um	kV rms	36	
2.3	Rated lightning impulse withstand voltage	kV peak	170	
2.4	Rated short duration power frequency voltage	kV	70	
2.5	Rated frequency fr	Hz	50	
2.6	Rated short-time thermal current Ith, 1 s	kA	31.5	
2.7	Rated dynamic current Idyn	kV peak	78	
2.8	Rated primary voltage	kV	33/√3	
2.9	Rated secondary voltage			
	• I winding	V	110/√3	
	• II winding	V	110/√3	
2.10	Accuracy class:			
	• I winding		0.2	
	• II winding		3P	
2.11	Rated power:			
	• I winding	VA	10	
	• II winding	VA	25	
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**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1	Insulator material		Porcelain or araldite	
3.2	Insulating medium		Oil-paper or araldite	
3.3	Minimum creepage distance	mm/kV	Min. ≥ 31 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	pC	Max. ≤ 5	
	• Test voltage UM	pC	≤ 10	
3.7	Min. LV enclosure protection		IP55	
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)			

1.2.3.6 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 Um	kV rms	36	
2.4	Rated voltage of surge arrester Ur	kV rms	36	
2.5	Max. continuous operating voltage Uc	kV rms	29	
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 Ures			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 (Fdyn)	N	≥ 7500	
3.6.2	Specified long-term load SSL (Fstat)	N	≥ 5000	
3.7	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
3.8.	Housing insulating material		Composite/Silicon	
3.9	Insulating basement		Yes	
3.10	Surge arrester height	mm	Insert	
3.11	Surge arrester weight	kg	Insert	
3.12	Voltage distribution ring present / ring diameter	yes / no / mm	Insert	
3.14	HV terminal			
3.14.1	Shape		Flat	
3.14.2	Dimension	mm x mm	Min 100 x 50	
3.14.3	Number of holes		Min 2	
3.14.4	Distance between holes	Mm	50	
3.14.5	Material suitable for		Al terminal	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.3.7 33kV XLPE Cable

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
2	Manufacturer		Insert	
3	Origin		Insert	
4	Type		Insert	
5	Rated system voltage	kV	33	
5.1	phase	kV	Insert	
5.2	line to line	kV	Insert	
6	Max. permissible system voltage	kV	36	
7	Rated frequency	Hz	50	
8	Max. operating current	A	Insert	
9	Nominal cross sectional area	mm^2	300 mm2 Cu	
10	Impulse withstand voltage	kV	170	
11	Power frequency withstand voltage	kV	70	
12	Shape of conductor		Insert	
13	Nominal cross section of Cu-screen	mm^2	Insert	
14	Thickness of outer sheath	mm	Insert	
15	Insulation thickness	mm	8-9	
16	Min. bending radius	D	15	
17	Max. pulling force		Insert	
18	Max. DC resistance at 20℃	ohm/km	0.0366	
19	Max. AC resistance at 20℃	ohm/km	Insert	
20	Max. reactance in single configure	mH/km	Insert	
21	Operating capacitance	µF/km	Insert	
22	Charging current (phase)		Insert	
23	Charging load (phase)		Insert	
24	Earth fault current	kA	Insert	
25	Short circuit rating for 3 sec	kA	31.5 (Calculation is required)	
26	Current rating	kA	Insert (Calculation is required)	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
26.1	in soil	A	Insert	
26.2	in air	A	Insert	
27	standard		Insert	

1.2.4D : Transformers

1.2.4.1 400/235/34.5 kV 520/750 MVA ONAN/ONAF Autotransformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Autotransformer three-phase, oil immersed, with tertiary winding, hermetically sealed, with on-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044	
1.5.1			IEC 60076	
1.5.2			IEC 60137	
1.5.3			IEC 60214	
1.5.4			IEC 60354	
1.5.5			IEC 60529	
1.5.6			IEC 60815	
1.5.7			IEC 60947	
1.5.8			NEMA TR-1	
1.5.9			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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2	**Ratings and properties**			
2.1	**Rating (three phase)**		Rated power 750 MVA, all taps	
2.1.1	Frequency	Hz	50	
2.1.2	Corresponding minimum Frequency	Hz	48	
2.1.3	Connection of three-phase windings (group of vector IEC 60076)		YNa0d1	
2.1.4	Neutral point insulation		LI 325 AC 140	
2.1.5	Voltage ratio (No Load)	kV	400/235/34.5	
2.2	**Rated power by cooling ONAN / ONAF**			
2.2.1	Primary / secondary winding	MVA	520/750	
2.2.2	Tertiary – minimum	MVA	100 /150	
2.2.3	Loading Type		Simultaneous on HV-LV-TV, (HV/LV not derated for TV Loading)	
2.3	**Rated (highest) voltage of windings**			
2.3.1	HV winding	kV	420	
2.3.2	LV winding	kV	245	
2.3.3	TV - stabilizing winding	kV	36	
2.3.4	NV - Neutral voltage	kV	72.5	
2.4	**Tap changer**			
2.4.1	Manufacturer		Insert	
2.4.2	Manufacturer		MR/ABB/Equivalent	
2.4.3	Country of origin		Insert	
2.4.4	Switching technology		Vacuum	
2.4.5	Model designation		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4.6	Type of tap changing		On-load	
2.4.7	Electrical location of Tap winding		HV / Series Winding	
2.4.8	Geometric Location of Tap winding		[Insert]	
2.4.9	Type of voltage regulation		Constant Flux Variable Voltage (C.F.V.V.)	
2.4.10	Tapping range	% V	±10	
2.4.11	Tapping step/Size of Each tapping step	%	1.25	
2.4.12	Number of steps		17	
2.4.13	Short circuit current - time	kA-s	[Insert]	
2.4.14	Insulation level	kV	[Insert]	
2.4.15	Rated current	A	≥ 1600	
2.4.16	BIL to ground through the regulating coil	kV peak	Insert	
2.4.17	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
2.4.18	Tap position indicator		Digital code matrix (BCD)	
2.4.19	Auxiliary supply		3x400 V / 230 V, 50 Hz	
2.4.20	OLTC diverter switch tank		Separate from Main tank	
2.4.21	Breathing of OLTC		Separate/Shared conservator	
2.4.22	OLTC Oil guided to Radiator for cooling		No	
2.4.23	OLTC tap change principle type		Resistance/Reactance type	
2.4.24	MVA Rating of Transformer due to OLTC operation		Rated power 750 MVA, all taps	
2.4.25	Rated Voltage (No. load) due to OLTC operation	kV/kV/kV	Insert	
2.4.26	Percent Impedance design due to Tap Changing		Constant	
2.4.27	OLTC Drive Type		Insert	
3	**Special technical requirements**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1	**Short circuit impedance corrected to reference temperature of 75°C at rated frequency and rated power**			
3.1.1	HV - LV, on the basis of rated power with on-load tap changer in middle position	%	13 ±10 %	
3.1.2	HV - TV, on the basis of rated power with on-load tap changer in middle position	%	[Insert], (Max allowable SCC at TV line side 31.5 kArms)	
3.1.3	LV - TV, on the basis of rated power 'x' MVA with on-load tap changer in middle position	%	[Insert], (Max allowable SCC at TV line side 31.5 kArms)	
3.2	**Zero-sequence impedance, with tap changer in middle position:**			
3.2.1	HV - LV, on the basis of rated power with on-load tap changer in middle position	%	Insert	
3.2.2	HV - TV, on the basis of rated power with on-load tap changer in middle position	%	Insert	
3.2.3	LV - TV, on the basis of rated power 'x' MVA with on-load tap changer in middle position	%	Insert	
3.2.4	X/R ratio			
3.3	**Autotransformer capacity to withstand external short circuits**			
3.3.1	Short-circuit duration	sec	2	
3.3.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period:			
3.3.3	HV winding	kA	Infinite	
3.3.4	LV winding	kA	Infinite	
3.3.5	TV winding	kA	Infinite	
3.3.6	Pre-fault voltage	p.u.	1.05	
3.4	**Guaranteed losses [HV-LV-TV Simultaneously loaded]**			
3.4.1	**No Load Loss**			
3.4.1.1	No-load losses with tap changer in nominal tap position at rated voltage and rated frequency	kW	Insert	
3.4.1.2	No-load losses with tap changer in plus (+) extreme tap position at 110 % rated voltage, at rated frequency	kW	Insert	
3.4.1.3	No-load losses with tap changer in minus (-) extreme tap position at 90 % rated voltage, at rated frequency	kW	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.4.1.4	Average No-Load Loss (this value will be evaluated)	kW	(3.4.1.1 + 3.4.1.2 + 3.4.1.3)/3	
3.4.1.5	No-load losses capitalized value	BDT/kW	600,000	
3.4.1.6	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.2	**On-load losses at 75°C,**			
3.4.2.1	On-load losses at 75°C with tap changer in nominal tap position at rated voltage and rated frequency	kW	Insert	
3.4.2.2	On-load losses at 75°C with tap changer in plus (+) extreme tap position at 110 % rated voltage, at rated frequency	kW	Insert	
3.4.2.3	On-load losses at 75°C with tap changer in minus (-) extreme tap position at 90 % rated voltage, at rated frequency	kW	Insert	
3.4.2.4	Average On-load losses (this value will be evaluated)	kW	(3.4.2.1 + 3.4.2.2 + 3.4.2.3)/3	
3.4.2.5	On-load losses capitalized value	BDT/kW	300,000	
3.4.2.6	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.4.3	Ancillary Loss			
3.4.3.1	Ancillary equipment (fans, pumps, heaters, motors etc.)			
3.4.3.2	Load of ancillary equipment (this value will be evaluated)	kW	Insert	
3.4.3.3	Capitalized valued of ancillary equipment load	BDT/kW	300,000	
3.4.3.4	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	20	
3.5	**Rated Insulation level**			
3.5.1	High voltage (HV)		LI 1425 SI 1050 AC650	
3.5.2	Low voltage (LV)		LI 1050 AC 460	
3.5.3	Tertiary voltage (TV)		LI 170 AC 70	
3.5.4	Neutral voltage (NV)		LI 325 AC 140	
3.5.5	Method of Neutral Earthing		Solid Ground	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.6	**Efficiencies [HV-LV-TV Loading]**			
3.6.1	If cosφ = 1.0 and:			
3.6.1.1	• 25 % load of the rated value		Insert	
3.6.1.2	• 50 % load of the rated value		Insert	
3.6.1.3	• 75 % load of the rated value		Insert	
3.6.1.4	• 100 % load of the rated value		Insert	
3.6.2	If cosφ = 0.9 (inductive) and:			
3.6.2.1	• 25 % load of the rated value		Insert	
3.6.2.2	• 50 % load of the rated value		Insert	
3.6.2.3	• 75 % load of the rated value		Insert	
3.6.2.4	• 100 % load of the rated value		Insert	
3.6.3	If cosφ = 0.8 (inductive) and:			
3.6.3.1	• 25 % load of the rated value		Insert	
3.6.3.2	• 50 % load of the rated value		Insert	
3.6.3.3	• 75 % load of the rated value		Insert	
3.6.3.4	• 100 % load of the rated value		Insert	
3.7	**Voltage drop at the terminals of secondary**			
3.7.1	**Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position**			
3.7.1.1	• cosφ = 1.00		Insert	
3.7.1.2	• cosφ = 0.95 (inductive)		Insert	
3.7.1.3	• cosφ = 0.90 (inductive)		Insert	
3.7.1.4	• cosφ = 0.80 (inductive)		Insert	
3.7.2	**Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position [HV-LV-TV loaded, TV at 0.95 leading pf]**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7.2.1	• cosφ = 1.00		Insert	
3.7.2.2	• cosφ = 0.95 (inductive)		Insert	
3.7.2.3	• cosφ = 0.90 (inductive)		Insert	
3.7.2.4	• cosφ = 0.80 (inductive)		Insert	
3.8	**No-load current at rated frequency**			
3.8.1	At 0.90 Un		Insert	
3.8.2	At 1.00 Un		Insert	
3.8.3	At 1.05 Un		Insert	
3.9	**At the emergency cases it is allowed:**	MVA	Compliant to IEC 60076-7	
	• 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 volt age)			
3.10	**Guaranteed value of overloads in % of the rated power**			
3.10.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.10.1.1	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.1.2	After operation under 20 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.1.3	After operation under 120 min			
	• full rated power		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.10.2.1	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2.2	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2.3	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.11	**Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits:**			
3.11.1	• with all cooling groups in operation (excluding stand-by cooling group)		Insert	
3.11.2	• with one cooling group out of operation		Insert	
3.11.3	• with two cooling groups out of operation		Insert	
4	**Design & Construction**			
4.1*	**Cooling system**			
4.1.1	**Oil Flow through Windings/ windings group**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1.1.1	Guided Oil Flow inside transformer	Yes/No.	Yes	
4.1.1.2	Pattern of Oil Flow through Duct	Axial/Zig-Zag	[Insert]	
4.1.2	**Pressure drop inside transformer**			
4.1.2.1	Radial Locations with respect to core	bar	[Insert]	
4.1.2.2	Axial Locations with respect to core	bar	[Insert]	
4.1.3	**Radiators & Coolers**			
4.1.3.1	Radiator Location		A	
	Attached to Tank or Separate		Attached to Tank	
4.1.3.2	Number of cooling groups (total)	Qty.	Insert	
	Number of cooling groups (for rated power)	Qty.	Insert	
	Number of stand-by cooling groups	Qty.	Insert	
	Number of coolers in a cooling group	Qty.	Insert	
	Number of spare fans	Qty.	Insert	
	Rating of each cooler	kW	Insert	
4.1.3.3	Full vacuum withstand of complete cooler	mbar	Yes	
4.1.4	**HV side**			
4.1.4.1	No. of Radiator Bank	No.	[Insert]	
4.1.4.2	No. of Fins/Plates in each Radiator	No.	[Insert]	
4.1.4.3	No. of Cooler Fans	No.	[Insert]	
4.1.4.4	No. of group of Cooler Fan	No.	[Insert]	
4.1.4.5	Spare Fans in each group	No.	[Insert]	
4.1.4.6	No. of Blower/Motor Driving a Fan	No.	1	
4.1.4.7	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	
4.1.4.8	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1.4.9	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	
4.1.4.10	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
4.1.4.11	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
4.1.4.12	No. of Pipes collecting Hot Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.1.4.13	No. of Pipes collecting Cold Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.1.5	**LV side**			
4.1.5.1	No. of Radiator Bank	No.	[Insert]	
4.1.5.2	No. of Fins/Plates in each Radiator	No.	[Insert]	
4.1.5.3	No. of Cooler Fans	No.	[Insert]	
4.1.5.4	No. of group of Cooler Fan	No.	[Insert]	
4.1.5.5	Spare Fans in each group	No.	[Insert]	
4.1.5.6	No. of Blower/Motor Driving a Fan	No.	1	
4.1.5.7	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	
4.1.5.8	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	
4.1.5.9	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	
4.1.5.10	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
4.1.5.11	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
4.1.5.12	No. of Pipes collecting Hot Oil	No.	[Insert] (spare n+1, shall be considered)	
4.1.5.13	No. of Pipes collecting Cold Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.2*	**Oil Flow rate**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.2.1	**Oil Flow rate inside Transformer during ONAN Cooling**			
4.2.1.1	Highest Flow rate (Approx.)	m/s	[Insert]	
4.2.1.2	Location at Transformer		[Insert]	
4.2.1.3	Lowest Flow rate (Approx.)	m/s	[Insert]	
4.2.1.4	Location at Transformer		[Insert]	
4.2.1.5	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
4.2.2	**Oil Flow rate inside Transformer during ONAF Cooling**			
4.2.2.1	Highest Flow rate (Approx.)	m/s	[Insert]	
4.2.2.2	Location at Transformer		[Insert]	
4.2.2.3	Lowest Flow rate (Approx.)	m/s	[Insert]	
4.2.2.4	Location at Transformer		[Insert]	
4.2.2.5	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
4.2.3	**Predicted Hot Spot Location**			
4.2.3.1	HV Side		Insert	
4.2.3.2	LV side		Insert	
4.2.3.3	TV side		Insert	
4.2.3.4	Temperature Difference (D-Temp) between Inlet & Outlet of Radiator banks --- Design value	^{0}C	[Insert]	
4.3	**Temperature rise limits, at rated power, with complete cooling system in service and at rated voltage tap**			
4.3.1	Average Oil Temperature rise	^{0}C		
4.3.2	Top oil	°C	≤ 60	
4.3.3	Winding	°C	≤ 65	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.3.4	Hottest spot	°C	≤ 78	
4.3.5	Maximum hot spot temperature rises in core at rated power	^{0}C	78	
4.3.6	Internal Hot-spot Temperature (Amb. Temp. + Top oil rise + Core hot spot)	^{0}C	130	
4.3.7	Surface Temperature (Amb. Temp. + Top oil rise + Core surface temp.)	^{0}C	Insert	
4.3.8	Temperature gradient at rating specified	K		
4.3.9				
4.3.10*	**Temperature rise of metallic parts**			
4.3.10.1	Tank walls	^{0}C		
4.3.10.2	Tie plate	^{0}C		
4.3.10.3	Top clamp	^{0}C		
4.3.10.4	Bottom clamp	^{0}C		
4.4	**Core Construction**			
4.4.1	Type of Transformer Core (Shell or Core)		Core	
4.4.2	No. of Core Limb		Insert	
4.4.3	Core Material		CRGO Si steel [Hi-B]	
4.4.4	Grade Designation		Insert	
4.4.5	Core Graining Method		Laser-beam or plasma jet irradiation	
4.4.6	Thickness of Sheet	mm		
4.4.7	Specific Loss at 1.7T,50Hz	W/kg	<0.85	
4.4.8	Insulation material & Class			
4.4.9	Safe Working Temperature of Core	^{0}C		
4.4.10	Whether step lap construction adopted		Yes	
4.4.11	Whether boltless construction adopted		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4.12	Core Material Make , Country		Insert	
4.4.13	Whether Core is pre-cut or cut at Factory		Insert	
	Method of joining of legs		Insert	
	Method of joining of yokes		Insert	
	Joining material		Insert	
4.4.14	Flux density at nominal voltage and frequency and at nominal ratio - (no load)			
4.4.15	Cores	T		
4.4.16	Yokes	T		
4.4.17	Volts/turn	V		
4.4.18	Over flux withstand capability of the Transformer [flux density & time]	T, Min or s		
4.4.19	Continuously 10% over voltage and frequency and at principal tap	T, Min or s		
4.4.20	at 125% of rated Voltage	T, Min or s		
4.4.21	at 140% of rated Voltage	T, Min or s		
4.4.22	at 150% of rated Voltage	T, Min or s		
4.4.23	Magnetizing current (approx) at nominal ratio and			
4.4.23.1	at 0.90 x nominal voltage	% of FLA		
4.4.23.2	at 0.95 x nominal voltage	% of FLA		
4.4.23.3	at 1 .0 x nominal voltage	% of FLA		
4.4.23.4	at 1 .05 x nominal voltage	% of FLA		
4.4.23.5	at 1 .1 x nominal voltage	% of FLA		
4.4.24	Power factor of magnetizing current at normal voltage ratio and frequency			
4.4.25	Oil Ducts among cores		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.5	**Winding Construction**			
4.5.1	Materials of winding		Copper	
4.5.2	Make, country			
4.5.3	Conductor Used		CTC/others	
4.5.3.1	HV		[Insert]	
4.5.3.2	RV/ tap Winding		[Insert]	
4.5.3.3	LV		[Insert]	
4.5.3.4	TV		[Insert]	
4.5.4*	**Type of Conductor Used**			
4.5.4.1	HV		Cu - 'Interleaved' Disc	
4.5.4.2	RV/ tap Winding		Layer/Muti-start	
4.5.4.3	LV		Cu - Interleaved / disc-transposed, cured in epoxy coating	
4.5.4.4	TV		Helical/Disk/Layer [Cu - transposed, cured in epoxy coating]	
4.5.5	**Current density, Thermal**			
4.5.5.1	HV	A/mm^2	[Insert]	
4.5.5.2	RV/ tap Winding	A/mm^2	[Insert]	
4.5.5.3	LV	A/mm^2	[Insert]	
4.5.5.4	TV	A/mm^2	[Insert]	
4.5.6	**Current Density, Short circuit**			
4.5.6.1	HV	A/mm^2	[Insert]	
4.5.6.2	RV/ tap Winding	A/mm^2	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.5.6.3	LV	A/mm^2	[Insert]	
4.5.6.4	TV	A/mm^2	[Insert]	
4.5.7	Insulations at windings		Thermally Upgraded Paper	
4.5.7.1	Insulation Class		A	
4.5.7.2	Insulation Make, Country			
4.5.7.3	Additional Insulations as Protection caps at windings			
4.5.7.4	HV	Yes/No		
4.5.7.5	LV	Yes/No		
4.5.7.6	TV	Yes/No		
4.5.8	Oil Ducts among windings		Yes	
4.5.9	Material of Pressboard		[Insert]	
4.5.10	Material of Key Spacer		[Insert]	
4.5.11	**Resistance /phase [Design Value with Tolerance]**			
4.5.11.1	HV	Ω	[Insert]	
4.5.11.2	LV	Ω	[Insert]	
4.5.11.3	TV	Ω	[Insert]	
4.5.12	Connection of three-phase windings (vector group IEC 60076)		YNa0d1	
4.5.13	Tertiary winding connection (TV)		Delta made inside the tank, with three terminals brought out outside of the tank	
4.5.14	Geometric Location of windings with respect to core			
4.5.14.1	TW		[Insert]	
4.5.14.2	LW/ common winding		[Insert]	
4.5.14.3	HV/ series winding		[Insert]	
4.5.14.4	RW		[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.5.14.5	Winding Method		(Hor/Ver.)[Insert]	
4.5.15	**Winding connections [crimped, Brazed or others]**			
4.5.15.1	Between Windings			
4.5.15.2	Between Winding Layers/Disk			
4.5.15.3	Between Main Winding & Tap Winding			
4.5.15.4	Between Windings & Leads			
4.5.15.5	Clamping of Winding			
4.5.15.6	The individual winding sets clamped separately from each other and separately from the core.		Yes	
4.5.15.7	Acceptable Tangent delta of winding		Insert	
4.5.15.8	Acceptable PD level	pC		
4.6*	**Curing of Active Part**			
4.6.1	Highest temperature	^{0}C		
4.6.1.1	Duration	Hrs		
4.6.2	Average temperature	^{0}C		
4.6.2.1	Duration	Hrs		
4.6.5	Total duration	Hrs		
4.6.6	Active Part Compression during Pressure, (Approx.)	mm		
5	**Short Circuit**			
5.1	**Minimum Current through windings for Terminal Fault**			
5.1.1	HV (RMS/PEAK)	kArms/kAp		
5.1.2	LV (RMS/PEAK)	kArms/kAp		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.1.3	TV (RMS/PEAK)	kArms/kAp		
5.1.4	Peak Factor		2.69	
5.2	Pre-fault voltage	p.u.	1.05	
5.3	Withstand Duration	s	2	
5.4	Similar Design Transformer (as per IEC 60076-5, Annex A) type test reference			
5.4.1	Testing Authority		STL Lab, insert Name	
5.4.2	certificate reference			
5.4.3	Contact address of test Lab			
5.4.4	Validity of test certificate			
5.5	Force [Shall be based on Highest SCC among LLG, LL, LLL, LG at each side-HV/LV/TV] for offered TR			
5.5.1	Axial Force [CW/SW/RW/TW]	kN		
5.5.2	Free Buckling Force [CW/SW/RW/TW]	kN		
5.5.3	Compression Force [CW/SW/RW/TW]	kN		
5.5.4	Designed Safety Margin [CW/SW/RW/TW]			
a	For indivisual winding clamping		> 1.4	
b	For other design		>2	
5.6	Offered & Reference Similar Type testedDesign transformer Short Circuit Force relationship		Within 110%	
5.7	Temperature during SC			
5.7.1	HV Winding [Actual/Allowable]	^{0}C		
5.7.2	LV Winding[Actual/Allowable]	^{0}C		
5.7.3	RV Winding [Actual/Allowable]	^{0}C		
5.7.4	TV Winding[Actual/Allowable]			
5.8	Maximum Circulating Current in Delta tertiary for L-G fault at TV terminal	kA		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.8.1	Winding withstand capacity of this current	Min or s		
6*	**Dielectric Design**			
6.1	**Impulse Voltage At HV (LI)**			
6.1.1	Maximum applied voltage at critical points	kVp		
6.1.2	Permissible Voltage	kVp		
6.1.3	Safety Factor		>2	
6.1.4	Transferred surge at LV	kVp		
6.1.5	Transferred surge at TV	kVp		
6.1.6	ZnO Block to limit distributed impulse [tap Winding/other]		[At design satge]	
6.2	**Impulse Voltage At HV (SI)**			
6.2.1	Maximum applied voltage at critical points	kVp		
6.2.2	Permissible Voltage	kVp		
6.2.3	Safety Factor		>2	
6.2.4	Transferred surge at LV	kVp		
6.2.5	Transferred surge at TV	kVp		
6.2.6	ZnO Block to limit distributed impulse [tap Winding/other]		At Design stage	
6.3	**Impulse Voltage At LV (LI)**			
6.3.1	Maximum applied voltage at critical points	kVp		
6.3.2	Permissible Voltage	kVp		
6.3.3	Safety Factor		>2	
6.3.4	Transferred surge at HV	kVp		
6.3.5	Transferred surge at TV	kVp		
6.3.6	ZnO Block to limit distributed impulse [tap Winding/other]	kVp	At Design stage	
6.4	**Impulse Voltage at TV (LI)**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.4.1	Maximum applied voltage at critical points	kVp		
6.4.2	Permissible Voltage	kVp		
6.4.3	Safety Factor		>2	
6.4.4	Transferred surge at HV	kVp		
6.4.5	Transferred surge at LV	kVp		
6.4.6	ZnO Block to limit distributed impulse		No.	
7*	**Earthing**			
7.1	Neutral [with double connection], with copper conductor	Sq-mm		
7.2	Core , taken out		Yes	
7.3	Clamp, taken out		Yes	
7.4	Tank Body		Yes	
7.5	Cubicles		Yes	
7.6	Radiators, if separately mount /connected from tank		NA	
7.7	Others		Insert	
8*	**Valves & Manholes**			
8.1	Type of valves used			
8.2	Valve schedule attached		Yes	
8.3	Spare Manhole for inspection & future use		Yes, insert number & size	
9*	**Oil for Transformer & Tap Changer**			
9.1	Manufacturer		Insert	
9.2	Type, Grade & Model		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
9.3	Standard		IEC 60296	
9.4	Minimum flash point	°C	>140	
9.5	Viscosity at 40°C	mm^2/s	Max 8	
9.5.1	Viscosity at -30°C	mm^2/s	Max 800	
9.6	Maximum dielectric strength before / after treatment	kV (at 2.5cm)	60/70	
9.7	Total sulphur content	%	<0.01	
9.8	Corrosive Sulphur		No	
9.9	PCB content		Without PCB	
9.10	Water Content	mg/kg	<20	
9.11	DDF at 90°C [IEC 60247]		<0.001	
9.12	Density at 20°C	Kg/dm^3	>0.7	
9.13	Stray gassing under thermooxidative stress			
	Hydrogen	µL/L	<5	
	Methane/Ethane		<1	
9.14	Sludge	wt %	<0.01	
9.15	Antioxidants	wt %	<0.24	
9.16	Total acidity [IEC 61125]	mg KOH/g	<0.05	
9.17	Data sheet attached		Yes	
10	**Bushing**		IEC60137	
10.1	**HV bushing**			
10.1.1	Quantity		03	
10.1.2	Class	kV	420/1425/1050/650	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.1.3	Manufacturer		ABB (Sweden, Switzerland), Trench (France/USA), HSP (Germany), GE (Italy) or equivalent	
10.1.4	Type		Insert	
10.1.5	Rated current	A	≥ 1600	
10.1.6	Rated short circuit current (3 s)	kA rms	50	
10.1.7	Rated lightning impulse withstand voltage	kV peak	1425	
10.1.8	Rated switching impulse withstand voltage	kV peak	1050	
10.1.9	Rated power frequency withstand voltage	kV rms	650	
10.1.10	Connectors			
10.1.10.1	Shape	mm	Ø 50	
10.1.10.2	Length	mm	125	
10.1.10.3	Suitable for		Al wire	
10.1.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.1.12	Full vacuum withstand of complete bushing		YES	
10.1.13	Housing		Composite SiR	
10.1.14	Test tap	Yes		
10.1.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	2 kV	
10.1.16	USCD, Unified Specific Creepage Distance	Mm/kV	53.7	
10.1.17	Creepage factor ,Cf [According to IEC 60815]		<3.2	
10.1.18	profile factor, P.F.		<1.1	
10.1.19	Min. flashover distance	mm		
10.1.20	Cantilever test load	kN		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.1.21	Housing shed type	Alternate		
10.1.22	Air Vent	Yes		
10.1.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.1.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.1.25	Total Length	mm		
10.1.26	Outer diameter	mm		
10.1.27	CT Pocket Length for BCT	mm		
10.1.28	Oil quantity [for OIP type]	kg		
10.1.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.1.30	No. of Hole			
10.1.31	Diameter of each hole			
10.1.32	Distance between hole			
10.1.33	Fixing nut-bolt Material	AL or SS		
10.1.34	Earthing holes M12	No.		
10.1.35	End-shielding		Yes	
10.1.36	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.1.37	Top Terminal Suitable for	AL		
10.1.38	dissipation factor			
10.1.39	Partial discharge			
10.1.40	Insulation Class	F/155^0 C		
10.1.41	Total Weight	kg		
10.2	**LV bushing**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2.1	Quantity		03	
10.2.2	Class	kV	245	
10.2.3	Manufacturer		ABB(Sweden, Switzerland), Trench(France/USA), HSP (Germany), GE (Italy)or equivalent	
10.2.4	Type		Insert	
10.2.5	Rated current	A	≥ 2500	
10.2.6	Rated short circuit current (3 s)	kA rms	50	
10.2.7	Rated lightning impulse withstand voltage	kV peak	1050	
10.2.8	Rated switching impulse withstand voltage	kV peak	-	
10.2.9	Rated power frequency withstand voltage	kV rms	460	
10.2.10	Connectors			
10.2.10.1	Shape	mm	Ø 50	
10.2.10.2	Length	mm	125	
10.2.10.3	Suitable for		Al wire	
10.2.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.2.12	Full vacuum withstand of complete bushing		YES	
10.2.13	Housing		Composite SiR	
10.2.14	Test tap	Yes		
10.2.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	2 kV	
10.2.16	USCD, Unified Specific Creepage Distance	Mm/kV	53.7	
10.2.17	Creepage factor ,Cf [According to IEC 60815]		<3.2	
10.2.18	profile factor, P.F.		<1.1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2.19	Min. flashover distance	mm		
10.2.20	Cantilever test load	kN		
10.2.21	Housing shed type	Alternate		
10.2.22	Air Vent	Yes		
10.2.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.2.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.2.25	Total Length	mm		
10.2.26	Outer diameter	mm		
10.2.27	CT Pocket Length for BCT	mm		
10.2.28	Oil quantity [for OIP type]	kg		
10.2.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.2.30	No. of Hole			
10.2.31	Diameter of each hole			
10.2.32	Distance between hole			
10.2.33	Fixing nut-bolt Material	AL or SS		
10.2.34	Earthing holes M12	No.		
10.2.35	End-shielding			
10.2.36	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.2.37	Top Terminal Suitable for	AL		
10.2.38	dissipation factor			
10.2.39	Partial discharge			
10.2.40	Insulation Class	F/155^0 C		
10.2.41	Total Weight	kg		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.3	**TV bushing**			
10.3.1	Quantity		03	
10.3.2	Class	kV	36	
10.3.3	Manufacturer		ABB(Sweden, Switzerland), Trench(France/USA), HSP (Germany),GE (Italy) or equivalent	
10.3.4	Type		Insert	
10.3.5	Rated current	A	≥ 2000	
10.3.6	Rated short circuit current (3 s)	kA rms	31.5	
10.3.7	Rated lightning impulse withstand voltage	kV peak	170	
10.3.8	Rated switching impulse withstand voltage	kV peak	-	
10.3.9	Rated power frequency withstand voltage	kV rms	70	
10.3.10	Connectors			
10.3.10.1	Shape	mm	Ø 50	
10.3.10.2	Length	mm	125	
10.3.10.3	Suitable for		Al wire	
10.3.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.3.12	Full vacuum withstand of complete bushing		YES	
10.3.13	Housing		Composite SiR	
10.3.14	Test tap	Yes		
10.3.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	2 kV	
10.3.16	USCD, Unified Specific Creepage Distance	Mm/kV	53.7	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.3.17	Creepage factor ,Cf [According to IEC 60815]		<3.2	
10.3.18	profile factor, P.F.		<1.1	
10.3.19	Min. flashover distance	mm		
10.3.20	Cantilever test load	kN		
10.3.21	Housing shed type	Alternate		
10.3.22	Air Vent	Yes		
10.3.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.3.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.3.25	Total Length	mm		
10.3.26	Outer diameter	mm		
10.3.27	CT Pocket Length for BCT	mm		
10.3.28	Oil quantity [for OIP type]	kg		
10.3.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.3.30	No. of Hole			
10.3.31	Diameter of each hole			
10.3.32	Distance between hole			
10.3.33	Fixing nut-bolt Material	AL or SS		
10.3.34	Earthing holes M12	No.		
10.3.35	End-shielding			
10.3.36	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.3.37	Top Terminal Suitable for	AL		
10.3.38	dissipation factor			
10.3.39	Partial discharge	pC		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.3.40	Insulation Class	F/155^0 C		
10.3.41	Total Weight	kg		
10.4	**NV bushing**			
10.4.1	Quantity		01	
10.4.2	Class	kV	72.5	
10.4.3	Manufacturer		ABB(Sweden, Switzerland), Trench(France/USA), HSP (Germany), GE (Italy)or equivalent	
10.4.4	Type		Insert	
10.4.5	Rated current	A	≥ 2000	
10.4.6	Rated short circuit current (3 s)	kA rms	50	
10.4.7	Rated lightning impulse withstand voltage	kV peak	325	
10.4.8	Rated switching impulse withstand voltage	kV peak	-	
10.4.9	Rated power frequency withstand voltage	kV rms	140	
10.4.10	Connectors			
10.4.10.1	Shape	mm	Ø 50	
10.4.10.2	Length	mm	125	
10.4.10.3	Suitable for		Al wire	
10.4.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.4.12	Full vacuum withstand of complete bushing		YES	
10.4.13	Housing		Composite SiR	
10.4.14	Test tap	Yes		
10.4.15	The max. test voltage of	at 50 Hz, kV AC	2 kV	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	the tap for 1 minute.			
10.4.16	USCD, Unified Specific Creepage Distance	Mm/kV	53.7	
10.4.17	Creepage factor ,Cf [According to IEC 60815]		<3.2	
10.4.18	profile factor, P.F.		<1.1	
10.4.19	Min. flashover distance	mm		
10.4.20	Cantilever test load			
10.4.21	Housing shed type	Alternate		
10.4.22	Air Vent	Yes		
10.4.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.4.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.4.25	Total Length	mm		
10.4.26	Outer diameter	mm		
10.4.27	CT Pocket Length for BCT	mm	600	
10.4.28	Oil quantity [for OIP type]	kg		
10.4.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.4.40	No. of Hole			
10.4.41	Diameter of each hole			
10.4.42	Distance between hole			
10.4.43	Fixing nut-bolt Material	AL or SS		
10.4.44	Earthing holes M12	No.		
10.4.45	End-shielding			
10.4.46	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.4.47	Top Terminal Suitable for	AL		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.4.48	dissipation factor			
10.4.49	Partial discharge	pC		
10.4.40	Insulation Class	F/155^0 C		
10.4.41	Total Weight	kg		
11*	**Sound**			
11.1	At No load, rated frequency, 100% rated voltage , principle tap	dB	<70	
11.2	At No load, rated frequency, 105% rated voltage, principle tap	dB		
11.3	At load, rated frequency, 100% rated voltage, principle tap	dB		
11.4	At load, rated frequency, 105% rated voltage, principle tap	dB		
11.5	Guaranteed during Testing	dB		
13	**Weights and dimensions**			
13.1	**Total weight of autotransformer, equipped for service**	kg	Insert	
13.2	Core and oil assembly	kg	Insert	
13.3	Total mass excluding oil	kg	Insert	
13.4	Tank and accessories	kg	Insert	
13.5	Oil mass in tank	kg	Insert	
13.6	Oil mass in coolers	kg	Insert	
13.7	Oil mass total	kg	Insert	
13.8	Total mass	kg	Insert	
13.9*	**Maximum shipping weight (the heaviest item)**	kg	Insert	
13.10	**Height from foundation to:**			
13.10.1	• Highest point of HV bushing	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
13.10.2	• Highest point of tank	mm	Insert	
13.10.3	• Highest point of conservator	mm	Insert	
13.10.4	• Highest point of lifting hook for removal of core and oil assembly	mm	Insert	
13.11	**Outer dimensions:**			
13.11.1	• Length	mm	Insert	
13.11.2	• Width	mm	Insert	
13.12	Informative dimensional sketch		To be enclosed with bid	
13.13*	**Maximum shipping dimensions of tank:**			
13.13.1	• Outside height	mm	Insert	
13.13.2	• Outside width	mm	Insert	
13.13.3	• Outside length	mm	Insert	
13.14	**Transportation drawing**		To be enclosed with bid	
14	**Auxiliary power supply**			
14.1	Motors		3x400 V / 50 Hz	
14.2	Heaters		230 V / 50 Hz	
14.3	Control voltage		110 V DC	
14.4	Oil pump		3x400 V / 50 Hz	
15	**Current transformer incorporated into the power autotransformer**			
15.1	CT in HV bushings, for protection, WTI and/or Tap Changer		In all phases, 3 cores characteristics shall be defined in design stage	
15.2	CT in LV bushings, for protection, WTI and/or Tap Changer		characteristics shall be characteristics shall be defined in design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
15.3	CT in neutral bushing, for protection		In all phases, 2cores characteristics shall be defined in design stage	
15.4	CT in TV bushings, for protection		In all phases, 3 cores characteristics shall be defined in design stage	
16*	**Layout**			
16.1	Primary winding bushings		Longitudinal axis	
16.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	
16.3	Conservator tank		As per spec	
16.4	Tap changer		As per spec	
16.5	Control cabinet		separate	
16.6	Coolers		Attached to Body	
16.7	Connection drawing, block diagram		To be enclosed with bid	
17	**Dehydrating breather**			
17.1	Type of dehydrating breather		Insert	
17.2	Dehumidifying agent	kg	Insert	
18	**Autotransformer tank**			
18.1	Type of design		Welded	
18.2	**Thickness of transformer tank:**			
18.2.1	• Sides	mm	Insert	
18.2.2	• Bottom	mm	Insert	
18.2.3	• Top	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
18.3	Material of the autotransformer tank		Insert	
18.4	Wheels			
18.4.1	Wheel number for each rail of two pair rails		Two pairs	
18.4.2	Axial inter space in transversal direction between two pairs of rails	mm	Insert	
18.4.3	Transversal distance between wheels in pair	mm	Insert	
18.4.4	Distance between wheels in longitudinal direction	mm	Insert	
18.5	Corrosion protection of the tank		YES	
18.6	Vacuum withstand of the complete tank with cooler	mbar	1	
18.7	Over-pressure withstand of the complete autotransformer	bar	0.3	
18.8	Painting Color	Munsell no.		
19	**Conservator**			
19.1	Type		With diaphragm	
19.2	Number of compartments	pcs.	Insert	
19.3	Total volume of conservator	m^3	Insert	
19.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	
19.5	Pressure rise inside the tank due to oil expansion		Insert	
19.5.1	• Maximum diagraph stress at highest working pressure		Insert	
19.5.2	• Diagraph construction details		Insert	
19.5.3	• Type of diagraph material		Insert	
19.6	Corrosion protection of conservator		Insert	
19.7	Oil level indicators with alarm for minimum oil level	pcs.	2	
19.8	Membrane provided inside the conservator for ‘’breathing’’ of the transformer		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
20	**Miscellaneous Item**			
20.1	AVR Relay		MR, Germany or equivalent	
20.2	Bucholtz relay, Make		insert	
20.3	Control Cable, Make		insert	
20.4	WTI [Normal & Fiber Optic]		Yes, insert number	
20.5	OTI		Yes, insert number	
20.6	Remote Transformer Panel with all accessories, Make		Yes, insert	
20.7	Marshalling Cubicle with all accessories, Make		Yes, insert	
20.8	Cooling Cabinet with all accessories, Make		Yes, insert	
20.9	Material (Cooling & Marshalling Cabinet)		Insert	
20.10.	No. of PRD in Main Tank		Min 3	
20.11	No. of PRD in OLTC		Insert	
20.12	Oil Surge Relay			
20.13	Breather		Mtrab or Eq.	
20.15	Gasket Material		Nitrile Rubber	
20.16	Nut-Bolt, Make		Insert	
20.17	Nut-Bolt, Material		SS	
20.18	LA Make		Insert	
21	**Operating conditions**			
21.1	At the altitude (above sea level)	m	≤ 1000	
21.2	Maximum ambient temperature	°C	40	
21.3	Average daily temperature	°C	35	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
21.4	Average annual temperature	°C	30	
21.5	Minimum ambient temperature	°C	4	
21.6	Tertiary winding		Simultaneously load for Reactive compensation	
21.7	Parallel operation		Yes	
	Overall compliance with the requirements (yes/no)			

1.2.4.2 230/135/34.5 kV 350/450 MVA ONAN/ONAF Autotransformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Autotransformer three-phase, oil immersed, with tertiary winding, hermetically sealed, with on-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044	
1.5.1			IEC 60076	
1.5.2			IEC 60137	
1.5.3			IEC 60214	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.5.4			IEC 60354	
1.5.5			IEC 60529	
1.5.6			IEC 60815	
1.5.7			IEC 60947	
1.5.8			NEMA TR-1	
1.5.9			CENELEC EN 50216	
1.6	Quality control		ISO 9001	
1.7	Tertiary winding function		Stabilizing winding, auxiliary power supply& Reactive compensation	
1.8	Thermal insulation class		A	
2	**Ratings and properties**			
2.1	**Rating (three phase)**		Rated power 450MVA, all taps	
2.1.1	Frequency	Hz	50	
2.1.2	Corresponding minimum Frequency	Hz	48	
2.1.3	Connection of three-phase windings (group of vector IEC 60076)		YNa0d1	
2.1.4	Neutral point insulation		LI325 AC140	
2.1.5	Voltage ratio (No Load)	kV	230/135/34.5	
2.2	**Rated power by cooling ONAN / ONAF**			
2.2.1	Primary / secondary winding	MVA	350/450	
2.2.2	Tertiary – minimum	MVA	100/150	
2.2.3	Loading Type	7.1.1	Simulatneous on HV-LV-TV, (HV/LV not derated for TV Loading)	
2.3	**Rated voltage of windings**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3.1	HV winding	kV	230	
2.3.2	LV winding	kV	135	
2.3.3	TV - stabilizing winding	kV	34.5	
2.3.4	NV - Neutral voltage	kV	72.5	
2.4	**Tap changer**			
2.4.1	Manufacturer		Insert	
2.4.2	Manufacturer		MR/ABB or equivalent	
2.4.3	Country of origin		Insert	
2.4.4	Switching technology		Vacuum	
2.4.5	Model designation		Insert	
2.4.6	Type of tap changing		On-load	
2.4.7	Electrical location of Tap winding		HV / Series Winding	
2.4.8	Geometric Location of Tap winding		[Insert]	
2.4.9	Type of voltage regulation		Constant Flux Variable Voltage (C.F.V.V.)	
2.4.10	Tapping range	% V	±10	
2.4.11	Tapping step/Size of Each tapping step	%	1.25	
2.4.12	Number of steps		17	
2.4.13	Short circuit current - time	kA-s	[Insert]	
2.4.14	Insulation level	kV	[Insert]	
2.4.15	Rated current	A	≥1600	
2.4.16	BIL to ground through the regulating coil	kV peak	Insert	
2.4.17	Power frequency withstand voltage for 1 minute through the regulating coil	kV rms	Insert	
2.4.18	Tap position indicator		Digital code matrix (BCD)	
2.4.19	Auxiliary supply		3x400 V / 230 V, 50 Hz	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.4.20	OLTC diverter switch tank		Separate from Main tank	
2.4.21	Breathing of OLTC		Separate/Shared conservator	
2.4.22	OLTC Oil guided to Radiator for cooling		No	
2.4.23	OLTC tap change principle type		Resistance/Reactance type	
2.4.24	MVA Rating of Transformer due to OLTC operation		Rated power 450MVA, all taps	
2.4.25	Rated Voltage (No. load) due to OLTC operation	kV/kV/kV	insert	
2.4.26	Percent Impedance design due to Tap Changing		Constant Impedance	
2.4.27	OLTC Drive Type		Insert	
3	**Special technical requirements**			
3.1	**Short circuit impedance corrected to reference temperature of 75°C at rated frequency and rated power**			
3.1.1	HV - LV, on the basis of rated power with on-load tap changer in middle position	%	13 ±10 %	
3.1.2	HV - TV, on the basis of rated power with on-load tap changer in middle position	%	[Insert], (Max allowable SCC at TV 31.5kArms)	
3.1.3	LV - TV, on the basis of rated power 'x' MVA with on-load tap changer in middle position	%	[Insert], (Max allowable SCC at TV 31.5kArms)	
3.2	**Zero-sequence impedance, with tap changer in middle position:**			
3.2.1	HV - LV, on the basis of rated power with on-load tap changer in middle position	%	Insert	
3.2.2	HV - TV, on the basis of rated power with on-load tap changer in middle position	%	Insert	
3.2.3	LV - TV, on the basis of rated power 'x' MVA with on-load tap changer in middle position	%	Insert	
3.2.4	X/R ratio		Insert	
3.3	**Autotransformer capacity to withstand external short circuits**			
3.3.1	Short-circuit duration	sec	2	
3.3.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period:			
3.3.3	HV winding	kA	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3.4	LV winding	kA	Insert	
3.3.5	TV winding	kA	Insert	
3.3.6	Pre-fault voltage	p.u.	1.05	
3.4	**Guaranteed losses [Simultaneous Loading at HV-LV-TV]**			
3.4.1	No-load losses with tap changer in nominal tap position at rated voltage and rated frequency	kW	Insert	
3.4.2	No-load losses with tap changer in plus (+) extreme tap position at 110 % rated voltage, at rated frequency	kW	Insert	
3.4.3	No-load losses with tap changer in minus (-) extreme tap position at 90 % rated voltage, at rated frequency	kW	Insert	
3.4.4	Average No-load losses (this value will be evaluated)	kW	(3.4.1+3.4.2+3.4.3)/3	
3.4.5	No-load losses capitalized value	BDT/kW	600000	
3.4.6	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.4.7	On-load losses at 75°C, with tap changer in nominal tap position at rated voltage and rated frequency	kW	Insert	
3.4.8	On-load losses at 75°C, with tap changer in plus (+) extreme tap position at 110 % rated voltage, at rated frequency	kW	Insert	
3.4.9	On-load losses at 75°C, with tap changer in minus (-) extreme tap position at 90 % rated voltage, at rated frequency	kW	Insert	
3.4.10	Average On-load losses at 75°C, (this value will be evaluated)	kW	(3.4.7+3.4.8+3.4.9)/3	
3.4.11	On-load losses capitalized value	BDT/kW	300000	
3.4.12	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
3.4.13	Ancillary equipment (fans, pumps, heaters, OLTC Drives etc.)			
3.4.14	Load of ancillary equipment (this value will be evaluated)	kW	Insert	
3.4.15	Capitalized valued of ancillary equipment load	BDT/kW	300000	
3.4.16	Tolerance to be applied to ancillary equipment load in % of the guaranteed value	%	20	
3.5	**Rated Insulation level**			
3.5.1	High voltage (HV)		LI 1050AC460	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5.2	Low voltage (LV)		LI 650 AC 275	
3.5.3	Tertiary voltage (TV)		LI 170 AC 70	
3.5.4	Neutral voltage (NV)		LI 325 AC 140	
3.5.5	Method of Neutral Earthing		Solid Ground	
3.6	**Efficiencies [HV-LV-TV loaded]**			
3.6.1	If cosφ = 1.0 and:			
3.6.1.1	• 25 % load of the rated value		Insert	
3.6.1.2	• 50 % load of the rated value		Insert	
3.6.1.3	• 75 % load of the rated value		Insert	
3.6.1.4	• 100 % load of the rated value		Insert	
3.6.2	If cosφ = 0.8 (inductive) and:			
3.6.2.1	• 25 % load of the rated value		Insert	
3.6.2.2	• 50 % load of the rated value		Insert	
3.6.2.3	• 75 % load of the rated value		Insert	
3.6.2.4	• 100 % load of the rated value		Insert	
3.6.3	If cosφ = 0.9 (inductive) and:			
3.6.3.1	• 25 % load of the rated value		Insert	
3.6.3.2	• 50 % load of the rated value		Insert	
3.6.3.3	• 75 % load of the rated value		Insert	
3.6.3.4	• 100 % load of the rated value		Insert	
3.7	**Voltage drop at the terminals of secondary**			
3.7.1	**Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position [HV-LV loaded]**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.7.1.1	• cosφ = 1.00		Insert	
3.7.1.2	• cosφ = 0.95 (inductive)		Insert	
3.7.1.3	• cosφ = 0.90 (inductive)		Insert	
3.7.1.4	• cosφ = 0.80 (inductive)		Insert	
3.7.2	**Voltage drop at the terminals of secondary winding at rated temperature and at the middle tap changer position [HV-LV-TV loaded, TV at 0.95 leading pf]**			
3.7.2.1	• cosφ = 1.00		Insert	
3.7.2.2	• cosφ = 0.95 (inductive)		Insert	
3.7.2.3	• cosφ = 0.90 (inductive)		Insert	
3.7.2.4	• cosφ = 0.80 (inductive)		Insert	
3.8	**No-load current at rated frequency**			
3.8.1	At 0.90 Un		Insert	
3.8.2	At 1.00 Un		Insert	
3.8.3	At 1.05 Un		Insert	
3.9	**At the emergency cases it is allowed:**	MVA	Compliant to IEC 60076-7	
	• 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 volt age)			
3.10	**Guaranteed value of overloads in % of the rated power**			
3.10.1	Normal overloads prediction which can occur once a day (in % of the rated power) within the winding temperature rise limit of 75°C			
3.10.1.1	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	• ½ rated power		Insert	
3.10.1.2	After operation under 20 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.1.3	After operation under 120 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2	Sudden transient overloads (in % of the rated power) with the winding temperature rise limit of 85°C			
3.10.2.1	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2.2	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.10.2.3	After operation under 15 min			
	• full rated power		Insert	
	• ¾ rated power		Insert	
	• ½ rated power		Insert	
3.11	**Guaranteed values of loads at ambient temperature of 40°C, without danger of exceeding the oil and winding temperature limits:**			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.11.1	• with all cooling groups in operation (excluding stand-by cooling group)		Insert	
3.11.2	• with one cooling group out of operation		Insert	
3.11.3	• with two cooling groups out of operation		Insert	
4	**Design & Construction**			
4.1*	**Cooling system**			
4.1.1	**Oil Flow through Windings/ windings group**			
4.1.1.1	Guided Oil Flow inside transformer	Yes/No.	Yes	
4.1.1.2	Pattern of Oil Flow through Duct	Axial/Zig-Zag	[Insert]	
4.1.2	**Pressure drop in side transformer**			
4.1.2.1	Radial Locations with respect to core	bar	[Insert]	
4.1.2.2	Axial Locations with respect to core	bar	[Insert]	
4.1.3	**Radiators & Coolers**			
4.1.3.1	Radiator Location		A	
	Attached to Tank or Separate		Attached to Tank	
4.1.3.2	Number of cooling groups (total)	Qty.	Insert	
	Number of cooling groups (for rated power)	Qty.	Insert	
	Number of stand-by cooling groups	Qty.	Insert	
	Number of coolers in a cooling group	Qty.	Insert	
	Number of spare fans	Qty.	Insert	
	Rating of each cooler	kW	Insert	
4.1.3.3	Full vacuum withstand of complete cooler	mbar	Yes	
4.1.4	**HV side**			
4.1.4.1	No. of Radiator Bank	No.	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1.4.2	No. of Fins/Plates in each Radiator	No.	[Insert]	
4.1.4.3	No. of Cooler Fans	No.	[Insert]	
4.1.4.4	No. of group of Cooler Fan	No.	[Insert]	
4.1.4.5	Spare Fans in each group	No.	[Insert]	
4.1.4.6	No. of Blower/Motor Driving a Fan	No.	1	
4.1.4.7	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	
4.1.4.8	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	
4.1.4.9	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	
4.1.4.10	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
4.1.4.11	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
4.1.4.12	No. of Pipes collecting Hot Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.1.4.13	No. of Pipes collecting Cold Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.1.5	**LV side**			
4.1.5.1	No. of Radiator Bank	No.	[Insert]	
4.1.5.2	No. of Fins/Plates in each Radiator	No.	[Insert]	
4.1.5.3	No. of Cooler Fans	No.	[Insert]	
4.1.5.4	No. of group of Cooler Fan	No.	[Insert]	
4.1.5.5	Spare Fans in each group	No.	[Insert]	
4.1.5.6	No. of Blower/Motor Driving a Fan	No.	1	
4.1.5.7	Mounting of Fan in the radiator-HV side	Vertical/ Horizontal	[Insert]	
4.1.5.8	No. of Plates/Fins covered by single cooler, thus, AF Cooling	No.	[Insert]	
4.1.5.9	No. of Plates/Fins Not covered by single cooler, thus, AN Cooling	No.	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.1.5.10	No. of Pipes going out from Main Tank to Radiator Bank at Tank upper part (i.e. Hot Oil Pipes)	No.	[Insert]	
4.1.5.11	No. of Pipes Coming in from Radiator Bank to Tank at Main Tank Lower part (i.e. Cold Oil Pipes)	No.	[Insert]	
4.1.5.12	No. of Pipes collecting Hot Oil	No.	[Insert] (spare n+1, shall be considered)	
4.1.5.13	No. of Pipes collecting Cold Oil	No.	[Insert] (spare , n+1,shall be considered)	
4.2*	**Oil Flow rate**			
4.2.1	**Oil Flow rate inside Transformer during ONAN Cooling**			
4.2.1.1	Highest Flow rate (Approx.)	m/s	[Insert]	
4.2.1.2	Location at Transformer		[Insert]	
4.2.1.3	Lowest Flow rate (Approx.)	m/s	[Insert]	
4.2.1.4	Location at Transformer		[Insert]	
4.2.1.5	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
4.2.2	**Oil Flow rate inside Transformer during ONAF Cooling**			
4.2.2.1	Highest Flow rate (Approx.)	m/s	[Insert]	
4.2.2.2	Location at Transformer		[Insert]	
4.2.2.3	Lowest Flow rate (Approx.)	m/s	[Insert]	
4.2.2.4	Location at Transformer		[Insert]	
4.2.2.5	Flow rate optimized to stop induced vibration at Core, Winding	Yes/No	Yes	
4.2.3	**Predicted Hot Spot Location**			
4.2.3.1	HV Side		Insert	
4.2.3.2	LV side		Insert	
4.2.3.3	TV side		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.2.3.4	Temperature Difference (D-Temp) between Inlet & Outlet of Radiator banks --- Design value	^{0}C	[Insert]	
4.3	**Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap**			
4.3.1	Average Oil Temperature rise	^{0}C		
4.3.2	Top oil	°C	≤ 50	
4.3.3	Winding	°C	≤ 55	
4.3.4	Hottest spot	°C	≤ 65	
4.3.5	Winding temperature rise at CMR under service conditions stated in Schedule of Technical Requirement	^{0}C	65	
4.3.6	Maximum hot spot temperature rises in core at rated power	^{0}C	78	
4.3.7	Internal Hot-spot Temperature (Amb. Temp. + Top oil rise + Core hot spot)	^{0}C	130	
4.3.8	Surface Temperature (Amb. Temp. + Top oil rise + Core surface temp.)	^{0}C	Insert	
4.3.9	Temperature gradient at rating specified			
4.3.10*	**Temperature rise of metallic parts**			
4.3.10.1	Tank walls	^{0}C		
4.3.10.2	Tie plate	^{0}C		
4.3.10.3	Top clamp	^{0}C		
4.3.10.4	Bottom clamp	^{0}C		
4.4	**Core Construction**			
4.4.1	Type of Transformer Core (Shell or Core)		Core	
4.4.2	No. of Core Limb		insert	
4.4.3	Core Material		CRGO Si steel, Hi-B	
4.4.4	Grade Designation		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4.5	Core Graining Method		Laser-beam or plasma jet irradiation	
4.4.6	Thickness of Sheet	mm		
4.4.7	Specific Loss at 1.7T,50Hz	W/kg	<0.85	
4.4.8	Insulation material & Class			
4.4.9	Safe Working Temperature of Core	^{0}C		
4.4.10	Whether step lap construction adopted		Yes	
4.4.11	Whether boltless construction adopted		Yes	
4.4.12	Core Material Make , Country		Insert	
4.4.13	Whether Core is pre-cut or cut at Factory		Insert	
	Method of joining of legs		Insert	
	Method of joining of yokes		Insert	
	Joining material		Insert	
4.4.14	Flux density at nominal voltage and frequency and at nominalratio - (no load)			
4.4.15	Cores	T		
4.4.16	Yokes	T		
4.4.17	Volts/turn	V		
4.4.18	Over flux withstand capability of theTransformer [flux density & time]	T, Min or s		
4.4.19	Continuously 10% over voltage andfrequency and at principal tap	T, Min or s		
4.4.20	at 125% of rated Voltage	T, Min or s		
4.4.21	at 140% of rated Voltage	T, Min or s		
4.4.22	at 150% of rated Voltage	T, Min or s		
4.4.23	Magnetizing current (approx) at nominal ratio and			
4.4.23.1	at 0.90 x nominal voltage	% of FLA		
4.4.23.2	at 0.95 x nominal voltage	% of FLA		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4.23.3	at 1 .0 x nominal voltage	% of FLA		
4.4.23.4	at 1 .05 x nominal voltage	% of FLA		
4.4.23.5	at 1 .1 x nominal voltage	% of FLA		
4.4.24	Power factor of magnetizing current at normal voltage ratio and frequency			
4.4.25	Oil Ducts among cores		Yes	
4.5	**Winding Construction**			
4.5.1	Materials of winding		Copper	
4.5.2	Make, country			
4.5.3	Conductor Used		CTC/others	
4.5.3.1	HV		[Insert]	
4.5.3.2	RV/ tap Winding			
4.5.3.3	LV		[Insert]	
4.5.3.4	TV		[Insert]	
4.5.4*	**Type of Conductor Used**			
4.5.4.1	HV		Cu - 'Interleaved'Disc	
4.5.4.2	RV/ tap Winding		Insert	
4.5.4.3	LV		Cu - Interleaved / disc-transposed, cured in epoxy coating	
4.5.4.4	TV		Helical/Disk [Cu - transposed, cured in epoxy coating]	
4.5.5	**Current density, Thermal**			
4.5.5.1	HV	A/mm^2	[Insert]	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.5.5.2	RV/ tap Winding	A/mm^2	[Insert]	
4.5.5.3	LV	A/mm^2	[Insert]	
4.5.5.4	TV	A/mm^2	[Insert]	
4.5.6	**Current Density, Short circuit**			
4.5.6.1	HV	A/mm^2	[Insert]	
4.5.6.2	RV/ tap Winding	A/mm^2	[Insert]	
4.5.6.3	LV	A/mm^2	[Insert]	
4.5.6.4	TV	A/mm^2	[Insert]	
4.5.7	Insulations at windings		Thermally Upgraded Paper	
4.5.7.1	Insulation Class		A	
4.5.7.2	Insulation Make, Country		[Insert]	
4.5.7.3	Additional Insulations as Protection caps at windings			
4.5.7.4	HV	Yes/No		
4.5.7.5	LV	Yes/No		
4.5.7.6	TV	Yes/No		
4.5.8	Oil Ducts among windings		Yes	
4.5.9	Material of Pressboard		[Insert]	
4.5.10	Key Spacer		[Insert]	
4.5.11	**Resistance /phase [Design Value with Tolerance]**			
4.5.11.1	HV	Ω	[Insert]	
4.5.11.2	LV	Ω	[Insert]	
4.5.11.3	TV	Ω	[Insert]	
4.5.12	Connection of three-phase windings (vector group IEC 60076)		YNa0d1	
4.5.13	Tertiary winding connection (TV)		Delta made inside the tank, with three	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
			terminals brought out outside of the tank	
4.5.14	Geometric Location of windings with respect to core			
4.5.14.1	TW		[Insert]	
4.5.14.2	LW/ common winding		[Insert]	
4.5.14.3	HV/ series winding		[Insert]	
4.5.14.4	RW		[Insert]	
4.5.14.5	Winding Method		(Hor/Ver.)[Insert]	
4.5.15	**Winding connections [crimped, Brazed or others]**			
4.5.15.1	Between Windings		[Insert]	
4.5.15.2	Between Winding Layers/Disk		[Insert]	
4.5.15.3	Between Main Winding & Tap Winding		[Insert]	
4.5.15.4	Between Windings & Leads		[Insert]	
4.5.15.5	Clamping of Winding		[Insert]	
4.5.15.6	The individual winding sets clamped separately from each other and separately from the core.		Yes	
4.5.15.7	Acceptable Tangent delta of winding		Insert	
4.5.15.8	Acceptable PD level	pC		
4.6*	**Curing of Active Part**			
4.6.1	Highest temperature	^{0}C		
4.6.2	Duration	Hrs		
4.6.3	Average temperature	^{0}C		
4.6.4	Duration	Hrs		
4.6.5	Total duration	Hrs		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.6.6	**Active Part Compression during Pressure, (approx)**	mm		
4.7	**Winding clamping for Short circuit**	Insert		
5	**Short Circuit**			
5.1	Current through windings for Terminal Fault			
5.1.1	HV	kArms		
5.1.2	LV	kArms		
5.1.3	TV	kArms		
5.1.4	Peak Factor		2.69	
5.2	Pre-fault voltage	p.u.	1.05	
5.3	Withstand Duration	s	2	
5.4	Similar Design Transformer (as per IEC 60076-5, Annex A) type test reference			
5.4.1	Testing Authority		STL Lab, insert Name	
5.4.2	certificate reference			
5.4.3	Contact address of test Lab			
5.4.4	Validity of test certificate			
5.5	Force [Shall be based on Highest SCC among LLG, LL, LLL, LG at each side-HV/LV/TV] of offered TR			
5. 5.1	Axial Force [CW/SW/RW/TW]	kN		
5. 5.2	Free Buckling Force [CW/SW/RW/TW]	kN		
5.5.3	Compression Force [CW/SW/RW/TW]	kN		
5. 5.4	Designed Safety Margin [CW/SW/RW/TW]			
a	For indivisual winding clamping		> 1.4	
b	For other design		>2	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5. 5.5	Offered & Reference Similar Type testedDesign transformer Short Circuit Force relationship		Within 110%	
5.6	Temperature during SC			
5. 6.1	HV Winding [Actual/Allowable]	^{0}C		
5. 6.2	LV Winding [Actual/Allowable]	^{0}C		
5. 6.3	RV Winding [Actual/Allowable]	^{0}C		
5.6.4	TV Winding [Actual/Allowable]	^{0}C		
5.7	Maximum Circulating Current in Delta tertiary for L-G fault at TV terminal	kA		
5.7.1	Winding withstand capacity of this current	Min or s		
6*	**Dielectric Design**			
6.1	Impulse Voltage At HV (LI)	kVp		
6.1.1	Maximum applied voltage at critical points	kVp		
6.1.2	Permissible Voltage	kVp		
6.1.3	Safety Factor		>2	
6.1.4	Transferred surge at LV	kVp		
6.1.5	Transferred surge at TV	kVp		
6.1.6	ZnO Block to limit distributed impulse [tap Winding/other]		At Design stage	
6.2	Impulse Voltage At HV (SI)			
6.2.1	Maximum applied voltage at critical points	kVp		
6.2.2	Permissible Voltage	kVp		
6.2.3	Safety Factor		>2	
6.2.4	Transferred surge at LV	kVp		
6.2.5	Transferred surge at TV	kVp		
6.2.6	ZnO Block to limit distributed impulse [tap Winding/other]		At Design stage	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
6.3	Impulse Voltage At LV (LI)			
6.3.1	Maximum applied voltage at critical points	kVp		
6.3.2	Permissible Voltage	kVp		
6.3.3	Safety Factor		>2	
6.3.4	Transferred surge at HV	kVp		
6.3.5	Transferred surge at TV	kVp		
6.3.6	ZnO Block to limit distributed impulse		At Design stage	
6.4	**Impulse Voltage at TV (LI)**			
6.4.1	Maximum applied voltage at critical points	kVp		
6.4.2	Permissible Voltage	kVp		
6.4.3	Safety Factor		>2	
6.4.4	Transferred surge at HV	kVp		
6.4.5	Transferred surge at LV	kVp		
6.4.6	ZnO Block to limit distributed impulse		No.	
7*	**Earthing**			
7.1	Neutral [with double connection], with copper conductor	sqmm		
7.2	Core , taken out			
7.3	Clamp			
7.4	Tank Body			
7.5	Cubicles			
7.6	Radiators, if separately mount /connected		NA	
7.7	Others			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8*	**Valves & Manholes**			
8.1	Type of valves used			
8.2	Valve schedule attached		Yes	
8.3	Spare Manhole for inspection & future use		Yes, insert number & size	
9*	**Oil for Transformer & Tap-Changer**			
9.1	Manufacturer, country		Insert	
9.2	Type		Insert	
9.3	Standard		IEC 60296	
9.4	Minimum flash point	°C	>140	
9.5	Viscosity at 40°C	mm^2/s	Max 8	
9.5.1	Viscosity at -30°C	mm^2/s	Max 800	
9.6	Maximum dielectric strength before / after treatment	kV (at 2.5cm)	60/70	
9.7	Total sulphur content	%	<0.01	
9.8	Corrosive Sulphur		No	
9.9	PCB content		Without PCB	
9.10	Water Content	mg/kg	<20	
9.11	DDF at 90°C [IEC 60247]		<0.001	
9.12	Density at 20°C	Kg/dm^3	>0.7	
9.13	Stray gassing under thermooxidative stress			
	Hydrogen	µL/L	<5	
	Methane/Ethane		<1	
9.14	Sludge	wt %	<0.01	
9.15	Antioxidants	wt %	<0.24	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
9.16	Total acidity [IEC 61125]	mg KOH/g	<0.05	
9.17	Data sheet attached		Yes	
10	**Bushing**		IEC60137	
10.1	**HV bushing**			
10.1.1	Quantity		03	
10.1.2	Class	kV	245/1050/460	
10.1.3	Manufacturer		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy) or equivalent	
10.1.4	Type		Insert	
10.1.5	Rated current	A	≥ 1600	
10.1.6	Rated short circuit current (3 s)	kA rms	50	
10.1.7	Rated lightning impulse withstand voltage	kV peak	1425	
10.1.8	Rated switching impulse withstand voltage	kV peak	1050	
10.1.9	Rated power frequency withstand voltage	kV rms	650	
10.1.10	Connectors			
10.1.10.1	Shape	mm	insert	
10.1.10.2	Length	mm	insert	
10.1.10.3	Suitable for		Al wire	
10.1.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.1.12	Full vacuum withstand of complete bushing		YES	
10.1.13	Housing		Composite SiR	
10.1.14	Test tap	Yes		
10.1.15	The max. test voltage of	at 50 Hz, kV AC	insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	the tap for 1 minute.			
10.1.16	USCD, Unified Specific Creepage Distance	Mm/kV	insert	
10.1.17	Creepage factor ,Cf [According to IEC 60815]		insert	
10.1.18	profile factor, P.F.		insert	
10.1.19	Min. flashover distance	mm		
10.1.20	Cantilever test load	kN		
10.1.21	Housing shed type	Alternate		
10.1.22	Air Vent	Yes		
10.1.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.1.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.1.25	Total Length	mm		
10.1.26	Outer diameter	mm		
10.1.27	CT Pocket Length for BCT	mm		
10.1.28	Oil quantity [for OIP type]	kg		
10.1.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.1.30	No. of Hole			
10.1.31	Diameter of each hole			
10.1.32	Distance between hole			
10.1.33	Fixing nut-bolt Material	AL or SS		
10.1.34	Earthing holes M12	No.		
10.1.35	End-shielding			
10.1.36	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.1.37	Top Terminal Suitable for	AL		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.1.38	dissipation factor			
10.1.39	Partial discharge			
10.1.40	Insulation Class	F/155^0 C		
10.1.41	Total Weight	kg		
10.2	**LV bushing**			
10.2.1	Quantity		03	
10.2.2	Class	kV	145	
10.2.3	Manufacturer		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy) or equivalent	
10.2.4	Type		Insert	
10.2.5	Rated current	A	≥ 2500	
10.2.6	Rated short circuit current (3 s)	kA rms	50	
10.2.7	Rated lightning impulse withstand voltage	kV peak	650	
10.2.8	Rated switching impulse withstand voltage	kV peak	-	
10.2.9	Rated power frequency withstand voltage	kV rms	275	
10.2.10	Connectors			
10.2.10.1	Shape	mm	insert	
10.2.10.2	Length	mm	insert	
10.2.10.3	Suitable for		Al wire	
10.2.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.2.12	Full vacuum withstand of complete bushing		YES	
10.2.13	Housing		Composite SiR	
10.2.14	Test tap	Yes		

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	insert	
10.2.16	USCD, Unified Specific Creepage Distance	Mm/kV	insert	
10.2.17	Creepage factor ,Cf [According to IEC 60815]		insert	
10.2.18	profile factor, P.F.		insert	
10.2.19	Min. flashover distance	mm		
10.2.20	Cantilever test load			
10.2.21	Housing shed type	Alternate		
10.2.22	Air Vent	Yes		
10.2.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.2.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.2.25	Total Length	mm		
10.2.26	Outer diameter	mm		
10.2.27	CT Pocket Length for BCT	mm		
10.2.28	Oil quantity [for OIP type]	kg		
10.2.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.2.30	No. of Hole			
10.2.31	Diameter of each hole			
10.2.32	Distance between hole			
10.2.33	Fixing nut-bolt Material	AL or SS		
10.2.34	Earthing holes M12	No.		
10.2.35	End-shielding			
10.2.36	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.2.37	Top Terminal Suitable for	AL		
10.2.38	dissipation factor			
10.2.39	Partial discharge			
10.2.40	Insulation Class	F/155^0 C		
10.2.41	Total Weight	kg		
10.3	**TV bushing**			
10.3.1	Quantity		03	
10.3.2	Class	kV	36	
10.3.3	Manufacturer		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy) or equivalent	
10.3.4	Type		Insert	
10.3.5	Rated current	A	≥ 2000	
10.3.6	Rated short circuit current (3 s)	kA rms	31.5	
10.3.7	Rated lightning impulse withstand voltage	kV peak	170	
10.3.8	Rated switching impulse withstand voltage	kV peak	-	
10.3.9	Rated power frequency withstand voltage	kV rms	70	
10.3.10	Connectors			
10.3.10.1	Shape	mm	insert	
10.3.10.2	Length	mm	insert	
10.3.10.3	Suitable for		Al wire	
10.3.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.3.12	Full vacuum withstand of complete bushing		YES	
10.3.13	Housing		Composite SiR	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.3.14	Test tap	Yes		
10.3.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	insert	
10.3.16	USCD, Unified Specific Creepage Distance	Mm/kV	insert	
10.3.17	Creepage factor ,Cf [According to IEC 60815]		insert	
10.3.18	profile factor, P.F.		insert	
10.3.19	Min. flashover distance	mm		
10.3.20	Cantilever test load			
10.3.21	Housing shed type	Alternate		
10.3.22	Air Vent	Yes		
10.3.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.3.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.3.25	Total Length	mm		
10.3.26	Outer diameter	mm		
10.3.27	CT Pocket Length for BCT	mm		
10.3.28	Oil quantity [for OIP type]	kg		
10.3.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.3.30	No. of Hole			
10.3.31	Diameter of each hole			
10.3.32	Distance between hole			
10.3.33	Fixing nut-bolt Material	AL or SS		
10.3.34	Earthing holes M12	No.		
10.3.35	End-shielding			
10.3.36	Al-casted head [with oil expansion chamber and oil level			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Indicator--- for OIP]			
10.3.37	Top Terminal Suitable for	AL		
10.3.38	dissipation factor			
10.3.39	Partial discharge			
10.3.40	Insulation Class	F/155^0 C		
10.3.41	Total Weight	kg		
10.4	**NV bushing**			
10.4.1	Quantity		01	
10.4.2	Class	kV	72.5	
10.4.4	Manufacturer		ABB (Sweden/ Switzerland), Trench (France/USA), HSP (Germany), GE (Italy) or equivalent	
10.4.4	Type		Insert	
10.4.5	Rated current	A	≥ 2000	
10.4.6	Rated short circuit current (3 s)	kA rms	50	
10.4.7	Rated lightning impulse withstand voltage	kV peak	325	
10.4.8	Rated switching impulse withstand voltage	kV peak	-	
10.4.9	Rated power frequency withstand voltage	kV rms	140	
10.4.10	Connectors			
10.4.10.1	Shape	mm	insert	
10.4.10.2	Length	mm	insert	
10.4.10.3	Suitable for		Al wire	
10.4.11	Minimum creepage distance	mm/kV	≥ 31 mm/kV	
10.4.12	Full vacuum withstand of complete bushing		YES	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.4.13	Housing		Composite SiR	
10.4.14	Test tap	Yes		
10.4.15	The max. test voltage of the tap for 1 minute.	at 50 Hz, kV AC	insert	
10.4.16	USCD, Unified Specific Creepage Distance	Mm/kV	insert	
10.4.17	Creepage factor ,Cf [According to IEC 60815]		insert	
10.4.18	profile factor, P.F.		insert	
10.4.19	Min. flashover distance	mm		
10.4.20	Cantilever test load	kN	insert	
10.4.21	Housing shed type	Alternate		
10.4.22	Air Vent	Yes		
10.4.23	Allowable mounting angle [with Vertical]	^{0} [deg]		
10.4.24	Mounted Angle [with Vertical] in this transformer	^{0} [deg]		
10.4.25	Total Length	mm		
10.4.26	Outer diameter	mm		
10.4.27	CT Pocket Length for BCT	mm		
10.4.28	Oil quantity [for OIP type]	kg		
10.4.29	Mounting Flange made of corrosion free aluminum alloy	Yes		
10.4.40	No. of Hole			
10.4.41	Diameter of each hole			
10.4.42	Distance between hole			
10.4.43	Fixing nut-bolt Material	AL or SS		
10.4.44	Earthing holes M12	No.		
10.4.45	End-shielding			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.4.46	Al-casted head [with oil expansion chamber and oil level Indicator--- for OIP]			
10.4.47	Top Terminal Suitable for	AL		
10.4.48	dissipation factor			
10.4.49	Partial discharge			
10.4.40	Insulation Class	F/155^0 C		
10.4.41	Total Weight	kg		
11*	**Sound & RIV**			
11.1	At No load, rated frequency , 100% rated voltage	dB		
11.2	At No load, rated frequency, 105% rated voltage	dB		
11.5	Guaranteed during Testing	dB		
11.6	Audible noise level (acc. to NEMA TR1), at 105 % of rated voltage, at maximum power and with complete cooling system in service	dB	70	
11.7	Radio Interference Voltage at 0.5 MHz as specified in IEC 60694	µV	2500 max	
13	**Weights and dimensions**			
13.1	Total weight of autotransformer, equipped for service	kg	Insert	
13.2	Core and oil assembly	kg	Insert	
13.3	Total mass excluding oil	kg	Insert	
13.4	Tank and accessories	kg	Insert	
13.5	Oil mass in tank	kg	Insert	
13.6	Oil mass in coolers	kg	Insert	
13.7	Oil mass total	kg	Insert	
13.8	Total mass	kg	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
13.9*	Maximum shipping weight (the heaviest item)	kg	Insert	
13.10	Height from foundation to:			
13.10.1	• Highest point of HV bushing	mm	Insert	
13.10.2	• Highest point of tank	mm	Insert	
13.10.3	• Highest point of conservator	mm	Insert	
13.10.4	• Highest point of lifting hook for removal of core and oil assembly	mm	Insert	
13.11	Outer dimensions:			
13.11.1	• Length	mm	Insert	
13.11.2	• Width	mm	Insert	
13.12	Informative dimensional sketch		To be enclosed with bid	
13.13*	Maximum shipping dimensions of tank:			
13.13.1	• Outside height	mm	Insert	
13.13.2	• Outside width	mm	Insert	
13.13.3	• Outside length	mm	Insert	
13.14	Transportation drawing		To be enclosed with bid	
14	**Auxiliary power supply**			
14.1	Motors		3x400 V / 50 Hz	
14.2	Heaters		230 V / 50 Hz	
14.3	Control voltage		110 V DC	
14.4	Oil pump		3x400 V / 50 Hz	
15	**Current transformer incorporated into the power autotransformer**			
15.1	CT in HV bushings, for protection, WTI and/or Tap Changer		In all phases, 3 cores characteristics shall	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
			be defined in design stage	
15.2	CT in LV bushings, for protection, WTI and/or Tap Changer		characteristics shall be characteristics shall be defined in design stage	
15.3	CT in neutral bushing, for protection		In all phases, 2cores characteristics shall be defined in design stage	
15.4	CT in TV bushings, for protection		In all phases, 3 cores characteristics shall be defined in design stage	
16*	**Layout**			
16.1	Primary winding bushings		Longitudinal axis	
16.2	Secondary winding bushings		Longitudinal axis (opposite to HV)	
16.3	Conservator tank		As per spec	
16.4	Tap changer		As per spec	
16.5	Control cabinet		Seperate	
16.6	Coolers		Attached to tank	
16.7	Connection drawing, block diagram		To be enclosed with bid	
17	**Dehydrating breather**			
17.1	Type of dehydrating breather		Insert	
17.2	Dehumidifying agent	kg	Insert	
18	**Autotransformer tank**			
18.1	Type of design			
18.2	Thickness of transformer tank:			
18.2.1	• Sides	mm	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
18.2.2	• Bottom	mm	Insert	
18.2.3	• Top	mm	Insert	
18.3	Material of the autotransformer tank		Insert	
18.4	Wheels			
18.4.1	Wheel number for each rail of two pair rails		Two pairs	
18.4.2	Axial inter space in transversal direction between two pairs of rails	mm	4520	
18.4.3	Transversal distance between wheels in pair	mm	1435	
18.4.4	Distance between wheels in longitudinal direction	mm	1435	
18.5	Corrosion protection of the tank		YES	
18.6	Vacuum withstand of the complete tank with cooler	mbar	1	
18.7	Over-pressure withstand of the complete autotransformer	bar	0.3	
18.8	Painting Color	Munsell no.		
19	**Conservator**			
19.1	Type		With diaphragm	
19.2	Number of compartments	pcs.	Insert	
19.3	Total volume of conservator	m^3	Insert	
19.4	Minimum volume of conservator between highest and lowest levels as percentage of total cold oil at 0°C of the volume of autotransformer	%	Insert	
19.5	**Pressure rise inside the tank due to oil expansion Diagraph design parameters:**		Insert	
19.5.1	• Maximum diagraph stress at highest working pressure		Insert	
19.5.2	• Diagraph construction details		Insert	
19.5.3	• Type of diagraph material		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
19.6	Corrosion protection of conservator		Insert	
19.7	Oil level indicators with alarm for minimum oil level	pcs.	2	
19.8	Membrane provided inside the conservator for ‘‘breathing’’ of the transformer		Yes	
20	**Miscellaneous Item**			
20.1	AVR Relay		MR, Germany or equivalent	
20.2	Bucholtz relay, Make		insert	
20.3	Control Cable , Make		insert	
20.4	WTI [Normal &Fiber Optic]		Yes, insert number	
20.5	OTI		Yes, insert number	
20.6	Remote Transformer Panel with all accessories, Make		Yes, insert	
20.7	Marshalling Cubicle with all accessories, Make		Yes, insert	
20.8	Cooling Cabinet with all accessories, Make		Yes, insert	
20.9	Material (Cooling & Marshalling Cabinet)		Insert	
20.10.	No. of PRD in Main Tank		Min 3	
20.11	No. of PRD in OLTC		Insert	
20.12	Oil Surge Relay			
20.13	Breather		Mtrab or equivalent	
20.14	Gasket Material		Nitrile Rubber	
20.15	Nut-Bolt, Make		Insert	
20.16	Nut-Bolt, Material		SS	
20.17	LA Make		Insert	
20.18				

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
21	**Operating conditions**			
21.1	At the altitude (above sea level)	m	≤ 1000	
21.2	Maximum ambient temperature	°C	40	
21.3	Average daily temperature	°C	35	
21.4	Average annual temperature	°C	30	
21.5	Minimum ambient temperature	°C	4	
21.6	Tertiary winding		Reactive Compensation	
21.7	Parallel operation		Yes	
	Overall compliance with the requirements (yes/no)			

1.2.4.3 33/0.415 kV 700 kVA, ZNyn11, Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Distribution transformer three-phase, Oil immersed , two windings, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.6	Quality control		ISO 9001	
2	**Ratings and properties**			
2.1	Rated power:	kVA	700	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage	kV/V	33 ± 2 x 2,5 % / 415	
2.4	Percent Impedance	%	5	
2.5	Tap changer:			
	• Type of tap changing		Off-load	
	• Tapping range	%	±5	
	• Tapping step	%	2.5	
	• Rating		Rated power 700 kVA, all Taps	
2.6	Frequency	Hz	50	
2.7	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 [Three phase Fault]			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period:			
	• HV winding	kA	Infinite	
	• LV winding	kA	Infinite	
3.1.3	Percent Impedance for above	%	5	
3.2	Power transformer capacity to withstand external short circuits [Single phase Fault at HV]			
3.2.1	Short-circuit duration	s	3	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.2	Neutral current			
	• HV side	A	>2000	
	• LV side	A	Insert	
3.2.3	HV side Zero sequence Impedance for above	ohm	Insert	
3.2	Guaranteed losses			
3.2.1	Average No-load losses with tap changer in normal/high/low 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	Average On-load losses at 75°C, at rated voltage and rated **frequency, with tap changer in normal/high/low 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-AC3	
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	°C	≤ 60	
3.5.2	Winding	°C	≤ 65	
3.5.3	Hottest spot	°C	≤ 68	
4	**Oil**			
4.1	New		Insert	
4.2	Manufacturer		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm^2/s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	**Bushing**			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36/170/70	
5.1.3	Manufacturer		Insert	
5.1.4	Type		OIP/Porcelain	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 630	
5.1.7	Rated Short Circuit Current	kA,2s	25	
5.1.8	Minimum creepage distance (31 mm/kV)	mm/kV	≥ 31 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		OIP/Porcelain	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥ 1000	
5.2.7	Rated Short Circuit Current	kA,3s	15	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.8	Minimum creepage distance (31 mm/kV)	mm/kV	≥ 31 mm/kV	
6	**Weights and dimensions**			
6.1	Total weight of transformer, ready for service	kg	Insert	
6.2	Outer dimensions:			
	• Length	mm	Insert	
	• Width	mm	Insert	
6.3	Informative dimensional sketch		To be enclosed with bid	
7	**Dehydrating breather**			
7.1	Type of dehydrating breather		Insert	
7.2	Dehumidifying agent	kg	Insert	
8	**Conservator**			
8.1	Type		With dehydrating breather	
8.2	Number of compartments	pcs.	1	
8.3	Oil level indicators with alarm for minimum oil level	pcs.	1	
9	**Operating conditions**			
9.1	At the altitude (above sea level)	m	≤ 1000	
9.2	Maximum ambient temperature	°C	40	
9.3	Average daily temperature	°C	35	
9.4	Average annual temperature	°C	30	
9.5	Minimum ambient temperature	°C	4	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.4.4 33/0.415 kV 500 kVA, ZNyn11, Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General**			
1.1	Manufacturer		Insert	
1.2	Type		Distribution transformer three-phase, Oil immersed , two windings, with off-load tap changer, outdoor	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60076	
1.6	Quality control		ISO 9001	
2	**Ratings and properties**			
2.1	Rated power:	kVA	500	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage	kV/V	33 ± 2 x 2,5 % / 415	
2.4	Percent Impedance			
2.5	Tap changer:			
	• Type of tap changing		Off-load	
	• Tapping range	%	±5	
	• Tapping step	%	2.5	
	• Rating		Rated power 500 kVA, all taps	
2.6	Raed Frequency	Hz	50	
2.7	Connection of three-phase windings (group of vector IEC 60076)		Znyn11	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3	**Special technical requirements**			
3.1	Power transformer capacity to withstand external short circuits [Three phase Fault]			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit with-stand capacity and asymmetrical short-circuit withstand capacity during indicated period:			
	• HV winding	kA	31.5	
	• LV winding	kA	16	
3.1.3	Percent Impedance for above	%	5	
3.2	Power transformer capacity to withstand external short circuits [Single phase Fault at HV]			
3.2.1	Short-circuit duration	s	3	
3.2.2	Neutral current			
	• HV side	A	>1000	
	• LV side	A	Insert	
3.2.3	HV side Zero sequence Impedance for above	ohm	Insert	
3.2	Guaranteed losses			
3.2.1	Average No-load losses with tap changer in normal/high/low 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	Average On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal/high/low 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-AC3	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.5	Temperature rise limits, at rated power, with complete cooling system in service and at lowest voltage tap			
3.5.1	Top oil	K	≤ 60	
3.5.2	Winding	K	≤ 65	
3.5.3	Hottest spot	K	≤ 68	
4	**Oil**		**NA**	
4.1	New		Yes	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	>135	
4.6	Viscosity at 20°C	mm^2/s	Insert	
4.7	Minimum dielectric strength	kV/cm	Insert	
5	**Bushing**			
5.1	MV bushing (36 kV)			
5.1.1	Quantity		3 + 1	
5.1.2	Class	kV	36/170/70	
5.1.3	Manufacturer		Insert	
5.1.4	Type		OIP/Porcelain	
5.1.5	Model		Insert	
5.1.6	Rated current	A	≥ 630	
5.1.7	Rated Short Circuit Current	kA,1s	31.5	
5.1.8	Minimum creepage distance (31 mm/kV)	mm/kV	≥ 31 mm/kV	
5.2	LV bushings (3 kV)			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		OIP/Porcelain	
5.2.5	Model		Insert	
5.2.6	Rated current	A	≥800	
5.2.7	Rated Short Circuit Current	kA,3s	16	
5.2.7	Minimum creepage distance (31 mm/kV)	mm/kV	≥ 31 mm/kV	
6	**Weights and dimensions**			
6.1	Total weight of transformer, ready for service	kg	Insert	
6.2	Outer dimensions:			
	• Length	mm	Insert	
	• Width	mm	Insert	
6.3	Informative dimensional sketch		To be enclosed with bid	
7	**Dehydrating breather**			
7.1	Type of dehydrating breather		Insert	
7.2	Dehumidifying agent	kg	Insert	
8	**Conservator**			
8.1	Type		With dehydrating breather	
8.2	Number of compartments	pcs.	1	
8.3	Oil level indicators with alarm for minimum oil level	pcs.	1	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
9	**Operating conditions**			
9.1	At the altitude (above sea level)	m	≤ 1000	
9.2	Maximum ambient temperature	°C	40	
9.3	Average daily temperature	°C	35	
9.4	Average annual temperature	°C	30	
9.5	Minimum ambient temperature	°C	4	
	Overall compliance with the requirements (yes/no)			

1.2.5 E : 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.

The design proposal of the cubicles is subject of approval.

The cubicles shall be delivered completely wired and tested.

1.2.5.1 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)			

1.2.5.2 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)			

1.2.5.3 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.5.4 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.	2+5	
1.1.2	Front panel annunciation for control room (Code: 14256)	pcs.	1	
1.1.4	Horn on/off switch		Yes	
	Overall compliance with the requirements (yes/no)			

1.2.5.5 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	
	Overall compliance with the requirements (yes/no)			

1.2.5.6 Protection Cubicle No. 1 for 400 kV & 230 kV OHL

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14101	**Protection Cubicle No. 1 for 400 kV & 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.	3	
	Overall compliance with the requirements (yes/no)			

1.2.5.7 Protection Cubicle No. 2 for 400 kV & 230 kV OHL

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14102	**Protection Cubicle No. 2 for 400 kV & 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.	3	
	Overall compliance with the requirements (yes/no)			

1.2.5.8 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)			

1.2.5.9 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.5.10 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	
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)			

1.2.5.11 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.5.12 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	ms	> 50	
	• Restart time	s	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		5xIr	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 output)	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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

1.2.5.13 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	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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.

1.2.5.14 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	ms	> 50	
	• Restart time	s	Insert	
2.2	a.c. current inputs			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	20	
2.7	LED indications			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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.

1.2.5.15 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.

1.2.5.16 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		Yes	
	• 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

1.2.5.17 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		Yes	
	• 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.

1.2.5.18 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	
2.12	RAID controller type		Insert	
2.13	DVD RW type		Insert	
2.14	Serial interface RS232		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 22"	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.

1.2.5.19 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.16	Number of fast Ethernet network interface cards	pcs.	4	
2.17	Fans	Yes/No	Insert	
2.18	Monitor 32"	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)			

1.2.5.20 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		A3&A4	
2.4	Resolution	dpi	Insert	
2.5	Memory	MB	Insert	
2.6	Parallel port	Yes/No	Insert	
2.7	Fast Ethernet port		Yes	
2.8	USB port	Yes/No	Insert	
2.9	Minimum speed	Page/min	Insert	
	Overall compliance with the requirements (yes/no)			

1.2.5.21 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 75"	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)			

1.2.5.22 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	
2.2.2	Type of ports		RJ45 for 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 a 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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).

1.2.5.23 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.9.2	SSH/SSL encryption		Yes	
2.9.3	Enable/disable ports, MAC based port security		Yes	
2.9.4	Port based network access control		Yes	
2.10	System features			
2.10.1	Automatic learning negotiation and crossover detection			
2.10.2	Port configuration, status, statistics, mirroring, security			
2.10.3	Network fault recovery		≤ 5 ms	
2.11	Type Test Reports		To be included with bid	
2.12	Installation		Indoor	
	Overall compliance with the requirements (yes/no)			

1.2.5.24 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)			

1.2.5.25 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, interfacingset with substation system		1	
1.1.3	Laptop brand-name computer	pcs.	2	
1.1.4	Test plugs, including all necessary accessories (transport case, cables, plugs, etc.)	set	2	
	Overall compliance with the requirements (yes/no)			

1.2.5.26 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.27 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	Yes		

No	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	terminated). At least 20% spare terminations for each proposed type should be foreseen.			
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	
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.

1.2.5.28 Protection Terminal 400 kV 230 kV OHL-Main 1

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14001	**Protection Terminal 400kV & 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	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		Yes	
	• CT circuits supervision		Yes	
2.14	Automatic switch onto fault logic			
	• Impedance criteria		Yes	
	• Instantaneous overcurrent criteria		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.29 Protection Terminal 400 kV & 230 kV OHL Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14002	**Protection Terminal 400 kV & 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 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
	Secondary circuits supervision:			
2.13	• VT circuits supervision		Yes	
	• CT circuits supervision		Yes	
	Automatic switch onto fault logic			
2.14	• Impedance criteria		Yes	
	• Instantaneous overcurrent criteria		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.32 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 10	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	< 25	
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*Iset	ms	< 30	
2.13.2	Time delayed overcurrent protection			
2.13.2.1	Setting range	% Ir	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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*Iset	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.33 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.5	Standards		IEC	
2	**Characteristics**			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 10	
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 %	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 compensation		Yes	
2.10.8	Crossblock 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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*Iset	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.34 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 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 voltagefor 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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		Yes	
	• CT circuits supervision		Yes	
2.13	Automatic switch onto fault logic			
	• Impedance criteria		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	• Instantaneous overcurrent criteria		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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.35 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 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	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		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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Voltage control function			
2.4.1	Set voltage range	% Ur2	Insert	
2.4.2	Set voltage dead-band range	% Ur2	Insert	
2.4.3	Upper limit busbar voltage range	% Ur2	Insert	
2.4.4	Lower limit busbar voltage range	% Ur2	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	% Ur2	Insert	
2.4.8	Overcurrent blocking range	% Ir	Insert	
2.4.9	Parallel operation		Yes	
2.4.10	Parallel operation principal		Insert	
2.5	Communication ports		Yes	
2.5.1	Port for front-connected PC			
2.5.1.1	Protocols supported		Insert	
2.5.1.2	Communication speed	Kbit/s	Insert	
2.5.1.3	PC side connector type		Insert	
2.5.2	System interface			
2.5.2.1	Number of rear ports		Min. 1	
2.5.2.2	Protocols supported		IEC 61850	
2.5.2.3	Communication speed	Mbit/s	Min. 100	
2.5.2.4	Connector type		RJ45 or FO	
2.5.3	External time synchronisation		Insert	
2.6	Tap changer, tap position		BCD code	
2.7	Self-supervision		Yes	

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

1.2.5.36 Protection Terminal for Bus couplers 230 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 %	
	Interruption in auxiliary d.c. voltage:			
2.1.2	• Without resetting	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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*Iset	ms	20	
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*Iset	ms	30	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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			
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)			

1.2.5.37 Busbar and Breaker Failure Protection for 230 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	ms	> 50	
	• Restart time	s	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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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 output)	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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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		
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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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)			

1.2.5.38 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)			

1.2.5.39 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)			

1.2.5.40 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		Insert	
	• Line main 1 and 2			
	• Line back-up and bus coupler			
	• Transformer main 1 and 2			
	• Bay unit BBF			
	• Distance protection (code 14007)			
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:		Yes	
	• 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			
1.8	Socket should be designed for 4 mm banana plugs access		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Overall compliance with the requirements (yes/no)			

1.2.5.41 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	94 (for 110 V DC) 42 (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	500 (for 230kV SS, 110 V DC) 350 (for 132kV SS, 110 V DC) 150 (for 230kV SS, 48 V DC) 125 (for 132kV SS, 48 V DC)	
	• For 10h discharge time	Ah	NA	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.14	ECV	V	1,14	
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	
1.2	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)			

1.2.5.42 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		> 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,	10 MW, 500 V DC, 1 min	
1.25	Rated capacity	kVA	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.26	Rated output voltage	V d.c.	110	
1.27	Rated output current	A		
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)			

1.2.5.43 Fibre Optic Multiplexer Equipment

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	**General:**			
	Manufacturer			
	Model No.			
	Type			
1.1	Type of multiplexer		SDH (&PDH) : ADM	
1.2	Complying to ITU-T rec.		Yes	
1.3	Transmission Capacity	Mbit/s	STM-4: 622	
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)		As per field requirement	
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	No. of channels	4 or 2	
			30 or 15	
	• Capacity on 2Mbit/s or on 1Mbit/s	Channels /	30 / 2 pairs	
	• Capacity selectable	pair of wire	30 / 1 pair	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
			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	dBr	+7.5 … -16.0	
	• Output level	dBr	+7.0 … -16.5	
4.1.3	Analogue, 2wire with E&M:			
	• Input level	dBr	+6.5 … -12.5	
	• Output level	dBr	-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	Vpeak	250	
4.3.1.4	1 + 1 com path protection		yes	
4.3.2	Interface(s) for Differential Protection:			
4.3.2.1	Electrical interface: G.703	Kbit/s	64	
4.3.2.2	Optical Interface	Kbit/s	Minimum 64	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4	Data: channels per module			
4.4.1	1 + 1 com path protection, available for all		yes	
4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	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	No.	4	
	• WAN capacity	Mbit/s	Min: 2x 2Mbit/s	
	• Protocols	-	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			

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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.

1.2.5.44Energy Meter

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1	Manufacturer's name		CEWE/Elster/Landis+Gyr/EDMI/SELor equivalent	
2	Country of Origin		Insert	
3	Model		Should be filled up by bidder	
4	Meter type		Numerical, programmable, multi-function	
5	Display language		English	
6	Connection type		CT/VT operated, 3-phase, 4 wires, solidly grounded neutral	
7	Installation		Indoor installation	
8	Type of socket		To be mentioned	
9	Number of element	Nos	3 (three)	
10	Number of terminals	Nos	At least 10 (ten)	
11	Current range	A	1 to 10, user programmable	
12	Starting Current	A	0.1% of nominal	
13	Continuous Thermal current rating	A	1.5*In or higher	
14	Short time thermal rating	A	10*In or higher for 1sec	
15	Voltage range	V AC	50 to 82.5 (P-N) or higher range,	
			Burden-10MΩ	
16	Overload voltage	V AC	1.3*Vn, continuous	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
17	Burden			
	17.1 Current Circuit	VA/phase	< 0.1 @ 1A, < 0.5 @ 5A	
	17.2 Voltage Circuit (with auxiliary power)	VA/phase	< 0.1	
	17.3 Voltage Circuit (with self power)	VA/phase	< 6VA	
18	Auxiliary supply range		Dual Power Supply:	
			i. 80V to 240V AC/DC or higher range	
			ii. Self Power with VT voltage (80V to 130V AC)	
19	Operating frequency		50Hz (±5%)	
20	Measuring mode		True 4 quadrant	
21	Accuracy class			
22	Losses at nominal load		To be mentioned	
23	Local communication		DLMS, RS232/RS485/Ethernet	
24	Remote communication		Standard metering protocol, MODBUS; Communication facility to Network Control Center should be available	
25	Software interfacing facility with PC		Should be available	
26	Software requirement		1. Should be able to configure and monitor with user friendly PC-based tool. 2. Necessary software for configuration and parameterization has to be suppliedfree of cost and without any time- bound license	
27	Password protection		Should be available for programming, configuration and read out meter data	
28	Meter sealing condition		Hermatically or Ultrasonic welded	
29	Display options		Built-in HMI LCD display, configurable display, including meter ID, power quadrant display	
30	Integration period		30 (thirty) minutes	
	Resetting period		1 (one) month	
	Cumulative MD transfer		Built-in	
	Cycle Timing device		Built-in	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
31	Normal display list		• Complete LCD test, Present date, Present time • Current billing total kWh-Del, Current billing total kWh-Rec • Current billing total kVARh-(Q1+Q4), Current billing total kVARh-(Q2+Q3) • Current billing maximum kW-Del, Current billing maximum kW- Del Date, Current billing maximum kW-Del Time, Current billing cumulative kW-Del • Current billing maximum kW-Rec, Current billing maximum kW-Rec Date, Current billing maximum kW-Rec Time, Current billing cumulative kW-Rec • Phase A voltage, Phase B voltage, Phase C voltage • Phase A current, Phase B current, Phase C current • Phase A voltage angle, Phase B voltage angle, Phase C voltage angle • Phase A current angle, Phase B current angle, Phase C current angle • System PF-arithmetic, Line frequency	
32	Alternate mode display list		• Complete LCD test, Present date, Present time • Current billing total kWh-Del, Current billing total kWh-Rec • Current billing total kVARh-(Q1+Q4), Current billing total kVARh-(Q2+Q3) • System PF-arithmetic, Line frequency	
33	Online testing facility		Should be available with online CT shorting facility with security sealing provision	
34	Data storage		At least 32MB of nonvolatile memory for data storage and capable of simultaneously record 4 load profile recorders x 8 channels for at least 90days at 30 minute intervals.	
35	Data logging and event recording		Should be available	
36	In built clock		Should be available	
37	Provision of GPS synchronization		Should be available	
38	Additional Features (Optional)		i. Power Quality Measurement (At least 1 GB of memory, 192 channels of LDP, 24kHz waveform, 600 VSSI summary events, Wave View, Flicker, Power Harmonics and Interharmonics, Total Harmonic Distortion) ii. Necessary software for accessing the mentioned features should be provided without any time-bound license.	
39	Environment requirement			
	39.1 Ingress protection		IP54 or better	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	39.2 Operating temperature		-10ºC to +60ºC	
	39.3 Storage temperature		-40ºC to +80ºC	
	39.4 Humidity range		0% to 95%, non-condensing	
40	Weight of the meter		To be mentioned	
41	Dimension of the meter		To be mentioned	
42	Outline, drawing and leaflets		To be provided	
43	Performance curves for balanced and unbalanced load		To be mentioned	
44	Year of manufacture		To be mentioned	
45	Minimum Battery Service life and shelf life	Years	10 (ten) & 15 (fifteen) respectively	
46	Meter service life	Years	15 (fifteen)	
47	Reference standard		Relevant ANSI/IEC standard	
48	Warranty	Years	3 (three)	
49	Type test certificate		Should be provided	

1.2.6 F: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		Refer to B-1 of Vol-2	p. 5-120
2.1.1	Expandability			
2.2	Nominal current	Amp	1A	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.5.5.2	Fast: 1 kHz - 24kHz	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		Refer to B-1 of Vol-2	
3.1.1	Expandability			
3.2	Selectable input level	Vdc	N/O or N/C, 110 VDC	
3.3	Type		Potential or potential free contact	
3.4	Resolution	ms	Insert	
4	**Memory**			
4.1	Size	GB	4 GB 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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.6	In-built hard disk (auto-maintained) SSD type	TB	min. 1 TB	
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	GPS
6.4.	Time resolution between 2 synchronized pulses		Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
10.3.	Main memory capacity	Mb	Minimum 512 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)			

7.2 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		
4	**Gas Insulated Substation & Equipment**		
4.1	Manufacturer's authorization letter		
4.2	Manufacturer's QA certificates		
4.3	Technical data sheet		
4.4	List of performed type tests		
4.5	Type test certificates		
4.6	Reference list for the last ten years for the offered type		
5	**Circuit breakers**		
5.1	Manufacturer's authorization letter		
5.2	Manufacturer's QA certificates		
5.3	Technical data sheet		
5.4	List of performed type tests		
5.5	Type test certificates		
4.6	Reference list for the last ten years for the offered type		
6	**Disconnectors**		
6.1	Manufacturer's authorization letter		
6.2	Manufacturer's QA certificates		
6.3	Technical data sheet		
6.4	List of performed type tests		
6.5	Type test certificates		
6.6	Reference list for the last five ten for the offered type		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
7	**Current transformers**		
7.1	Manufacturer's authorization letter		
7.2	Manufacturer's QA certificates		
7.3	Technical data sheet		
7.4	List of performed type tests		
7.5	Type test certificates		
7.6	Reference list for the last ten years for the offered type		
8	**Voltage transformers**		
8.1	Manufacturer's authorization letter		
8.2	Manufacturer's QA certificates		
8.3	Technical data sheet		
8.4	List of performed type tests		
8.5	Type test certificates		
8.6	Reference list for the last ten years for the offered type		
9	**Surge arresters**		
9.1	Manufacturer's authorization letter		
9.2	Manufacturer's QA certificates		
9.3	Technical data sheet		
9.4	List of performed type tests		
9.5	Type test certificates		
9.6	Reference list for the last ten years for the offered type		
10	**Control system**		
10.1	Manufacturer's authorization letter		
10.2	Manufacturer's QA certificates		
10.3	Technical data sheet		
10.4	List of performed type tests		
10.5	Type test certificates		
10.6	Reference list for the last ten years for the offered type		
11	**Relay Protection System**		
11.1	Manufacturer's authorization letter		
11.2	Manufacturer's QA certificates		
11.3	Technical data sheet		
11.4	List of performed type tests		
11.5	Type test certificates		
11.6	Reference list for the last five years for the offered type		
12	**Metering System**		
12.1	Manufacturer's authorization letter		
12.2	Manufacturer's QA certificates		
12.3	Technical data sheet		
12.4	List of performed type tests		
12.5	Type test certificates		
12.6	Reference list for the last ten years forthe offered type		

Ref.	Description	Denomination / Description of Material in the Bid	Reference in the Bid
13	**Communication System**		
13.1	Manufacturer's authorization letter		
13.2	Manufacturer's QA certificates		
13.3	Technical data sheet		
13.4	List of performed type tests		
13.5	Type test certificates		
13.6	Reference list for the last ten years for the offered type		

8. Schedule F: Subcontractors

The following form shall be filled and attached to the bid.
Bidders are free to propose/list more than one Subcontractor for each item.
Quoted rates and prices shall be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.
In case that more than one Subcontractor has been proposed, the Employer have right to choose one or more of them, or can ask for replacement
Should a Subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable Subcontractor without any change to the bid price.
Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved Subcontractor for each item concerned.

If the Bidder will carry out any of the works and services, they shall put own name in the form

Subcontractors

The following Subcontractors are proposed for carrying out the facilities:

Item	Works and Service	Subcontractor's Name and Address	Nationality
11.1	Design		
11.2	Civil works		
11.3	Electrical works / installation, testing and commissioning		
11.4	NLDC		
Name of Bidder:			
Signature of Bidder:			

9. Schedule G: Proposed Alternative Standards to Which Equipment Shall Be Provided

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

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

Specified Standard	Alternative Standard	
	Number	Title

10. Schedule H: Proposed Contract & Site Organization

Personnel

The data on their experience should be supplied using the Form below for each candidate. The Bidder must demonstrate that he has the personnel for the key positions that meet the following requirements:

No.	Position	Total Work Experience (years)	Work Experience In Similar Projects (years)	Work Experience In Similar Projects in Oversea Area
1	Contractor's Representative Project Director / Project Manager	15	12	10
2	Substation Design Engineer	12	8	05
3	Site Manager	10	5	05
4	HV Electrical Engineer	10	5	05
5	Protection Engineer	10	5	05
6	Control Engineer	10	5	05
7	Substation Civil Engineer	10	5	05
8	Health & Safety (Accident Prevention) Officer*	8	5	03
9	Environmental Specialist*	8	5	03
10	Social/ Land Acquisition / Compensation Specialist*	8	5	03

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

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

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

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

- **Form PER – 1: Proposed Personnel**

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

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

- **Form PER – 2: Resume of Proposed Personnel**

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

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

From	To	Company / Project / Position / Relevant technical and management experience

10. Schedule I: Drawings and Documents to Be Submitted with Bid and After Contract

10.1 Drawing and Documents to be Submitted with BID

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

1. Typical single line, layout & sectional drawings of substation showing details of construction and dimensions.

2. Outline drawings of all switchgear equipment:-

   (a) Showing installed components, dimensions and weights;
   (b) Showing transport dimensions and weights;

3. Outline drawings of all power transformers, auxiliary transformers and Shunt Reactor (if any):-

   (a) Showing installed components, dimensions and weights;
   (b) Showing transport dimensions and weights;

4. Typical drawing of transformer remote control panel.

5. For furnishing Type Test Certificates of equipment, Please see ”Type Test Requirement”, clause 1.3, Section 6: Employer’s Requirement, Volume 01 of 03.

For each equipment, the Bidder shall provide the List of performed Type tests as following

Equipment					
No.	Type test	Name of Type test laboratory	Number of Type test report	Date of report	Number of pages

6. Quality Assurance Certificate ISO9001/9002 Certification (or equivalent) and Quality Assurance Programme & Typical Quality Plan for the work from the manufacturers of the following equipment:

   (i) Power transformer
   (ii) Switchgears (CB, DS/ES) &
   (iii) Instrument Transformer
   (iv) Relays& substation Automation System

(v) Fibre Optic Multiplexer Equipment for protection and communication
(vi) GIL / Underground power cables
(vii) Surge arrester
(viii) Wave trap (N/A)
(ix) Bus Reactor (N/A)
(x) DFDR
(xi) Battery & charger
(xii) Insulator

10.2 Drawings and Documents to be Submitted after Contract

Technical Drawings/Documents

General:
The Contractor shall prepare necessary technical documents for the equipment including detailed engineering drawings, design calculations and specifications showing full details of the civil works, equipment and materials to be used as well as all arrangement necessary for the installation works.

Prior to manufacturing, the contractor shall submit technical documents and drawings to the Employer for approval.

The Employer will review and send to the Contractor his comments on the documents within 4 weeks from receiving them, the commented drawings/ documents will be marked by “Approved”, “Approved with Conditions”, “Not Approved” or “Not Subject for Approved”.

Any comments given by the Employer shall be taken into account before commencement of civil works, manufacturing process at factories and if any modification or change is directed by the Employer, the documents shall be revised and resubmitted for approval after making necessary revisions (Within 14 days).

Approval of the documents shall in no way relieve the Contractor from any of his contractual obligations.

All costs and expenses for preparation and submission of the documents shall be borne by the Contractor including those for revision and submission of the documents.

The Technical documents shall have the followings features:
a) Units:
International System of Units (SI) shall be applied to all works.
b) Language:
English shall be the formal language, hence all documents, correspondences, drawings, reports, schedules, instructions, name plates, rating plates, caution plates and notices shall be written in English.
c) Symbols, Marks and Abbreviations:
All symbols, marks and abbreviations, etc., used on any documents shall be clearly explained by a legend on the same document or on separate sheets.

The abbreviations and marks used for an individual device shall be identical throughout whole documentation so as to avoid confusion and misunderstanding.
d) Sizes and Identifications of Documents:
The size of the drawings shall be standardized as follows:
- Al (594 mm x 841 mm)
- A2 (420 mm x 594 mm)
- A3 (297 mm x 420 mm)
- A4 (210 mm x 297 mm)

Design calculations, specifications, lists, instruction manuals and other documents shall preferably be prepared and submitted in A4 size.

All documents shall have a uniform title block at the bottom right hand corner, inclusive of the origin of the documents. The title block shall show the drawing title with main ratings such as capacity or voltage etc., drawing number, revision number or letter, date to have been prepared, name of the Contractor and/or manufacturer and the signature of the Contractor's authorized representative. Project title block will be informed from Engineer after contract. A spare blank space shall be provided above the title block of each document for the Employer comments.

Typical Technical Documents Required to be Submitted to the Employer:

The Bidder/Contractor shall submit the following technical documents and drawings:
A) With the Bid: (Refer to also Item 10.1 above)
The following drawings shall be submitted with the Bid:

a) General arrangement of substation.
This drawing shall give the principal dimensions and approximate positions of the circuit breakers, isolating switches, etc.
b) General arrangement and overall dimension drawings of the switchgear.
c) Single line diagram of the main connections with secondary circuit of protection and metering etc.
d) General arrangement for transformers.
e) General arrangement of control and indicating panels.
f) General arrangement of relay panels
g) Drawings for MV switchgear & auxiliary buildings and guard house including floor plan, section, elevation and dimensions.
h) Catalogues, literature and reference list of proposed Switchgear equipment, protection relays and SAS.
i) Quality Management System Manual and ISO Certificate of the equipment manufacturer for 400kV & 230kV GIS, Auto Transformer, Shunt Reactor, 33kV Switchgear, Protection relays, Battery and Battery charger, Communication equipment and SAS.
j) Type testing certificates and procedures for similar switchgear, transformer, shunt reactor, circuit breaker, cable, etc.
k) Routine testing certificates and procedures for all equipment.

B) After Contract Award Stage:
The followings are minimum requirement. Additional documents/drawings shall be submitted to the Employer, when required by the Employer.

a) Master List of Drawings and Documents (Master Document List):
After contract signing, the Contractor shall create and submit a master list of drawings and documents to the Employer for approval, for the purpose of monitoring and smooth processing of document approval, which shall contain document title and number, date to be submitted, re-submission date, approval date etc. underneath each column of relevant document classification or category.
i) Single Line diagram (SLD) for main circuits and secondary circuits.
ii) Layout drawings of the substation showing buildings/rooms, equipment arrangement, overall dimensions of equipment bays, cable routes or connections between equipment, internal/access roads and phase-phase and phase-earth clearances where applicable.
iii) Outline drawings of switchgear bays, circuit breakers, disconnecting switches, earthing switches and other main plant showing overall dimensions and weights, including details for shipping.
iv) General arrangement for transformers and shunt reactors.
v) Bushings or cable termination details for switchgears and transformers/reactors.
vi) Descriptive information and drawings for transformers, dealing with tank, core and winding arrangements including type of coils, insulation, use of grading, on-load tap-changing equipment and location of all ancillary devices, these drawings shall show masses crane lift necessary for un-tanking and size of lifting lugs.
vii) Typical drawings of protection equipment, relay panels, and associated equipment enclosures.
viii) SAS system configuration and related drawings
ix) AC/DC system and panels arrangement drawing
x) Telecommunication equipment system diagram & panel arrangement

xi) Detailed schematic diagram for all equipment
Xii) Interconnection/Wiring Diagrams, Cables route & Cable schedule between panels/equipment
xiii) Civil Engineering/design drawings
xiv) Details of Building services equipment and system arrangement/calculations
xv) Others, when required

- The contractor shall include any other drawings, catalogues, descriptions and photographs necessary to present a clear picture of the type and class of equipment to be provided under the contract.
- Project Implementation Schedule/Program shall be submitted to the Employer for approval within one month after signing the contract, showing the detailed program time schedule in bar/Gantt chart or equivalent for design, manufacturing, civil works, factory testing, delivery to substations, installation, site tests/commissioning and energization.
- The project organization chart including site organization shall also be submitted to the Employer for approval within one month after signing the contract.

b) Subcontractors & manufacturers:
Summary list of the final selected subcontractors/manufacturers shall be submitted for Approval s howing materials/equipment, place of manufacturing and testing etc.

The Employer has the right to request the Contactor to submit detailed subcontract (Suborder) documents if required.

c) Specifications:
The Contractor shall prepare specifications for all major equipment/materials, installation, and commissioning for the Employer approval.

The specification shall contain the type, ratings, design, construction, materials, dimensions, corrosion protection and other necessary performance of the equipment.

d) Calculation sheets:
The Contractor shall submit all design calculation sheets for approval required for the substations systems and equipment in accordance with related IEC standards or equivalents, but not limited to:
i) 230/33kV/LV cable sizing calculation
ii) CT/VT ratings and sizing calculation (Burden, Class, Knee point voltage, Secondary resistance etc)
iii) Batteries and Battery Charger capacity
iv) Auxiliary Transformer capacity calculation
v) Earthing system, conductor sizing and safety of personnel and equipment calculations
vi) Detailed civil structural design calculations.
vii) Protective Relay settings calculations and recommendations
viii) Insulation coordination study

e) Lists:
The following lists shall be submitted for approval:
- Cable Lists
  - List of site installation equipment
  - List of Test Equipment and Special Tools.
  - List of Spare Parts

f) Factory Test Time Schedules
g) Factory Test Procedures
h) Factory Test Reports with witness signature
i) Site test time schedule and Procedures
j) Site Test /Commissioning Report
k) Operation and maintenance Instruction Manuals and installation manual.
l) Red marked As-Built Drawings
m) As-Built Drawings
n) Monthly Project progress report
o) Weekly and Daily site report

Required Numbers of Drawings/Documents:
Numbers of the documents to be submitted to Engineer shall be as follows:

a) During the Design/ Manufacturing stage:

- Documents for approval : 6 copies.
- Reference documents : 6 copies

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b) Before energizing stage:

• Red mark corrected drawings : 4 copies.

c) After commissioning test:

• Complete sets of bound prints of As-built drawings : 4 copies.

d) After Final Acceptance:

• Complete sets of bound prints of As-built documents : 4 copies.

• CD ROM containing as-built documents : 4 sets as PDF.

Corresponding Letters:

The corresponding letter shall have series letter number, with the date of submission, address, project name, substation name, subject etc.

The project letter numbering system may be instructed by the Employer after the Contract.

11. Schedule J: Departures from The Specification

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

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

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

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

Item	Volume	Clause	Detail of Departure from Specification
			NOT APPLICABLE

12. Schedule K: Coefficient and Indices for Price Adjustment

Price Adjustment Formula

Prices payable to the Contractor, in accordance with the Contract, shall be subjected to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula. Each percentage of the formula (except the fixed element) shall be changed by the Contractor.

(1) Transformer

$$P_1 = P_0 \times (a + b\frac{L_1}{L_0} + c\frac{M_{11}}{M_{01}} + d\frac{M_{12}}{M_{02}} + e\frac{M_{13}}{M_{03}} + f\frac{M_{14}}{M_{04}}) - P_0$$

Where,

P_1 = Price Adjustment amount of power transformer and shunt reactor, payable to the Contractor

P_0 = Contract Price (base price)

a= percentage of fixed element in Contract Price (*a* = 15%)

b= percentage of labour component in Contract Price (*b* = 20%)

c= percentage of material Core (Si steel) component in Contract Price (*c* = 22%)

d = percentage of material (Copper) component in Contract Price (*d* = 25%)

e = percentage of material (Steel) component in Contract Price (*e* = 15%)

f = percentage of material (Zinc) component in Contract Price (*f* = 3%)

L_0, L_1= labour indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

M_{01}, M_{11}= material (Core, Si steel) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

M_{02}, M_{12}= material (Copper) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

M_{03}, M_{13}= material (Steel) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

M_{04}, M_{14}= material (Zinc) indices applicable to the appropriate industry in the country of origin of the base date and the date for adjustment, respectively

Conditions Applicable To Price Adjustment

The Bidder shall indicate the source of labor and materials indices and the base date indices in its Bid.

Item	Country of Origin; Currency of index	Source of Indices Used Title / definition	Base Date Indices Value Date
L_0, L_1 (Labour)			
M_{01}, M_{11} (Si Steel)			

M_{02}, M_{12} (Copper)			
M_{03}, M_{13} (Steel)			
M_{04}, M_{14} (Zinc)			

The following conditions shall apply:

a. The base date shall be the date 28 days prior to the deadline for submission of the Bid.
b. The date of adjustment shall be the mid-point of the period of manufacture of the component or Plant. The mid-point shall be determined by considering the start date of manufacture to be 30 days after Contract Effective Date. The end date of manufacture is considered to be 30 days prior to the shipping date.
c. No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.
d. If the currency in which the Contract price, P_0, is expressed is different from the currency of the country of origin of the labour and/or materials indexes, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall correspond to the ratio of exchange rates between the two currencies on the base date and the date for adjustment as defined above.
e. No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.
f. If no data is entered for one item in the above table, the price adjustment does not apply to this item.
g. Any payments resulting from price adjustments will be settled at the end of contract.

Coefficient Scope of Index	**Country of Origin; Currency of Index**	**Source of Index; Title/Definition**	**Value on Stated Dates**	
			Value	**Date**
For Transformer a= b= c= d= e= f=				

Schedule B1 : Plant and Equipment Supplied from Outside the Employer's Country

New 400/230/132 kV Substation at Purbachal

(For deatailed description of the technical requirements please refer to clause 1.2.1: Technical Requirements for 400/230/132KV GIS Substation at Purbachal, Schedule A: Scope of Works, volume 3 of 3 of the bidding document)

Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1A	**420 kV switchgear, equipment connection and steel structures**						
1A1	420kV GIS Line Feeder Bays	Set	4				
1A2	420kV GIS Auto Transformer Feeder Bays	Set	3				
1A3	420kV Bus Coupler Bays	Set	2				
1A4	420kV GIS Bus Section Bays	Set	2				
1A5	420 kV GIS type three phase LA	Set	4				
1A6	420kV GIS type Bus FES and Bus VT	Set	4				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1A7	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2				
1A8	Standalone Partial Discharge measurement and analyzer system for Complete GIS	Lot	1				
	AIS Switchgear, Equipment & Structure						
1A9	390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	21				
1A10	420kV CVT, Single-phase, 50Hz, 1425kVp BIL, 3 windings	No.	12				
1A11	420kV, 4000A, single phase Wavetrap	No.	4				
1A12	**400kV Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 400kV Switchyard including LA, CVT and WT conncetion**						
	i. Tubular Conductor and/or Flexible Conductor	Lot	1				
1A13	**Insulator and fittings including all necessary clamps and connectors as required for completing 400kV GIS Switchyard**						
	i. Insulator	Lot	1				
	ii. Fittings & Clamps, Connector	Lot	1				
	iii. Nut-bolt	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1A14	**Steel gantry each circuit of 400kV Transmission Line, Transformer & Equipment support structure including all necessary accessories required for completing 400kV GIS Switchyard**						
	i. Steel Structure for T/L with Nut & Bolts						
	a) Gantry Column	No.	5				
	b) Beam	No.	4				
	ii Equipment Structure						
	a) LA	No.	21				
	b) 420kV CVT	No.	12				
	iii. Nut-Bolt	Lot	1				
	iv. LV power & control cable tray including fitting, fixing accessories	Lot	1				
1B	**245 kV switchgear, equipment connection and steel structures**						
1B1	245kV GIS Line Feeder Bays	Set	2				
1B2	245kV GIS Auto Transformer Feeder Bays	Set	6				
1B3	245kV Bus Coupler Bays	Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1B4	245kV Bus Section Bays	Set	2				
1B5	245kV GIS type Bus FES and Bus VT	Set	4				
1B6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2				
	AIS Switchgear, Equipment & Structure						
1B7	198kV rated voltage, 158 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	24				
1B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**						
	i. Tubular Conductor and/or Flexible Conductor	Lot	1				
1B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**						
	i. Insulator	Lot	1				
	ii. Fittings & Clamps, Connector	Lot	1				
	iii. Nut-bolt	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		*(2)*	*(3) = (1) x (2)*	
1B10	**Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard**							
	i.	Steel Structure for T/L with Nut & Bolts						
	a)	Gantry Column	No.	3				
	b)	Beam	No.	2				
	ii.	Steel Structure for 400/230kV & 230/132kV Transformers with Nut & Bolts						
	a)	Gantry Column	No.	14				
	b)	Beam	No.	12				
	iii.	Equipment structure						
	a)	LA	No.	24				
	iv.	Nut & Bolts	Lot	1				
	v.	LV power & control cable tray including fitting, fixing accessories	Lot	1				
1C	**145 kV switchgear, equipment connection and steel structures**							

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1C1	145kV GIS Line Feeder Bays	Set	6				
1C2	145kV GIS Auto Transformer Feeder Bays	Set	2				
1C3	145kV Bus Coupler Bays	Set	2				
1C4	145kV Bus Section Bays	Set	2				
1C5	145kV GIS type Bus FES and Bus VT	Set	4				
1C6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2				
	AIS Switchgear, Equipment & Structure						
1C7	120kV rated voltage, 102 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	24				
1C8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**						
	i. Tubular Conductor and/or Flexible Conductor	Lot	1				
	Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard						
1C9	i Insulator, Post & Disk	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
1C9	ii	Fittings & Clamp, Connector	Lot	1				
	iii.	Nut-bolt	Lot	1				
1C10	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**							
	i.	Steel Structure for T/Lwith Nut & Bolts						
	a)	Gantry Column	No.	8				
	b)	Beam	No.	6				
	ii.	Equipment Structure						
	a)	LA	No.	24				
	iii.	Nut & Bolts	Lot	1				
	iv.	LV power & control Cable tray including fitting, fixing accessories	Lot	1				
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1				
1D	**36kV Switchgears, equipment connection and steel structures**							
	36kV AIS Switchgears for Aux. Power Bays, comprises with:							

Item No.		Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		*(2)*	*(3) = (1) x (2)*	
1D1	i)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, VCB with spring operating mechanism	Set	2				
	ii)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single vertical/horizontal break, post type, motor operated Disconnector with Earth Switch	Set	4				
	iii)	36kV, single-phase, 31.5kA/3sec, 50Hz, 170kVp BIL, Current Transformers	No.	6				
	iv)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	6				
	v)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	6				
1D1.x		**36kV AIS Switchgears for Unloaded tertiary Auto-Transformer Bays, comprises with:**						
	i)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	9				
	ii)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	9				
1D2		Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 36kV Switchyard						
	i)	Tubular Conductor and/or Flexible Conductor	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1D3	Insulator and fittings including all necessary clamps and connectors as required for completing 36kV Switchyard						
	i) Insulator, Post & Disk	Lot	1				
	ii) Fittings & Clamps, Connector	Lot	1				
	iii) Nut-bolt	Lot	1				
1D4	Steel structure for each circuit of Aux. power TR and Auto.TR tertiary side connection including all necessary accessories required for completing 36kV Switchyard						
	i) Equipment Structure with Nut & Bolts	Lot	1				
	ii) LV power & control cable tray including fitting, fixing accessories	Lot	1				
1D5	33kV Power Cable with associated material						
	i) 33kV, single phase, 300 sqmm XLPE cable	meter	50				
	ii) 33kV, single phase, outdoor cable termination with accessories	No.	12				
1E	**Power Transformers and Auxuliary Transformer**						
1E1	400/235/34.5 kV, 520/750 MVA (ONAN/ONAF), threephase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and Remote Tap Changer Control (RTCC) Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	3				
1E2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for 400/235/34.5 kV auto transformers.	Set	3				
1E3	230/135/34.5 kV, 350/450 MVA (ONAN/ONAF), three phase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and RTCC Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2				

Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1E4	Potable dissolved gas monitoring system for transformer	Set	1				
1E5	33/0.415 kV, 500kVA, three phase outdoor type earthing/auxiliary Zig-Zag transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.	Set	2				
1E6	CAFS of Fire Fighting system for transformer with water feeding equipment						
	i) 400/235/34.5 kV Auto-transformer	set	3				
	ii) 230/135/34.5 kV Auto-transformer	set	2				
1F	**Control, Protection, Substation Automation & Metering**						
400kV Circuit							
1F1	Control, protection and Monitoring including SAS Function for Overhead Line circuits, along with Control & Protection Cubicles	Set	4				
1F2	Control, protection and Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	Set	3				
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	Set	2				
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2				
1F5	Busbar Protection including SAS Function (400kV Circuit) [Main-1 & Mian-2, different make]	Set	2				
1F6	**Tariff metering comprises with :**	Lot	1				
	i. Meters (Main meter & Check meter in one set)	Set	7				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		*(2)*	*(3) = (1) x (2)*	
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
230kV Circuits								
1F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles		Set	2				
1F8	Control, Protection, Monitoring including SAS Function for Auto transformer (750MVA) circuits, along with Control & Protection Cubicles		Set	3				
1F9	Control, protection and Monitoring including SAS Function for Auto transformer (450MVA) circuits, along with Control & Protection Cubicles		Set	3				
1F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles		Set	2				
1F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles		Set	2				
1F12	Busbar Protection including SAS Function (230kV Circuit)		Set	1				
1F13	**Tariff metering comprises with :**		Lot	1				
	i.	Meters (Main & Check)	set	8				
	ii.	Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
132kV Circuits								

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		(2)	(3) = (1) x (2)	
1F14	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	set	6				
1F15	Control, Protection, Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	set	2				
1F16	Control, Protection, Monitoring & SAS for Bus Coupler circuits, including Control & Protection Cubicles	set	2				
1F17	Control, Protection, Monitoring & SAS Function for Bus section circuits, including Control & Protection Cubicles	set	2				
1F18	Busbar Protection including SAS Function (132kV Circuit)	set	1				
1F19	**Tariff metering comprises with :**	Lot	1				
	i) Meters (Main & Check)	Set	8				
	ii) Complete Panel including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
36kV Circuit							
1F20	Control, Monitoring, Protection & SAS function for 33kV station power system, including Control & Protection Cubicles	Set	2				
1F21	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-tranformer, including Control & Protection Cubicles (can be merged with TR main/backup protection)	Set	3				
1F22	**Tariff metering comprises with :**	Lot	1				
	i) Meters (Main & Check)	set	2				

Name of Bidder:

Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		(2)	(3) = (1) x (2)	
1F22	ii) Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
1F23	**Substation Automation system**	Lot	1				
1G	Digital Fault & Disturbance Recorder	Lot	1				
1H	**Power Cable & GIL**						
1H1	420kV Gas Insulated Line (GIL) for seven (7) feeders, single phase encloser, which consist of four (4) T/L & three (3) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (25 - 140 meter). Actual payment shall be as per final design. The Length given here is as single phase length.	m	1800				
1H2	245kV Gas Insulated Line (GIL) for eight (8) feeders, single phase encloser, which consist of two (2) T/L &six (6) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (30 - 135 meter). Actual payment shall be as per final design. The Length given here is as single phase length	m	1800				
1H3	132kV, 2000sqmm (minimum), XLPE Power cable & termination						
	i. XLPE HV Power cable (Cable shall be laid in cable trench with flat formation arrangement)	m	1900				
	ii. Outdoor type Cable Sealing End per phase with required necessary accessories for line & transformer bays	Nos.	24				
1H4	**Steel structure for each circuit of 132kV cable connection**						
	i. Equipment Structure with Nut & Bolts						

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
	a)	Outdoor type Cable Sealing End	Nos.	24				
1I	**Multicore Cables for control, protection, metering & power circuits**							
	i.	LV Control Cable	Lot	1				
	ii.	LV Power Cable	Lot	1				
1J	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.							
1J1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building		Lot	1				
1J2	Lightning Protection System for complete substation (overhead, mast type)		Lot	1				
1J3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)		Set	2				
1K	**Batteries, Chargers & DC distribution board**							
1K1	**110V Ni-cad Batteries with chargers & distribution board**							
	i.	for 400kV system						
	a)	_110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2				
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2				
	c)	_110V DC Distribution panel, MCC type (LV S.W room, SPR, control Room) with Digital Display & Controller	Lot	1				
	d)	Inverter, Input- AC & DC, output -AC 230V 5kVA 60min	set	2				

Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
	ii.	for 230kV & 132kV system						
	a)	_110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2				
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2				
	c)	_110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller	Lot	1				
1K2	**48V Ni-cad Batteries with chargers & distribution board**							
	i.	_48V battery Banks, minimum 200Ah at the 5-hours rate of discharge	Set	2				
	ii.	_Charger (IGBT Type) each float charge shall not be less than 120A rating	Set	2				
	iii.	_48V DC Distribution Panel with Digital Display & Controller	Lot	1				
1L	**LVAC Distribution**							
1L1	AC 415V / 230V Distribution panels (MCC type, LV S.W room, Each Panel & Control room, Generator room etc) with Digital Display & Controller		Lot	1				
1L2	Tariff metering at LV side		Lot	1				
1M	**Civil Works, Building and Foundation (Details in Schedule B4)**							
1M1	Complete land development		Refer to Schedule B4					
1M2	Complete civil items required for outdoor works		Refer to Schedule B4					
	i.	Complete civil works for 420kV Indoor GIS Building including Protection & Metering Room, Control Room, 110V Battery Room, 48 Battery Room, Warehouse *etc.*						
	a)	_Foundation works	Refer to Schedule B4					
	b)	_Super structures	Refer to Schedule B4					
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture *etc.*	Refer to Schedule B4					

Name of Bidder: Signature of Bidder:

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Item No.		Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
1M3	d)	_10 ton EOT crane (price for supply of EOT crane)	No.	1				
	e)	_Warehouse_separate spare materials by installing shelves and labels.	Refer to Schedule B4					
	ii.	Complete civil works for 245kV cum 132kV Indoor GIS Building including Protection & Metering Room, 110V Battery Room *etc.*	Refer to Schedule B4					
	a)	_Foundation works	Refer to Schedule B4					
	b)	_Super structures	Refer to Schedule B4					
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Refer to Schedule B4					
	d)	_10 ton EOT crane (price for supply of EOT crane)	No.	1				
	iii.	Emergency auxulary power room & water feeding room	Refer to Schedule B4					
	a)	_Foundation works	Refer to Schedule B4					
	b)	_Super structures	Refer to Schedule B4					
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Refer to Schedule B4					
	d)	_Complete civil work for CAF system including pipe network	Refer to Schedule B4					
1M4	Testing of Foundation		Refer to Schedule B4					
1N	**Lighting, small power, air conditioning and Ventilation, Fire Fighting System & CCTV**							
1N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Batterys Rooms, other rooms, etc.) and emergency DC lighting for Indoor.		Lot	1				
1N2	Lighting (LED type) for outside building for security, roadway, switchyard		Lot	1				
1N3	Fire Fighting system for GIS Hall & Control Room							
	i)	Fire Fighting system For 230kV cum 132kV GIS Hall & Panel Room	Lot	1				
	ii)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	1				
	iii)	Fire Fighting system For Control Room	Lot	1				
1N4	Complete CCTV with motion sensor		Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
1O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations - 87 or 21 relay for each transmission line protection (through fibre cores) - 21 relay carrier signal (main and back-up) - SCADA data from switchgear and control system - IP and Analog telephone system - Hot-line telephone system All PLC terminal equipment at remote end substations are ABB make**							
1O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising							
	i.	ADM with TP unit without booster with Panels (Front opening, Swing Frame type) & accessories	Set	1				
	ii.	IDF/SDF	Set	1				
	iii.	Cables	Lot	1				
	iv.	EOW telephone with board	Set	1				
	v.	Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories	Lot	1				
	vi.	All other Accessories not included above	Lot	1				
	Other Indoor equipment, at Local end SS							
	i.	PABX Card (FXO)	Set	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		*(2)*	*(3) = (1) x (2)*	
1O2	ii.	Primary phone (IP phone)	No.	2				
	iii.	Secondary phone (2W phone)	No.	10				
	iv.	Indoor MDF	Set	1				
1O3	Outdoor equipment, at Local end SS							
	i.	Underground optical fiber cable, armoured, 48 core	Lot	1				
	ii.	Pigtail cables	Lot	1				
	iii.	Outdoor termination box	Set	1				
1O4	Extension/Adaptation of Indoor Fibre Optic Multiplexer Equipment & system at remote end substations each comprising							
	i.	Optical STM-16 Card for each 400 kV line at remote end	Lot	1				
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1				
	iii.	Optical STM-4 Card for each 132 kV line at remote end	Lot	1				
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1				
	v.	Optical Booster, if required	Lot	1				
	vi.	Outdoor termination box	Set	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
	vii.	Cables, ODF, MDF, panels as required	Lot	1				
1O5	PLC equipment at Local end SS							
	i.	Indoor PLC Equipment with all acessories & Panels (Front opening, Swing Frame type)	Set	4				
	ii.	Line matching unit	No.	8				
	iii.	Cables & other accessories for complete PLCC system	Lot	1				
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	1				
1O6	Installation, testing & commissioning		Lot	1				
1P	**SCADA system for Telecontrol and Telemetering**							
1P1	i.	Equipment at Substation						
	a)	Gateway (server, engineering software)	Set	2				
	b)	Ethernet Switch	Set	2				
	c)	Hardware Firewall	Set	1				
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1				
	e)	Cables	Lot	1				
	f)	All Other Accessories	Lot	1				
	ii.	Integration work with Master & Backup NLDC including Engineering & Commissioning	Lot	1				
1R	**Generator for Emergency Aux. Power (with smoke reduction device)**							
1R1	250kW 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device		Set	1				
1S	**Other equipment**							

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
1S1	Scissor Lift : Battery type for one person / Minimum working height greater than 10m	Set	1				
1S2	Emergency Interphone (each room)	Lot	1				

Total Price(for New Purbachal 400/230/132kV SS) carried to Summary of Price Schedule
Total Price in words (for New Purbachal 400/230/132kV SS)……

Name of Bidder: Signature of Bidder:

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Schedule B1 : Mandatory Spare, Maintanence & Test Equipement Supplied from Outside the Employer's Country

New 400/230/132 kV Substation at Purbachal

Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		(2)	(3) = (1) x (2)	
AS	**420kV Switchgear, equipment and connection**						
AS1	Complete CB module for GIS	phase	2				
AS2	Complete Operation Mechanism with accessories of CB for GIS	set	1				
AS3	Tripping coil for GIS	no	6				
AS4	Closing coil for GIS	no	3				
AS5	Complete DS/ES module for GIS	phase	2				
AS6	Complete Operation Mechanism with accessories of DS/ES for GIS	set	1				
AS7	Complete HSES module for GIS	phase	2				
AS8	Complete Operation Mechanism with accessories of HSES for GIS	set	1				
AS9	Complete CT module for GIS	phase	2				
AS10	Complete VT module for GIS	phase	2				
AS11	Complete LA module for GIS	phase	2				
AS12	Gas pressure gauge	no	6				
AS13	Pressure Relief Device	no	6				
AS14	Rubber gaskets “O” rings and seals for SF6 gas	lot	1				
AS15	All types of control valves for SF6 gas	lot	1				
AS16	GIS-to-Air Bushing	phase	2				
AS17	Each type of Supporting insulator for GIS	set	3				
AS18	Each type of Spacer for GIS	set	4				
AS19	Set of special tools, gauges and instruments for operation and maintenance of GIS	set	2				
AS20	SF6 gas cylinders - 45 kg	no	10				
AS21	420kV CVT, Single-phase, 50Hz, 1425kVp BIL, 3 windings	No.	9				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
AS22	390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide	No.	9				
AS23	Each type of Clamps and Fittings (Minimum 2 nos. or 10% of supplied quantity, whichever is the highest)	lot	1				
BS	**245kV Switchgear, equipment and connection**						
BS1	Complete CB module for GIS	phase	2				
BS2	Complete Operation Mechanism with accessories of CB for GIS	set	1				
BS3	Tripping coil for GIS	no	6				
BS4	Closing coil for GIS	no	3				
BS5	Complete DS/ES module for GIS	phase	2				
BS6	Complete Operation Mechanism with accessories of DS/ES for GIS	set	1				
BS7	Complete HSES module for GIS	phase	2				
BS8	Complete Operation Mechanism with accessories of HSES for GIS	set	1				
BS9	Complete CT module for GIS	phase	2				
BS10	Complete VT module for GIS	phase	2				
BS11	Gas pressure gauge	no	6				
BS12	Pressure Relief Device	no	6				
BS13	Rubber gaskets “O” rings and seals for SF6 gas	lot	1				
BS14	All types of control valves for SF6 gas	lot	1				
BS15	GIS-to-Air Bushing	phase	2				
BS16	Each type of Supporting insulator for GIS	set	3				
BS17	Each type of Spacer for GIS	set	4				
BS18	Set of special tools, gauges and instruments for operation and maintenance of GIS	set	2				
BS19	SF6 gas cylinders - 45 kg	no	10				
BS20	198kV rated voltage, 158 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	no	4				
BS21	Each type of Clamps and Fittings (Minimum 2 nos. or 10% of supplied quantity, whichever is the highest)	lot	1				
CS	**145kV Switchgear, equipment and connection**						
CS1	Complete CB module for GIS	phase	3				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		(2)	(3) = (1) x (2)	
CS2	Complete Operation Mechanism with accessories of CB for GIS	set	1				
CS3	Tripping coil for GIS	no	6				
CS4	Closing coil for GIS	no	3				
CS5	Complete DS/ES module for GIS	phase	3				
CS6	Complete Operation Mechanism with accessories of DS/ES for GIS	set	1				
CS7	Complete HSES module for GIS	phase	3				
CS8	Complete Operation Mechanism with accessories of HSES for GIS	set	1				
CS9	Complete CT module for GIS	phase	3				
CS10	Complete VT module for GIS	phase	3				
CS11	Gas pressure gauge	no	6				
CS12	Pressure Relief Device	no	6				
CS13	Rubber gaskets “O” rings and seals for SF6 gas	lot	1				
CS14	All types of control valves for SF6 gas	lot	1				
CS15	Each type of Supporting insulator for GIS	set	3				
CS16	Each type of Spacer for GIS	set	4				
CS17	Set of special tools, gauges and instruments for operation and maintenance of GIS	set	2				
CS18	SF6 gas cylinders - 45 kg	no	10				
CS19	120kV rated voltage, 102 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	no	4				
CS20	Each type of Clamps and Fittings (Minimum 2 nos. or 10% of supplied quantity, whichever is the highest)	lot	1				
CS21	132kV XLPE Power Cable	m	500				
CS22	132kV Outdoor type Cable Sealing End	no.	3				
ES	**Power Transformers**						
	400/235/34.5kV Auto Transformer						
ES1	Each type of Bushings						
	a 420kV	no	3				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Code	Foreign Currency (in…….)		Remark
						Unit Price	Total Price	
						CIP	CIP	
				(1)		(2)	(3) = (1) x (2)	
	b	245kV	no	3				
	c	36kV	no	3				
	d	Neutral	no	1				
ES2	Buchholz Relay		Set	1				
ES3	Pressure Relief Device		Set	1				
ES4	WTI		Set	2				
ES5	OTI		Set	1				
ES6	Oil level monitor		Set	1				
ES7	Complete Cooling Fan module with Motor		Set	2				
ES8	Each type of Breathers module with Silicagel		Set	2				
ES9	Set of O-rings and Gaskets with cutting tools		Set	2				
ES10	Transformer oil 200 litter barrel		nos.	20				
ES11	Oil Insulation Tester		No	1				
ES12	Each type of Clamps and Fittings (Minimum 2 nos. or 10% of supplied quantity, whichever is the highest)		lot	1				
ES13	Set of special tools, gauges and instruments for operation and maintenance of Transformer and OLTC (To be listed up by Bidder)		Set	2				
230/135/34.5kV Auto Transformer								
ES1	Each type of Bushings							
	a	245kV	no	3				
	b	145kV	no	3				
	c	36kV	no	3				
	d	Neutral	no	1				
ES2	Buchholz Relay		Set	1				
ES3	Pressure Relief Device		Set	1				
ES4	WTI		Set	2				
ES5	OTI		Set	1				
ES6	Oil level monitor		Set	1				
ES7	Complete Cooling Fan module with Motor		Set	2				
ES8	Each type of Breathers module with Silicagel		Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		(2)	(3) = (1) x (2)	
ES9	Set of O-rings and Gaskets with cutting tools	Set	2				
ES10	Transformer oil 200 litter barrel	nos.	20				
ES11	Each type of Clamps and Fittings (Minimum 2 nos. or 10% of supplied quantity, whichever is the highest)	lot	1				
ES12	Set of special tools, gauges and instruments for operation and maintenance of Transformer and OLTC (To be listed up by Bidder)	Set	2				
FS	**Control, Protection, SAS and Metering**						
FS1	Each type of Protection Relays						
	a Line Differential Protection Relay with backup Distance Protection & Directional Earth Fault Protection Functions	no.	24				
	b Transformer Differential Relay	no.	3				
	c Directional & Non-directional Overcurrent and Directional & Non-directional Earth Fault Protection Relay	no.	4				
	d BCU	no.	4				
FS2	Heater	set	6				
FS3	Humidity Sensors	set	6				
FS4	Thermostat	set	6				
FS5	Tripping relays	set	8				
FS6	Each type of Trip circuit supervision relays (Bidder to list)	set	8				
FS7	Each type of MCB	set	2				
FS8	Ethernet Switches	nos.	2				
FS9	Relay Test Block & socket	no.	1				
GS	**DFDR**						
GS1	Each type MCBs	set	1				
GS2	Each type of Ethernet switches	set	1				
KS	**Battery, Charger & DC distribution**						
KS1	Each type of Fuses	set	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Code	Foreign Currency (in…….)		Remark
					Unit Price	Total Price	
					CIP	CIP	
			(1)		*(2)*	*(3) = (1) x (2)*	
KS2	Each type of MCB for battery	no.	2				
KS3	Each type of MCB for charger	no.	2				
LS	**LVAC distribution**						
LS1	3-phase set LVAC board incoming MCCB	set	1				
LS2	3-phase sets outgoing MCCBs	set	2				
LS3	1-phase sets outgoing MCBs	set	6				
SS	**Test Equipment**						
SS1	SF6 Multi-Analyser for measurement of % SF6, Moisture and SO2 concetration (DILO)	No.	1				
SS2	SF6 Gas leakage detector (infared type)	No.	1				
MS	**Maintenance Equipment**						
MS1	SF6 Gas Treatment Plant for Gas Filling, Recovery,Evacuation, Filtering, Drying and Storage (DILO)	No.	1				
MS2	Portable vacuum pump suitable for SF6 circuit breaker	No.	1				
MS3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2				
Total Price carried to Summary of Price Schedule (Spare, Maintanence & Test Equipement of S/S)							

Name of Bidder:

Signature of Bidder:

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Schedule B2 : Plant and Equipment Supplied from within the Employer's Country

New 400/230/132 kV Substation at Purbachal

(For deatailed description of the technical requirements please refer to clause 1.2.1: Technical Requirements for 400/230/132KV GIS Substation at Purbachal, Schedule A: Scope of Works, volume 3 of 3 of the bidding document)

Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1A	**420 kV switchgear, equipment connection and steel structures**					
1A1	420kV GIS Line Feeder Bays	Set	4			
1A2	420kV GIS Auto Transformer Feeder Bays	Set	3			
1A3	420kV Bus Coupler Bays	Set	2			
1A4	420kV GIS Bus Section Bays	Set	2			
1A5	420 kV GIS type three phase LA	Set	4			
1A6	420kV GIS type Bus FES and Bus VT	Set	4			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1A7	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2			
1A8	Standalone Partial Discharge measurement and analyzer system for Complete GIS	Lot	1			
	AIS Switchgear, Equipment & Structure					
1A9	390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	21			
1A10	420kV CVT, Single-phase, 50Hz, 1425kVp BIL, 3 windings	No.	12			
1A11	420kV, 4000A, single phase Wavetrap	No.	4			
1A12	**400kV Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 400kV Switchyard including LA, CVT and WT conncetion**					
	i. Tubular Conductor and/or Flexible Conductor	Lot	1			
1A13	**Insulator and fittings including all necessary clamps and connectors as required for completing 400kV GIS Switchyard**					
	i. Insulator	Lot	1			
	ii. Fittings & Clamps, Connector	Lot	1			
	iii. Nut-bolt	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
1A14	**Steel gantry each circuit of 400kV Transmission Line, Transformer & Equipment support structure including all necessary accessories required for completing 400kV GIS Switchyard**						
	i.	Steel Structure for T/L with Nut & Bolts					
	a)	Gantry Column	No.	5			
	b)	Beam	No.	4			
	ii	Equipment Structure					
	a)	LA	No.	21			
	b)	420kV CVT	No.	12			
	iii.	Nut-Bolt	Lot	1			
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1			
1B	**245 kV switchgear, equipment connection and steel structures**						
1B1	245kV GIS Line Feeder Bays		Set	2			
1B2	245kV GIS Auto Transformer Feeder Bays		Set	6			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1B3	245kV Bus Coupler Bays	Set	2			
1B4	245kV Bus Section Bays	Set	2			
1B5	245kV GIS type Bus FES and Bus VT	Set	4			
1B6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2			
	AIS Switchgear, Equipment & Structure					
1B7	198kV rated voltage, 158 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	24			
1B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**					
	i. Tubular Conductor and/or Flexible Conductor	Lot	1			
1B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**					
	i. Insulator	Lot	1			
	ii. Fittings & Clamps, Connector	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
	iii.	Nut-bolt	Lot	1			
1B10	**Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard**						
	i.	Steel Structure for T/L with Nut & Bolts					
	a)	Gantry Column	No.	3			
	b)	Beam	No.	2			
	ii.	Steel Structure for 400/230kV & 230/132kV Transformers with Nut & Bolts					
	a)	Gantry Column	No.	14			
	b)	Beam	No.	12			
	iii.	Equipment structure					
	a)	LA	No.	24			
	iv.	Nut & Bolts	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
	v. LV power & control cable tray including fitting, fixing accessories	Lot	1			
1C	**145 kV switchgear, equipment connection and steel structures**					
1C1	145kV GIS Line Feeder Bays	Set	6			
1C2	145kV GIS Auto Transformer Feeder Bays	Set	2			
1C3	145kV Bus Coupler Bays	Set	2			
1C4	145kV Bus Section Bays	Set	2			
1C5	145kV GIS type Bus FES and Bus VT	Set	4			
1C6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2			
	AIS Switchgear, Equipment & Structure					
1C7	**120kV rated voltage, 102 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type**	**No.**	**24**			
1C8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**					

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1			
1C9	**Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard**						
	i	Insulator, Post & Disk	Lot	1			
	ii	Fittings & Clamp, Connector	Lot	1			
	iii.	Nut-bolt	Lot	1			
1C10	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**						
	i.	Steel Structure for T/Lwith Nut & Bolts					
	a)	Gantry Column	No.	8			
	b)	Beam	No.	6			
	ii.	Equipment Structure					
	a)	LA	No.	24			
	iii.	Nut & Bolts	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
	iv.	LV power & control Cable tray including fitting, fixing accessories	Lot	1			
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1			
1D	**36kV Switchgears, equipment connection and steel structures**						
1D1	**36kV AIS Switchgears for Aux. Power Bays, comprises with:**						
	i)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, VCB with spring operating mechanism	Set	2			
	ii)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single vertical/horizontal break, post type, motor operated Disconnector with Earth Switch	Set	4			
	iii)	36kV, single-phase, 31.5kA/3sec, 50Hz, 170kVp BIL, Current Transformers	No.	6			
	iv)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	6			
	v)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	6			
	36kV AIS Switchgears for Unloaded tertiary Auto-Transformer Bays, comprises with:						

Name of Bidder: Signature of Bidder:

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Item No.		Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
1D1.x	i)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	9			
	ii)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	9			
1D2		Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 36kV Switchyard					
	i)	Tubular Conductor and/or Flexible Conductor	Lot	1			
1D3		Insulator and fittings including all necessary clamps and connectors as required for completing 36kV Switchyard					
	i)	Insulator, Post & Disk	Lot	1			
	ii)	Fittings & Clamps, Connector	Lot	1			
	iii)	Nut-bolt	Lot	1			
1D4		Steel structure for each circuit of Aux. power TR and Auto.TR tertiary side connection including all necessary accessories required for completing 36kV Switchyard					
	i)	Equipment Structure with Nut & Bolts	Lot	1			
	ii)	LV power & control cable tray including fitting, fixing accessories	Lot	1			
1D5		33kV Power Cable with associated material					
	i)	33kV, single phase, 300 sqmm XLPE cable	meter	50			
	ii)	33kV, single phase, outdoor cable termination with accessories	No.	12			
1E		**Power Transformers and Auxuliary Transformer**					

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1E1	400/235/34.5 kV, 520/750 MVA (ONAN/ONAF), threephase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and Remote Tap Changer Control (RTCC) Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	3			
1E2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for 400/235/34.5 kV auto transformers.	Set	3			
1E3	230/135/34.5 kV, 350/450 MVA (ONAN/ONAF), three phase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and RTCC Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2			
1E4	Potable dissolved gas monitoring system for transformer	Set	1			
1E5	33/0.415 kV, 500kVA, three phase outdoor type earthing/auxiliary Zig-Zag transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.	Set	2			
1E6	CAFS of Fire Fighting system for transformer with water feeding equipment					
	i) 400/235/34.5 kV Auto-transformer	set	3			
	ii) 230/135/34.5 kV Auto-transformer	set	2			
1F	**Control, Protection, Substation Automation & Metering**					
400kV Circuit						

Name of Bidder:

Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1F1	Control, protection and Monitoring including SAS Function for Overhead Line circuits, along with Control & Protection Cubicles	Set	4			
1F2	Control, protection and Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	Set	3			
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	Set	2			
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2			
1F5	Busbar Protection including SAS Function (400kV Circuit) [Main-1 & Mian-2, different make]	Set	2			
1F6	**Tariff metering comprises with :**	Lot	1			
	i. Meters (Main meter & Check meter in one set)	Set	7			
	ii. Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1			
230kV Circuits						
1F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	Set	2			
1F8	Control, Protection, Monitoring including SAS Function for Auto transformer (750MVA) circuits, along with Control & Protection Cubicles	Set	3			
1F9	Control, protection and Monitoring including SAS Function for Auto transformer (450MVA) circuits, along with Control & Protection Cubicles	Set	3			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	Set	2			
1F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2			
1F12	Busbar Protection including SAS Function (230kV Circuit)	Set	1			
1F13	**Tariff metering comprises with :**	Lot	1			
	i. Meters (Main & Check)	set	8			
	ii. Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1			
132kV Circuits						
1F14	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	set	6			
1F15	Control, Protection, Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	set	2			
1F16	Control, Protection, Monitoring & SAS for Bus Coupler circuits, including Control & Protection Cubicles	set	2			
1F17	Control, Protection, Monitoring & SAS Function for Bus section circuits, including Control & Protection Cubicles	set	2			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1F18	Busbar Protection including SAS Function (132kV Circuit)	set	1			
1F19	**Tariff metering comprises with :**	Lot	1			
	i) Meters (Main & Check)	Set	8			
	ii) Complete Panel including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1			
36kV Circuit						
1F20	Control, Monitoring, Protection & SAS function for 33kV station power system, including Control & Protection Cubicles	Set	2			
1F21	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-tranformer, including Control & Protection Cubicles (can be merged with TR main/backup protection)	Set	3			
1F22	**Tariff metering comprises with :**	Lot	1			
	i) Meters (Main & Check)	set	2			
	ii) Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1			
1F23	**Substation Automation system**	Lot	1			
1G	Digital Fault & Disturbance Recorder	Lot	1			
1H	**Power Cable & GIL**					

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1H1	420kV Gas Insulated Line (GIL) for seven (7) feeders, single phase encloser, which consist of four (4) T/L & three (3) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (25 - 140 meter). Actual payment shall be as per final design. The Length given here is as single phase length.	m	1800			
1H2	245kV Gas Insulated Line (GIL) for eight (8) feeders, single phase encloser, which consist of two (2) T/L &six (6) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (30 - 135 meter). Actual payment shall be as per final design. The Length given here is as single phase length	m	1800			
1H3	132kV, 2000sqmm (minimum), XLPE Power cable & termination					
	i. XLPE HV Power cable (Cable shall be laid in cable trench with flat formation arrangement)	m	1900			
	ii. Outdoor type Cable Sealing End per phase with required necessary accessories for line & transformer bays	Nos.	24			
1H4	**Steel structure for each circuit of 132kV cable connection**					
	i. Equipment Structure with Nut & Bolts					
	a) Outdoor type Cable Sealing End	Nos.	24			
1I	**Multicore Cables for control, protection, metering & power circuits**					
	i. LV Control Cable	Lot	1			
	ii. LV Power Cable	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1J	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.					
1J1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1			
1J2	Lightning Protection System for complete substation (overhead, mast type)	Lot	1			
1J3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2			
1K	**Batteries, Chargers & DC distribution board**					
1K1	**110V Ni-cad Batteries with chargers & distribution board**					
	i. for 400kV system					
	a) _110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2			
	b) _Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2			
	c) _110V DC Distribution panel, MCC type (LV S.W room, SPR, control Room) with Digital Display & Controller	Lot	1			
	d) Inverter, Input- AC & DC, output -AC 230V 5kVA 60min	set	2			
	ii. for 230kV & 132kV system					
	a) _110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2			
	c)	_110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller	Lot	1			
1K2	**48V Ni-cad Batteries with chargers & distribution board**						
	i.	_48V battery Banks, minimum 200Ah at the 5-hours rate of discharge	Set	2			
	ii.	_Charger (IGBT Type) each float charge shall not be less than 120A rating	Set	2			
	iii.	_48V DC Distribution Panel with Digital Display & Controller	Lot	1			
1L	**LVAC Distribution**						
1L1	AC 415V / 230V Distribution panels (MCC type, LV S.W room, Each Panel & Control room, Generator room etc) with Digital Display & Controller		Lot	1			
1L2	Tariff metering at LV side		Lot	1			
1M	**Civil Works, Building and Foundation (Details in Schedule B4)**						
1M1	Complete land development		Refer to Schedule B4				
1M2	Complete civil items required for outdoor works		Refer to Schedule B4				
	i.	Complete civil works for 420kV Indoor GIS Building including Protection & Metering Room, Control Room, 110V Battery Room, 48 Battery Room, Warehouse *etc.*					
	a)	_Foundation works	Refer to Schedule B4				
	b)	_Super structures	Refer to Schedule B4				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture *etc.*	Refer to Schedule B4				
	d)	_10 ton EOT crane (price for supply of EOT crane)	No.	1			
	e)	_Warehouse_separate spare materials by installing shelves and labels.	Refer to Schedule B4				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
1M3	ii.	Complete civil works for 245kV cum 132kV Indoor GIS Building including Protection & Metering Room, 110V Battery Room *etc.*	Refer to Schedule B4				
	a)	_Foundation works	Refer to Schedule B4				
	b)	_Super structures	Refer to Schedule B4				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Refer to Schedule B4				
	d)	_10 ton EOT crane (price for supply of EOT crane)	No.	1			
	iii.	Emergency auxulary power room & water feeding room	Refer to Schedule B4				
	a)	_Foundation works	Refer to Schedule B4				
	b)	_Super structures	Refer to Schedule B4				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Refer to Schedule B4				
	d)	_Complete civil work for CAF system including pipe network	Refer to Schedule B4				
1M4	Testing of Foundation		Refer to Schedule B4				
1N	**Lighting, small power, air conditioning and Ventilation, Fire Fighting System & CCTV**						
1N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and Ventilation (GIS hall, Batterys Rooms, other rooms, etc.) and emergency DC lighting for Indoor.		Lot	1			
1N2	Lighting (LED type) for outside building for security, roadway, switchyard		Lot	1			
1N3	Fire Fighting system for GIS Hall & Control Room						
	i)	Fire Fighting system For 230kV cum 132kV GIS Hall & Panel Room	Lot	1			
	ii)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	1			
	iii)	Fire Fighting system For Control Room	Lot	1			
1N4	Complete CCTV with motion sensor		Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
1O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for Communication and Protection at Local & Remote end substations** **- 87 or 21 relay for each transmission line protection (through fibre cores)** **- 21 relay carrier signal (main and back-up)** **- SCADA data from switchgear and control system** **- IP and Analog telephone system** **- Hot-line telephone system** **All PLC terminal equipment at remote end substations are ABB make**						
1O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising						
	i.	ADM with TP unit without booster with Panels (Front opening, Swing Frame type) & accessories	Set	1			
	ii.	IDF/SDF	Set	1			
	iii.	Cables	Lot	1			
	iv.	EOW telephone with board	Set	1			
	v.	Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories	Lot	1			
	vi.	All other Accessories not included above	Lot	1			
	Other Indoor equipment, at Local end SS						

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
1O2	i.	PABX Card (FXO)	Set	1			
	ii.	Primary phone (IP phone)	No.	2			
	iii.	Secondary phone (2W phone)	No.	10			
	iv.	Indoor MDF	Set	1			
1O3	Outdoor equipment, at Local end SS						
	i.	Underground optical fiber cable, armoured, 48 core	Lot	1			
	ii.	Pigtail cables	Lot	1			
	iii.	Outdoor termination box	Set	1			
1O4	Extension/Adaptation of Indoor Fibre Optic Multiplexer Equipment & system at remote end substations each comprising						
	i.	Optical STM-16 Card for each 400 kV line at remote end	Lot	1			
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1			
	iii.	Optical STM-4 Card for each 132 kV line at remote end	Lot	1			
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1			

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Local Currency (in BDT)		Remark
					Unit Price	Total Price	
					EXW	EXW	
				(1)	*(2)*	*(3) = (1) x (2)*	
	v.	Optical Booster, if required	Lot	1			
	vi.	Outdoor termination box	Set	1			
	vii.	Cables, ODF, MDF, panels as required	Lot	1			
1O5	PLC equipment at Local end SS						
	i.	Indoor PLC Equipment with all acessories & Panels (Front opening, Swing Frame type)	Set	4			
	ii.	Line matching unit	No.	8			
	iii.	Cables & other accessories for complete PLCC system	Lot	1			
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	1			
1O6	Installation, testing & commissioning		Lot	1			
1P	**SCADA system for Telecontrol and Telemetering**						
1P1	i.	Equipment at Substation					
	a)	Gateway (server, engineering software)	Set	2			
	b)	Ethernet Switch	Set	2			
	c)	Hardware Firewall	Set	1			
	d)	Complete Panel (Swing Frame type) including wiring, lighting, heater, humidity controller & other accessories	Lot	1			
	e)	Cables	Lot	1			
	f)	All Other Accessories	Lot	1			
	ii.	Integration work with Master & Backup NLDC including Engineering & Commissioning	Lot	1			
1R	**Generator for Emergency Aux. Power (with smoke reduction device)**						

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Local Currency (in BDT)		Remark
				Unit Price	Total Price	
				EXW	EXW	
			(1)	*(2)*	*(3) = (1) x (2)*	
1R1	250kW 0.415kV, 50Hz Diesel generator • Expected Operation Time 24h • Noise level Less than 55dB at a distance of 10m • Fuel Tank Capacity: Adequate capacity for three days'continuous operation • With Smoke reduction device	Set	1			
1S	**Other equipment**					
1S1	Scissor Lift : Battery type for one person / Minimum working height greater than 10m	Set	1			
1S2	Emergency Interphone (each room)	Lot	1			

Total Price(for New Purbachal 400/230/132kV SS) carried to Summary of Price Schedule
Total Price in words (for New Purbachal 400/230/132kV SS)……

Name of Bidder:

Signature of Bidder:

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Schedule B3: Design Services

New 400/230/132 kV Substation at PURBACHAL

Item No	Description of Required Services	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
				foreign portion	foreign portion	local portion	local portion
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5)=(1) x (4)*
1	Design and engineering services of the whole substation, local and foreign part	Lump sum	1				
2	Overvoltage and Insulation Co-ordination study for 400kV Substaion	Lump sum	1				
3	Relay Co-ordination study for the Substation with software	Lump sum	1				
New 400/230/132 kV Substation at Purbachal **Subtotal - to Schedule B5 - Grand Total**							

Name of Bidder: Signature of Bidder

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Schedule B4.1 : Installation and Other Services

New 400/230/132 kV Substation at Purbachal

(For deatailed description of the technical requirements please refer to clause 1.2.1: Technical Requirements for 400/230/132KV GIS Substation at Purbachal, Schedule A: Scope of Works, volume 3 of 3 of the bidding document)

Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1A	**420 kV switchgear, equipment connection and steel structures**						
1A1	420kV GIS Line Feeder Bays	Set	4				
1A2	420kV GIS Auto Transformer Feeder Bays	Set	3				
1A3	420kV Bus Coupler Bays	Set	2				
1A4	420kV GIS Bus Section Bays	Set	2				
1A5	420 kV GIS type three phase LA	Set	4				
1A6	420kV GIS type Bus FES and Bus VT	Set	4				
1A7	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1A8	Standalone Partial Discharge measurement and analyzer system for Complete GIS	Lot	1				
	AIS Switchgear, Equipment & Structure						
1A9	390kV rated voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	21				
1A10	420kV CVT, Single-phase, 50Hz, 1425kVp BIL, 3 windings	No.	12				
1A11	420kV, 4000A, single phase Wavetrap	No.	4				
1A12	**400kV Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 400kV Switchyard including LA, CVT and WT conncetion**						
	i. Tubular Conductor and/or Flexible Conductor	Lot	1				
1A13	**Insulator and fittings including all necessary clamps and connectors as required for completing 400kV GIS Switchyard**						
	i. Insulator	Lot	1				
	ii. Fittings & Clamps, Connector	Lot	1				
	iii. Nut-bolt	Lot	1				
	Steel gantry each circuit of 400kV Transmission Line, Transformer & Equipment support structure including all necessary accessories required for completing 400kV GIS Switchyard						

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1A14	i.	Steel Structure for T/L with Nut & Bolts						
	a)	Gantry Column	No.	5				
	b)	Beam	No.	4				
	ii	Equipment Structure						
	a)	LA	No.	21				
	b)	420kV CVT	No.	12				
	iii.	Nut-Bolt	Lot	1				
	iv.	LV power & control cable tray including fitting, fixing accessories	Lot	1				
1B	**245 kV switchgear, equipment connection and steel structures**							
1B1	245kV GIS Line Feeder Bays		Set	2				
1B2	245kV GIS Auto Transformer Feeder Bays		Set	6				
1B3	245kV Bus Coupler Bays		Set	2				
1B4	245kV Bus Section Bays		Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1B5	245kV GIS type Bus FES and Bus VT	Set	4				
1B6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities	Set	2				
	AIS Switchgear, Equipment & Structure						
1B7	198kV rated voltage, 158 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	24				
1B8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 230kV Switchyard**						
	i. Tubular Conductor and/or Flexible Conductor	Lot	1				
1B9	**Insulator and fittings including all necessary clamps and connectors as required for completing 230kV Switchyard**						
	i. Insulator	Lot	1				
	ii. Fittings & Clamps, Connector	Lot	1				
	iii. Nut-bolt	Lot	1				
	Steel gantry for each circuit of 245kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 230kV Switchyard						

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1B10	i.	Steel Structure for T/L with Nut & Bolts						
	a)	Gantry Column	No.	3				
	b)	Beam	No.	2				
	ii.	Steel Structure for 400/230kV & 230/132kV Transformers with Nut & Bolts						
	a)	Gantry Column	No.	14				
	b)	Beam	No.	12				
	iii.	Equipment structure						
	a)	LA	No.	24				
	iv.	Nut & Bolts	Lot	1				
	v.	LV power & control cable tray including fitting, fixing accessories	Lot	1				
1C	**145 kV switchgear, equipment connection and steel structures**							
1C1	145kV GIS Line Feeder Bays		Set	6				
1C2	145kV GIS Auto Transformer Feeder Bays		Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1C3	145kV Bus Coupler Bays		Set	2				
1C4	145kV Bus Section Bays		Set	2				
1C5	145kV GIS type Bus FES and Bus VT		Set	4				
1C6	Busbar extension module, each set comprises with sufficient buffer gas compartments and appropriate disconnect facilities		Set	2				
	AIS Switchgear, Equipment & Structure							
1C7	**120kV rated voltage, 102 kV(rms) continuous operating voltage at 50oC, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type**		**No.**	**24**				
1C8	**Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 132kV Switchyard**							
	i.	Tubular Conductor and/or Flexible Conductor	Lot	1				
1C9	**Insulator and fittings including all necessary clamps and connectors as required for completing 132kV Switchyard**							
	i	Insulator, Post & Disk	Lot	1				
	ii	Fittings & Clamp, Connector	Lot	1				
	iii.	Nut-bolt	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1C10	**Steel gantry for each circuit of 145kV Transmission Line, Transformer & Equipment support Structure including all necessary accessories required for completing 132kV Switchyard**							
	i.	Steel Structure for T/Lwith Nut & Bolts						
	a)	Gantry Column	No.	8				
	b)	Beam	No.	6				
	ii.	Equipment Structure						
	a)	LA	No.	24				
	iii.	Nut & Bolts	Lot	1				
	iv.	LV power & control Cable tray including fitting, fixing accessories	Lot	1				
	v.	HV power Cable tray including fitting, fixing accessories	Lot	1				
1D	**36kV Switchgears, equipment connection and steel structures**							
	36kV AIS Switchgears for Aux. Power Bays, comprises with:							
	i)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, VCB with spring operating mechanism	Set	2				

Name of Bidder: Signature of Bidder:

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Item No.		Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1D1	ii)	36kV, 630A, 31.5kA/3sec, 50Hz, 170kVp BIL, single vertical/horizontal break, post type, motor operated Disconnector with Earth Switch	Set	4				
	iii)	36kV, single-phase, 31.5kA/3sec, 50Hz, 170kVp BIL, Current Transformers	No.	6				
	iv)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	6				
	v)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	6				
1D1.x	**36kV AIS Switchgears for Unloaded tertiary Auto-Transformer Bays, comprises with:**							
	i)	36kV, 31.5kA/3sec, single-phase 50Hz, 170kVp BIL, inductive Voltage Transformers	No.	9				
	ii)	30kV rated voltage, 24 kV(rms) continuous operating voltage at 50°C, 10kA nominal discharge current, 50Hz, gapless metal oxide type, single phase Surge Arresters, outdoor type	No.	9				
1D2	Rigid tubular conductor and/or stranded conductors including accessories for each connection as required for completing 36kV Switchyard							
	i)	Tubular Conductor and/or Flexible Conductor	Lot	1				
1D3	Insulator and fittings including all necessary clamps and connectors as required for completing 36kV Switchyard							
	i)	Insulator, Post & Disk	Lot	1				
	ii)	Fittings & Clamps, Connector	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	iii) Nut-bolt	Lot	1				
1D4	Steel structure for each circuit of Aux. power TR and Auto.TR tertiary side connection including all necessary accessories required for completing 36kV Switchyard						
	i) Equipment Structure with Nut & Bolts	Lot	1				
	ii) LV power & control cable tray including fitting, fixing accessories	Lot	1				
1D5	33kV Power Cable with associated material						
	i) 33kV, single phase, 300 sqmm XLPE cable	meter	50				
	ii) 33kV, single phase, outdoor cable termination with accessories	No.	12				
1E	**Power Transformers and Auxuliary Transformer**						
1E1	400/235/34.5 kV, 520/750 MVA (ONAN/ONAF), threephase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and Remote Tap Changer Control (RTCC) Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	3				
1E2	On-line Dissolved Gas (multi-gas) & Moisture Analyzer system for 400/235/34.5 kV auto transformers.	Set	3				
1E3	230/135/34.5 kV, 350/450 MVA (ONAN/ONAF), three phase outdoor type auto transformer equipped with delta connected 33 kV tertiary winding (brought out to terminal bushings) and RTCC Panel. Direct Hot Spot Temperature measurement facility using fiber optic shall be available.	Set	2				
1E4	Potable dissolved gas monitoring system for transformer	Set	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1E5	33/0.415 kV, 500kVA, three phase outdoor type earthing/auxiliary Zig-Zag transformer and BCT with off-load tap changer, associated outdoor neutral CTs and steel support structures including all necessary connections.	Set	2				
1E6	CAFS of Fire Fighting system for transformer with water feeding equipment						
	i) 400/235/34.5 kV Auto-transformer	set	3				
	ii) 230/135/34.5 kV Auto-transformer	set	2				
1F	**Control, Protection, Substation Automation & Metering**						
400kV Circuit							
1F1	Control, protection and Monitoring including SAS Function for Overhead Line circuits, along with Control & Protection Cubicles	Set	4				
1F2	Control, protection and Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	Set	3				
1F3	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	Set	2				
1F4	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2				
1F5	Busbar Protection including SAS Function (400kV Circuit) [Main-1 & Mian-2, different make]	Set	2				
1F6	**Tariff metering comprises with :**	Lot	1				
	i. Meters (Main meter & Check meter in one set)	Set	7				
	ii. Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
230kV Circuits							
1F7	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	Set	2				
1F8	Control, Protection, Monitoring including SAS Function for Auto transformer (750MVA) circuits, along with Control & Protection Cubicles	Set	3				
1F9	Control, protection and Monitoring including SAS Function for Auto transformer (450MVA) circuits, along with Control & Protection Cubicles	Set	3				
1F10	Control, Protection, Monitoring including SAS Function for Bus Coupler circuits, along with Control & Protection Cubicles	Set	2				
1F11	Control, Protection, Monitoring including SAS Function for Bus section circuits, along with Control & Protection Cubicles	Set	2				
1F12	Busbar Protection including SAS Function (230kV Circuit)	Set	1				
1F13	**Tariff metering comprises with :**	Lot	1				
	i. Meters (Main & Check)	set	8				
	ii. Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
132kV Circuits							
1F14	Control, Protection, Monitoring including SAS Function for overhead line circuits, along with Control & Protection Cubicles	set	6				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1F15	Control, Protection, Monitoring including SAS Function for Auto transformer circuits, along with Control & Protection Cubicles	set	2				
1F16	Control, Protection, Monitoring & SAS for Bus Coupler circuits, including Control & Protection Cubicles	set	2				
1F17	Control, Protection, Monitoring & SAS Function for Bus section circuits, including Control & Protection Cubicles	set	2				
1F18	Busbar Protection including SAS Function (132kV Circuit)	set	1				
1F19	**Tariff metering comprises with :**	Lot	1				
	i) Meters (Main & Check)	Set	8				
	ii) Complete Panel including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
36kV Circuit							
1F20	Control, Monitoring, Protection & SAS function for 33kV station power system, including Control & Protection Cubicles	Set	2				
1F21	Control, Monitoring, Protection & SAS function for Unloaded tertiary side of Auto-tranformer, including Control & Protection Cubicles (can be merged with TR main/backup protection)	Set	3				
1F22	**Tariff metering comprises with :**	Lot	1				
	i) Meters (Main & Check)	set	2				
	ii) Complete Panel (Front opening, Swing frame type) including wiring, lighting, heater, humidity controller, TTB, MCBs & other accessories	Lot	1				
1F23	**Substation Automation system**	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1G	Digital Fault & Disturbance Recorder	Lot	1				
1H	**Power Cable & GIL**						
1H1	420kV Gas Insulated Line (GIL) for seven (7) feeders, single phase encloser, which consist of four (4) T/L & three (3) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (25 - 140 meter). Actual payment shall be as per final design. The Length given here is as single phase length.	m	1800				
1H2	245kV Gas Insulated Line (GIL) for eight (8) feeders, single phase encloser, which consist of two (2) T/L &six (6) T/R, terminating chambers complete with support structure, etc. The Length of GIL maybe different from each bay as per actual design (30 - 135 meter). Actual payment shall be as per final design. The Length given here is as single phase length	m	1800				
1H3	132kV, 2000sqmm (minimum), XLPE Power cable & termination						
	i. XLPE HV Power cable (Cable shall be laid in cable trench with flat formation arrangement)	m	1900				
	ii. Outdoor type Cable Sealing End per phase with required necessary accessories for line & transformer bays	Nos.	24				
1H4	**Steel structure for each circuit of 132kV cable connection**						
	i. Equipment Structure with Nut & Bolts						
	a) Outdoor type Cable Sealing End	Nos.	24				
1I	**Multicore Cables for control, protection, metering & power circuits**						
	i. LV Control Cable	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	ii. LV Power Cable	Lot	1				
1J	**Earthing and Lightning Protection system** Design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.						
1J1	Earthing system for complete substation (grounding mesh, grounding rod/ needle type grounding rod) including GIS Building	Lot	1				
1J2	Lightning Protection System for complete substation (overhead, mast type)	Lot	1				
1J3	3-phase Portable earthing devices (for maintenance) with connectors and telescopic glass fibre operating pole suitable for plant shall be supplied (for each voltage level, respectively)	Set	2				
1K	**Batteries, Chargers & DC distribution board**						
1K1	**110V Ni-cad Batteries with chargers & distribution board**						
	i. for 400kV system						
	a) _110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2				
	b) _Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2				
	c) _110V DC Distribution panel, MCC type (LV S.W room, SPR, control Room) with Digital Display & Controller	Lot	1				
	d) Inverter, Input- AC & DC, output -AC 230V 5kVA 60min	set	2				
	ii. for 230kV & 132kV system						
	a) _110V Battery Banks, minimum 400Ah at the 5-hours rate of discharge	Set	2				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	b)	_Charger (IGBT Type), each float charge shall not be less than 150A rating	Set	2				
	c)	_110V DC Distribution panel, MCC type (Panel Room) with Digital Display & Controller	Lot	1				
1K2	**48V Ni-cad Batteries with chargers & distribution board**							
	i.	_48V battery Banks, minimum 200Ah at the 5-hours rate of discharge	Set	2				
	ii.	_Charger (IGBT Type) each float charge shall not be less than 120A rating	Set	2				
	iii.	_48V DC Distribution Panel with Digital Display & Controller	Lot	1				
1L	**LVAC Distribution**							
1L1	AC 415V / 230V Distribution panels (MCC type, LV S.W room, Each Panel & Control room, Generator room etc) with Digital Display & Controller		Lot	1				
1L2	Tariff metering at LV side		Lot	1				
1M	**Civil Works, Building and Foundation**							
1M1*	Complete land development							
	i.	Complete compacted land development with carried/dredged earthfilling including approach road	CuM	378312				
	ii.	Slpoe protection						
	a)	_Slpoe (1V:2H) protection with turfing	sqm	6675				
	b)	_Slpoe (1V:2H) protection with CC block	sqm	6675				
	Complete civil items required for outdoor works							
	i	Outdoor gantry foundation in 400kV switchyard						
	a)	_Gantry column	Nos	5				
	ii	Outdoor equipment foundation in 400kV switchyard						
	a)	_SA/LA	Nos	21				
	b)	_CVT	Nos	12				
	c)	_Busduct support	Lot	1				
	iii.	Outdoor gantry foundation in 230kV switchyard						

Name of Bidder: Signature of Bidder:

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Item No.		Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1M2*	a)	_Gantry column	Nos	17				
	iv.	Outdoor equipment foundation in 230kV switchyard						
	a)	_SA/LA	Nos	24				
	v.	Outdoor gantry foundation in 132kV switchyard						
	a)	_Gantry column	Nos	8				
	vi.	Outdoor equipment foundation in 132kV switchyard						
	a)	_SA/LA	Nos	24				
	vii.	Outdoor equipment foundation 33kV switchyard						
	a)	_CB	Set**	2				
	b)	_DS	Set**	4				
	c)	_CT	Nos	6				
	d)	_IVT	Nos	15				
	e)	_SA/LA	Nos	15				
	f)	_Zigzag/auxilary transformer	Nos	2				
	g)	_Tertiary bus connection	Nos	2				
	viii.	Transformer foundation	Nos	5				
	ix.	Blast wall with foundation	Nos	4				
	x.	Property line demarkation	Meter	950				
	xi.	Security boundary wall for overall plan	Meter	857				
	xii.	Substation main gate	Nos	2				
	xiii.	Approach road (pavement width 6m)	Meter	60				
	xiv.	Internal road						
	a)	_6m wide road	Meter	400				
	b)	_4.5m wide road	Meter	850				
	c)	_3m wide road	Meter	50				
	xv.	Surface drain	Meter	858				
	xvi.	Cable trench/tunnel with soakpit						

Name of Bidder: Signature of Bidder:

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Item No.		Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	a)	_For LV control, communication, relay *etc.* cables	Lot	1				
	b)	_For HV power cables	Meter	280				
	xvii.	Whole substation surface finishing with drainage system including outlet (excluding surface drain)	Lot	1				
	xviii.	Gravelling in switchyard area	Lot	1				
	xix.	Septic tank (capacity: 25users for 5 years) and soakpit	Nos	4				
	xx.	Pump shed including deep tubewell, motor, pump, water reservoir, water pipe line, electrical connetion *etc.*	Nos	4				
	xxi.	Guard house	Nos	1				
	xxii.	Sentry post	Nos	4				
	xxiii.	Car port	Nos	1				
	xxiv.	RCC box culvert	Nos	1				
1M3	i.	Complete civil works for 420kV Indoor GIS Building including Protection & Metering Room, Control Room, 110V Battery Room, 48 Battery Room, Warehouse *etc.*						
	a)	_Foundation works	Lot	1				
	b)	_Super structures	Lot	1				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture *etc.*	Lot	1				
	d)	_10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1				
	e)	_Warehouse_separate spare materials by installing shelves and labels.	Lot	1				
	ii.	Complete civil works for 245kV cum 132kV Indoor GIS Building including Protection & Metering Room, 110V Battery Room *etc.*						
	a)	_Foundation works	Lot	1				
	b)	_Super structures	Lot	1				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	d)	_10 ton EOT crane installation arrangement (excluding price for supply of EOT crane)	Lot	1				
	iii.	Emergency auxulary power room & water feeding room						
	a)	_Foundation works	Lot	1				
	b)	_Super structures	Lot	1				
	c)	_All finish works like rendering, painting, water supply, sanitary, floor finish, furniture, *etc.*	Lot	1				
	d)	_Complete civil work for CAF system including pipe network	Lot	1				
1M4	Testing of foundation							
	i	Compression test of pile	No	5				
	ii	Uplift test of pile	No	3				
	* actual payment shall be as per actual work at site ** set means three phase							
1N	**Lighting, small power, air conditioning and Ventilation, Fire Fighting System**							
1N1	Indoor Lighting (LED type), small power, air conditioning (except GIS Hall) and		Lot	1				
1N2	Lighting (LED type) for outside building for security, roadway, switchyard		Lot	1				
1N3	Fire Fighting system for GIS Hall & Control Room							
	i)	Fire Fighting system For 230kV cum 132kV GIS Hall & Panel Room	Lot	1				
	ii)	Fire Fighting system For 400kV GIS Hall & Panel Room	Lot	1				
	iii)	Fire Fighting system For Control Room	Lot	1				
1N4	Complete CCTV with motion sensor		Lot	1				
1O	**Fibre Optic Multiplexer Equipment & PLC Equipment and System for**							
1O1	Indoor Fibre Optic Multiplexer, at Local end SS, Equipment each comprising							
	i.	ADM with TP unit without booster with Panels (Front opening, Swing Frame type) & accessories	Set	1				
	ii.	IDF/SDF	Set	1				
	iii.	Cables	Lot	1				
	iv.	EOW telephone with board	Set	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement		Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
					Unit Price	Total Price	Unit Price	Total Price
				(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
	v.	Panel including wiring, lighting, filtering fan, humidity controller, heater, power socket & other accessories	Lot	1				
	vi.	All other Accessories not included above	Lot	1				
1O2	Other Indoor equipment, at Local end SS							
	i.	PABX Card (FXO)	Set	1				
	ii.	Primary phone (IP phone)	No.	2				
	iii.	Secondary phone (2W phone)	No.	10				
	iv.	Indoor MDF	Set	1				
1O3	Outdoor equipment, at Local end SS							
	i.	Underground optical fiber cable, armoured, 48 core	Lot	1				
	ii.	Pigtail cables	Lot	1				
	iii.	Outdoor termination box	Set	1				
1O4	Extension/Adaptation of Indoor Fibre Optic Multiplexer Equipment & system at							
	i.	Optical STM-16 Card for each 400 kV line at remote end	Lot	1				
	ii.	Optical STM-4 Card for each 230 kV line at remote end	Lot	1				
	iii.	Optical STM-4 Card for each 132 kV line at remote end	Lot	1				
	iv.	Required no. of cards with 4 commands for distance protection after detail design	Lot	1				
	v.	Optical Booster, if required	Lot	1				
	vi.	Outdoor termination box	Set	1				
	vii.	Cables, ODF, MDF, panels as required	Lot	1				
1O5	PLC equipment at Local end SS							
	i.	Indoor PLC Equipment with all acessories & Panels (Front opening, Swing Frame type)	Set	4				
	ii.	Line matching unit	No.	8				
	iii.	Cables & other accessories for complete PLCC system	Lot	1				
	iv.	Indoor PLC Equipment & accessories as complete system for Remote end station	Lot	1				
1O6	Installation, testing & commissioning		Lot	1				

Name of Bidder: Signature of Bidder:

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Item No.	Description of Equipment Requirement	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*	*(4)*	*(5) = (1) x (4)*
1P	**SCADA system for Telecontrol and Telemetering**						
1P1	i. Equipment at Substation						
	a) Gateway (server, engineering software)	Set	2				
	b) Ethernet Switch	Set	2				
	c) Hardware Firewall	Set	1				
	d) Complete Panel (Swing Frame type) including wiring, lighting, heater,	Lot	1				
	e) Cables	Lot	1				
	f) All Other Accessories	Lot	1				
	ii. Integration work with Master & Backup NLDC including Engineering &	Lot	1				
1R	**Generator for Emergency Aux. Power (with smoke reduction device)**						
1R1	250kW 0.415kV, 50Hz Diesel generator	Set	1				
1S	**Other equipment**						
1S1	Scissor Lift : Battery type for one person / Minimum working height greater than	Set	1				
1S2	Emergency Interphone (each room)	Lot	1				

Total Price (for New Purbachal 400/230/132kV SS) carried to Summary of Price Schedule
Total Price in words (for New Purbachal 400/230/132kV SS)……

Name of Bidder: Signature of Bidder:

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Schedule B4.2: Installation and Other Services

Item No.	Description of Required Services	Unit	Quantity	Foreign Currency (in USD)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
			(1)	*(2)*	*(3) = (1) x (2)*		
2	**Additional Services (Provisional Sum)***						
2.1	Employer's Factory Acceptance Tests Witness (refer to clause 1.3 (b), Scope of Works, Volume 2 of the bdding document)	Lot	1	115500	115500	-	-
2.2	International Training (refer to clause 1.3 (a), Scope of Works, Volume 2 of the bdding document)	Lot	1	66000	66000	-	-
2.3	Local O&M Training (refer to clause 1.3 (c), Scope of Works, Volume 2 of the bdding document)	Lot	1	33000	33000	-	-
Total Price for Additional Services					**214500**		
(carried to Schedule-5 : Grand Summary)							

These costs are fixed ceiling and will be included in total price. But the payment shall be at actual.

Schedule B5: Grand Summary

		Total price	
		Foreign Currency (in…….)	Local Currency (in BDT)
New 400/230/132 kV Substation at PURBACHAL			
Schedule No. B1:	Plant and Equipment Supplied from Outside the Employer's Country		
Schedule No.B2:	Plant & Equipment Supplied from within the Employer's Country		
Schedule No. B3:	Design Services		
Schedule No. B4.1:	Installation and Other Services		
New 400/230/132 kV Substation at PURBACHAL Grand Total			
Mandatory Spare, Maintanence & Test Equipement			
Schedule No. B1:	Mandatory Spare, Maintanence & Test Equipement Supplied from Outside the Employer's Country		
Mandatory Spare, Maintanence & Test Equipement Grand Total			
Additional Services			
Schedule No. B4.2:	Installation and Other Services : Additional Services (Provisional Sum)	USD 214,500.00	
Additional Services		**USD 214,500.00**	
Grand Total			
Grand Grand Total			

Name of Bidder:

Signature of Bidder:

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Schedule B6: Recommended Spare Parts

No	Description	Unit	Quantity	Foreign Currency (in…….)		Local Currency (in BDT)	
				Unit Price	Total Price	Unit Price	Total Price
				CIP	CIP	EXW	EXW
			(1)	*(2)*	*(3)=(1)x(2)*	*(4)*	*(5)=(1)x(4)*

Name of Bidder: Signature of Bidder:

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Country of Origin

Item	Country	Code