



Bay of Bengal Power Company (Pvt.) Limited

(A Joint Venture of BPDB and China Huadian Hong Kong Co. Ltd, China)

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BAY OF BENGAL POWER COMPANY LIMITED

TENDER DOCUMENT FOR

Volume 2 (B)

**Design, Supply, Installation, Testing & Commissioning of 160
MW Solar (AC) PV Power Plant at Moheshkhali Peninsula,
Cox's Bazar District, Bangladesh.
(One Stage Two Envelope Tendering Method)**

AGAINST TENDER REFERENCE No.: BBPCL/Maheshkhali-1320MW/XXXX/2024

Dated: 23.04.2024

April'2024

1. Solar Photovoltaic Module

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
1.	Name of the Manufacturer	To be mentioned	
2.	Type/ Model Number	To be mentioned	
3.	Address of the Manufacturer	To be mentioned	
4.	Standard	Design, manufacturing, performance & testing shall be in accordance to the IEC, BS, BDS or equivalent international standards.	
5.	Type of solar Cells	Mono-Crystalline, Bifacial	
6.	Rated Power /Maximum Power (Pmax)	Minimum 550 Wp at STC, (Standard Testing Conditions)	
7.	Power Tolerance (STC)	0~+3%	
8.	Voltage at Pmax (V mp)	Min 41.50 V	
9.	Current at Pmax (I mp)	Min 13.12A	
10.	Open circuit voltage (Voc)	Min 49.8 V	
11.	Temperature Co-efficient (Pmax)	Maximum -0.34%/°C	
12.	Temperature Co-efficient (Voc)	Maximum -0.265%/°C	
13.	Module Efficiency at STC	Minimum 21.30%	
14.	Front Glass	2.0 mm, High Transmission, Anti-Reflection Coating, Tempered glass.	
15.	Back Glass	2.0 mm Heat Strengthen glass	
16.	Frame	Anodized Aluminum Alloy	
17.	Operating Temperature	-40°C to +85°C	
18.	Nominal Operating cell temperature (NOCT)	45 ± 2 °C	
19.	Static Load front and back (e.g. wind)	As per Employer's Requirement Technical part 1	
20.	Junction Box	IP 68 rated	
21.	Connector	MC4/ T6	
22.	Cables Cross Section	Min 4.0 mm ²	
23.	Cable Length	As required	
24.	Maxm System Voltage	1500V	

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Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
25.	Power Bifaciality	Min 70%	
26.	Module Fire Performance	UL type 29 or IEC class c	
27.	Expected Life	25 years	
28.	Maximum Annual Degradation over 25 years life of Module	0.45% (The first annual degradation of the module is $\leq 2\%$).	
29.	Warranty	Minimum 20 years	
30.	Certifications	UL, TUV, ISO	
31.	Weight and Dimension	To be mentioned	
32.	Catalogue	To be submitted	

2. Compact Inverter and Transformer Box

Sl. No	Description	Requirement	Manufacturer's Particulars
1.	Name of the Item	Grid Tied Inverter	
2.	Name of the Manufacturer	To be mentioned	
3.	Address of the Manufacturer	To be mentioned	
4.	Standard	Design, manufacturing, performance & testing shall be in accordance to the IEC, BS, BDS, CE, EN, IEEE or equivalent international standards.	
5.	Certifications	To be mentioned	
6.	Model number	To be mentioned	
INPUT			
7.	Max PV input Voltage	1500	
8.	Minimum No of Independent MPP input	2 Nos	
9.	Nominal AC Output Power	Min 3125 KW @ 50°C /3437 KW @ 45°C	
10.	AC Frequency, adjustable	50 ± 5% Hz	
11.	Nominal AC Voltage Range	20 KV to 35 KV	
12.	AC Grid Connection	3 phases, 4 wire	
13.	Output Current	To be mentioned	
14.	Idle power	To be mentioned	
15.	Total Harmonic Distortion (THD)	< 3% (at nominal power)	
16.	Inverter Euro efficiency	Minimum 98%	
17.	Power Factor	0.8 leading to 0.8 lagging	
18.	Transformer Rated Power	Min 3150 KVA	
19.	LV/MV Voltage	.6KV / 33KV	
20.	Vector group	Dyn11	
21.	Transformer cooling	ONAN	
22.	Input side disconnecting point	DC LBS	
23.	Output side disconnecting point	AC CB	
24.	DC Overvoltage protection	To be Incorporated	
25.	Ground fault monitoring	To be Incorporated	
26.	DC Reverse Polarity Protection	Load break switch + Fuse	

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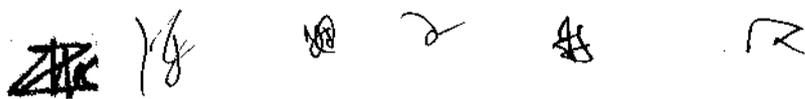
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Sl. No	Description	Requirement	Manufacturer's Particulars
27.	Anti-Islanding Protection	To be incorporated	
28.	Display monitor	To be provided	
29.	Internal consumption at standby	< 450W	
30.	Grid Support	Active & Reactive Power control and Power ramp rate control	
31.	Communication	RS 485, Ethernet / Optical fibre	
32.	Dimension	To be mentioned	
33.	Warranty	Minimum 5 years	
34.	Catalogue	To be submitted	
35.	Inverter corrosion protection requirement	The inverter corrosion protection requirement is minimum C5-M. The corrosion protection requirement shall be supported by test report.	

3. The Guaranteed technical particulars of the String Inverter

Sl. No.	Parameter	Minimum Requirement	To be Proposed by the Bidder
1.	Manufacturer	To be mentioned	
2.	Country of Manufacture	To be mentioned	
3.	Model	To be mentioned	
4.	Type	central, line or self-commutated	
5.	Transformer-less	Yes	
Input (DC)			
6.	Max. Input Voltage	1500V	
7.	Number of MPPT Tracker	To be mentioned	
8.	Max Current under MPPT	65A	
9.	MPPT Voltage Range (V)	500-1500	
10.	Max Number of Connector per MPPT	To be mentioned	
11.	Max. input current/string (A)	To be mention	
Output (AC)			
12.	AC nominal power (KVA)	Min. 330	
13.	Nominal AC Active power (KW)	Min 300	
14.	Output Power Surge (10 sec.)	To be mentioned	
15.	Output Power Surge (1 sec.)	To be mentioned	



16.	Nominal AC voltage (V)	800V	
17.	Output Voltage Tolerance	To be mentioned	
18.	Nominal AC current (A)	Min 216A	
19.	AC frequency (Hz)	50Hz	
20.	Min Power factor (cos phi)	To be mentioned	
21.	Max THD (%)	1 % [Supported by Test Report]	
22.	Minimum euro efficiency (%)	≥98%	
23.	Maximum efficiency (%)	≥99%	
24.	CEC efficiency (%)	To be mentioned	
25.	Nominal conversion efficiency at 25%, 50%, 75% and 100% load	To be mentioned	
26.	Power Consumption (% at nominal power and % at standby)	To be mentioned	
27.	Operating temperature range (°C - °C)	To be mentioned	
28.	Adjustable power range	.8 lag to .8 lead	
29.	Loading Capability (% of rated load)	To be mentioned	
30.	Degree of Protection (IP)	IP66	
31.	Noise emission (DB)	To be mentioned	
32.	PV String Current Monitoring	Yes	
33.	Anti Islanding Protection	Yes	
34.	Surge Protection (DC & AC)	Type II	
35.	Smart String-Level Disconnect (SSLD)	Yes	
36.	AC Overcurrent Protection	Yes	
37.	Ground fault protection & monitoring	Yes	
38.	DC Reverse-polarity Protection	Yes	
39.	Operating Temperature	Upto 60°C	
40.	Inverter corrosion protection requirement	The inverter corrosion protection requirement is minimum C5-M. The corrosion protection requirement shall be supported by test report.	
41.	Communication	RS 485/MBUS	
42.	AC Connector	Waterproof	
43.	Overall dimensions (mm x mm)	To be mentioned	
44.	Weight (kg)	To be mentioned	
45.	Minimum product warranty period	To be mentioned	

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4. Specification of LV/ 33KV Transformer in case of string inverter offered

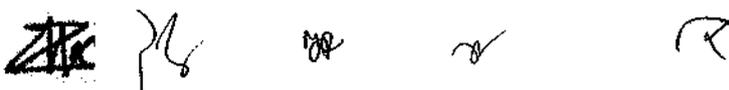
SL	Description	Minimum Requirement	Guaranteed Value
1.	Manufacturer Name	to be mentioned	
2.	Country of Origin	to be mentioned	
3.	Model Number	to be mentioned	
4.	AC Power @ 40°C	to be mentioned	
5.	Rated Input Voltage	800 V	
6.	LV Main Inputs	ACB (4,000 A / 800 V / 3P, 2 x 1 pcs), MCCB (400 A / 800 V / 3P, 2 x 15 pcs)	
7.	Rated Output Voltage	33KV	
8.	Frequency	50 Hz	
9.	Transformer Type	Oil-immersed, Conservator Type / Dry	
10.	Transformer Cooling Type	ONAN/ ONAF	
11.	Transformer Tappings	± 2 x 2.5%	
12.	Transformer Oil Type	Mineral Oil (PCB Free)	
13.	Transformer Vector Group	DYn11	
14.	Transformer Min. Peak Efficiency Index	In Accordance with EN 50588-1	
15.	RMU Type	SF6 Gas Insulated	
16.	RMU Transformer Protection Unit	MV Vacuum Circuit Breaker Unit	
17.	RMU Cable Incoming / Outgoing Unit	Direct Cable Unit or Cable Load Break Switch Unit	
18.	Auxiliary Transformer	Dry Type Transformer, 5 kVA, Single-phase, li0	
19.	Output Voltage of Auxiliary Transformer	230 Vac	
20.	Transformer Monitoring & Protection	Oil Level, Oil Temperature, Oil Pressure and Buchholz	
21.	Protection Degree of MV & LV Room	IP 54	
22.	Internal Arcing Fault of STS	IAC A 20 kA 1s	
23.	MV Relay Protection	50/51, 50N/51N	
24.	LV Overvoltage Protection	Type I+II	
25.	Anti-rodent Protection	C5-Medium in accordance with ISO 12944	
Features			
26.	2 kVA UPS	to be mentioned	
27.	MV Surge Arrester for Transformer	to be mentioned	
	Anti-rodent Protection	C5-Medium in accordance with ISO 12944	
General			
30.	Dimensions (W x H x D)	to be mentioned	
	Weight	to be mentioned	
	Operating Temperature Range	-25°C ~ 60°C 4 (-13°F ~ 140°F)	
	Relative Humidity	0% ~ 95%	
	Max. Operating Altitude	1,000 m 5	
	MV-LV AC Connections	Prewired and Pretested, No Internal Cabling Onsite	

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	LV & MV Room Cooling	Smart Cooling without Air-across for Higher Availability	
	Communication	Modbus TCP, Preconfigured with SmartACU2000D	
	Applicable Standards	IEC 62271-202, EN 50588-1, IEC 60076, IEC 62271-200, IEC 61439-1	

3. 33/132KV 100MVA Power Transformer

SI No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1.	RATING AND PERFORMANCE			
1.1	a) Manufacturer's Name	-	To be mentioned	
	b) Manufacturer's address with website, official domain email	-	To be mentioned	
	c) Country of Origin	-	To be mentioned	
	d) Year of Manufacturing	Year	Not before 2023	
1.2	Manufacturer's Model no.	-	To be mention	
1.3	Rated Capacity	MVA	100 MVA ONAN	
1.4	No. of phases	-	3	
1.5	Rated frequency	Hz	50	
1.6	Normal transformation ratio at No-load and Principal Tap	KV	33/132	
1.7	Installation	-	Outdoor	
1.8	Type of Transformer	-	Core, Conservator, Oil immersed	
1.9	Direction of normal power flow	-	LT -HT	
1.10	No of windings	Nos	2	
1.11	Bushing materials	-	Porcelain/Polymer	
1.12	Type of cooling	-	To be mentioned	
1.13	Coolant	-	To be mentioned	
1.14	Type of earthing	-	Through NGR/ Effectively earth	
1.15	Type of base	-	To be mention	
1.16	Vector group	-	Ynd11	
1.17	No Load Losses at rated voltage, ratio and frequency	KW	To be mention	
1.18	Full Load Losses at rated voltage, normal ratio & frequency in ONAF condition at 75 ⁰ C	KW	To be mention	
1.19	Full Load losses at rated voltage, normal ratio & frequency in ONAN condition at 75 ⁰ C.	KW	To be mentioned	
1.20	Auxiliary Losses		To be mentioned	
1.21	Total losses		To be mentioned	
1.22	No Load Current	%	~0.10	
1.23	Impedance (Rated Tap)	Ud%	7.58	
1.24	Insulation Level LV Side HV Side		170 KV 550KV	



SI No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1.25	Max. Temp. Rise over 40 ⁰ C of ambient (at CMR & normal tap change position) supported by Design Calculation sheet (to be enclosed) on the basis of DesignData: -			
	a) Winding Temp. Rise	0C	65	
	b) Top Oil Temp. Rise	0C	55	
	TEST VOLTAGE:			
1.26	Impulse front wave test voltage (1.2/50micro sec. wave shape): a) High voltage side b) Low voltage side	kV kV	To be mentioned	
1.27	Power Frequency withstand test voltage for 1 (one) minute: a) High voltage side b) Low voltage side	kV kV	To be mentioned	
1.28	Short Circuit Current		40KA, 3 sec	
1.29	Impedance voltage at 75 0C and at normal ratio and rated frequency and at ONAN condition (supported by type test report).	%	10.5 %	
1.30	All windings shall have uniform insulations	-	Yes	
2.	VOLTAGE CONTROL (OLTC)			
2.1	Type of Tap Changer control	-	On load auto regulation and remote & manual control	
2.2	OLTC, MDU & AVR Manufacturer's name & country	-	MR, Germany/ABB, Sweden/ HM China	
2.3	Year of Manufacturing	Year	Not before 2023	
2.4	Model Number		To be mentioned	
2.5	Nos. of tapping	-	To be mentioned	
2.6	Power Frequency withstand test voltage between first and last contracts of the selector switch between diverter & switch contract.	kV	75	
2.7	Rated Voltage for control circuit		To be mentioned	
2.8	Power Supply for control motor		To be mentioned	
3.	GENERAL			
3.1	Core Manufacturer's Name & Address		To be mentioned	
3.2	Material of core & grading		To be mentioned	
3.3	Core Loss/ Kg, supported by Characteristic Curve (to be submitted)		To be mentioned	
3.4	Thickness of core, mm		To be mentioned	
3.5	Core Dia, mm		To be mentioned	
3.6	Total weight of core, Kg		To be mentioned	
3.7	Maximum flux density in iron at normal voltage and frequency and at normal ratio (ONAF condition) a) Cores b) Yokes	Tesla Tesla	< 1.7 To be mentioned	
3.8	(a) Maximum current density in HV winding at Continuous Maximum Running (CMR) (b) Cross section of HV winding	A/m m2 mm2	< 2.5	

SI No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
3.9	(a) Maximum current density in LV winding at Continuous Maximum Running (CMR) (b) Cross section of LV winding	A/m	< 2.5	
4.	DETAILS OF CONSTRUCTION			
4.1	Types of winding: a) HV b) LV	-	To be mentioned	
4.2	Material of windings	-	copper	
4.3	Winding resistance of: a) H.T. winding, b) L.T. winding,	Ohm. Ohm.	To be mentioned To be mentioned	
4.4	Outer, Inner & Mean dia of copper winding: a) H.T. winding, b) L.T. winding,	mmmm	To be mentioned To be mentioned	
4.5	Size of Copper conductor/bar: a) H.T. winding SWG, dia. in mm / area in mm ² b) L.T. winding SWG, area in mm ²		To be mentioned To be mentioned	
4.6	Number of Turns: a) HT winding. b) LT winding	nos. nos.	To be mentioned To be mentioned	
4.7	Copper weight of windings: a) HT winding b) LT winding	Kg Kg	To be mentioned To be mentioned	
4.8	Total weight of copper windings	Kg	To be mentioned	
4.9	Vacuum withstand capability of the tank			
	Main tank	Kpa	To be mentioned	
	Conservator	Kpa	To be mentioned	
	Radiators	Kpa	To be mentioned	
4.10	Provision of tank earthing and Core earthing	-	Yes	
4.11	Bladder / Air bag in Conservator	-	Yes	
4.12	Material used for gaskets for oil tight joints	mm	To be mentioned	
4.13	Type of winding connections (Crimped or brazed)	-	To be mentioned	
5.	RADIATORS			
5.1	Thickness of radiator plates/ cooling tubes	mm	To be mentioned	
5.2	Equipment for ON cooling state a) radiators on main tank	-	To be mentioned	
5.3	Number of radiators per transformer	Nos.	To be mentioned	
5.4	Rating of each radiator bank	KW	To be mentioned	
5.5	Power of each fan	KW	To be mentioned	
5.6	Nos. of fans	Nos.	To be mentioned	
6.	Oil Volume and Weight			
6.1	Type of oil		Type- A, Unused insulating mineral oil, free	



Sl No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
			from PCB (Polychlorinated biphenyl)	
6.2	Manufacturer Name of oil		Shall be mentioned	
6.3	Breakdown Voltage at 2.5mm gap between electrodes		>50 kV	
6.4	Density at 20 ⁰ C		0.895 g/cm ³ (maximum)g/cm ³ (maximum)	
6.5	Flash point (Closed cup)		140 ⁰ C (minimum)	
7.	TRANSFORMER BUSHING INSULATORS			
7.1	Insulator material	-	Porcelain/Polymer	
7.2	Bushing Current Rating at 75°C	A	To be mentioned	
7.3	Insulator type and rated voltage	-	To be mentioned	
7.4	Total creepage distance of shedding	mm	Min. 25mm per KV	
7.5	Rated Short Circuit Current withstand capability		40kA, 3 sec.	
8.	CT of Bushing			
8.1	Manufacturer's name & country	-	To be mentioned	
9.	Marshalling Box/ Kiosk		Shall be provided	
10.	Silica Gel Breather		Shall be provided	
11.	Oil Temperature Indicator			
	Alarm contact		To be mentioned	
	Trip Contact		To be mentioned	
	Alarm & Trip Range		To be mentioned	
12.	Winding Temperature Indicator			
	Alarm contact		To be mentioned	
	Trip Contact		To be mentioned	
	Alarm & Trip Range		To be mentioned	
13.	Dial Thermometer			
	Alarm Contact		To be mentioned	
	Trip Contact		To be mentioned	
14.	Buchholz relay (Both for main tank & OLTC)		Yes	
	Make/Model Number		To be mentioned	
	Alarm contact		To be mentioned	
	Trip Contact		To be mentioned	
15.	PRD (Both for main tank & OLTC)		Yes	
	Make/Model Number		To be mentioned	
	Alarm contact		To be mentioned	
	Trip Contact		To be mentioned	
16.	Is terminal permanent terminal marking provided?		Yes	
17.	Parallel operation of identical transformer		Required	
18.	Guaranteed Noise level as per IEC 551	db	To be mentioned	
19.	Harmonics			
	R.M.S. value of the fundamental current	Amp	To be mentioned	
20.	Type of paint applied internally		To be mentioned	
21.	Type of paint applied externally		To be mentioned	

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Sl No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
22.	Type of weatherproof anti rust material primer		To be mentioned	
23.	Dimension of the transformer			
	Length	mm	To be mentioned	
	Width	mm	To be mentioned	
	Height	mm	To be mentioned	
24.	Standard		IEC 60044, IEC 60076 IEC 60137, IEC 60214 IEC 60354, IEC 60529 IEC 60815, IEC 60947 NEMA TR-1 CENELEC EN 50216	

4. Guaranteed Technical Particulars of 132kV Indoor Type Gas insulated switchgear (GIS) with Protection, Control and Metering Equipment

132kV GIS (Plant Side)				
Sl No	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2023	
2.	Manufacturer's Model no.	-	To be mentioned	
3.	Manufacturer & country of origin	-	To be mentioned	
4.	Applied Standard	-	Latest version of IEC 62271 fully complied	
5.	System nominal voltage	kV	132	
6.	Maximum System Voltage	kV	145	
7.	Rated Frequency	Hz	50	
8.	Material of Bus-Bar	-	HDHC Copper	
9.	Busbar Scheme	-	Double Bus with Bus Couple	
10.	Installation	-	Free Standing	
11.	Rated Current for Main Bus (each bus section): Double Bus (As per scope)	Amps	2000	
12.	Cross Section of bus bar	mm ²	To be mentioned	
13.	Rated short time withstand current	kA	40	
14.	Short time current rated duration	Sec.	3	

15.	Rated peak withstand current	kA	100	
16.	Pressure relief device is integrated with each gas chamber	-	Yes	
17.	Mimic diagram is depicted in front of switchgear panel	-	Yes	
18.	Electrical and Mechanical interlock between Circuit breaker, isolator and earth switch	-	Yes	
19.	Capacitive Voltage Indicator with Interlock contact for ES operation	-	Yes	
20.	Secondary Circuits:			
	Rated Auxiliary AC Supply for Heater & Lighting		230 V AC	
	Auxiliary AC Supply Voltage Limits for Proper Operation		+15% ~ -15% of the Rated Supply Voltage	
	Frequency Limits for Proper Operation		+5% ~ -5% of the Rated Frequency	
	Rated Auxiliary DC Supply for Control & Signaling Circuit		220 V DC	
	Auxiliary DC Supply Voltage Limits for Proper Operation		+20% ~ -30% of the Rated Supply Voltage	
21.	Solid Insulators			
	Type of solid insulators	-	disc type	
	Material of solid insulator		To be mentioned	
	Discharge level at 110% of the rated voltage	pC	10	
	Gas tight disc type insulator:			
	Bursting pressure	Bar	To be mentioned	
	Routine test pressure	Bar	To be mentioned	
22.	Insulation Medium			
	Insulation Medium		SF6	
	Max. permissible moisture content	ppmv	700	
	Max. permissible air content	vol%	10	

23.	132kV Circuit Breaker			
	Description of the Item	-	SF6 Circuit Breaker	
	Country of Origin	-	To be mentioned	

Standard	-	IEC 62271	
Certifications	-	To be mentioned	
Model Number	-	To be mentioned	
Rated Frequency	Hz	50	
System Nominal Voltage	kV	132	
Maximum system Voltage	kV	145	
Rated Nominal Current			
For 132kV Line Feeder	A	2000	
For 132/33kV Transformer Feeder	A	1250	
For 132kV Bus Coupler bay	A	2000	
Number of Breaks Per Phase	-	To be mentioned	
Insulation media	-	SF6	
Interrupting Medium	-	SF6	
Basic Insulation Level	kV peak	650 (1.2/50 μ s)	
Power Frequency Withstand Voltage	kV	275 (For 1 Minute @ 50 Hz)	
First pole to clear factor	-	To be mentioned	
Rated Breaking Capacity:			
(i) Symmetrical, rms		40 kA	
(ii) Asymmetrical, rms		To be mentioned (Including DC)	
Rated Short Circuit Making Current		100 kA (Peak)	
Rated Short Time Current Withstand Capability for 3 second		40 kA	
Rate of Rise of Recovery Voltage		0.57 kV/ μ s	
Rated breaking current, small capacitive current			
Line charging	-	To be mentioned	
Cable charging	-	To be mentioned	
Capacitor bank	-	To be mentioned	
Rated breaking current, small inductive current			
Unloaded transformer	-	To be mentioned	
Transformer loaded with reactor	-	To be mentioned	
Shunt reactors	-	To be mentioned	
Switching overvoltage	p.u.	2.5	
Re-ignition and Re-strike free		Shall Comply	

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	Operation			
	Rated Auxiliary AC Supply for Spring Charge Motor, Lamp & Heater		230 V AC	
	Auxiliary AC Supply Voltage Limits for Proper Operation		+15% ~ -15% of the Rated Supply Voltage	
	Frequency Limits for Proper Operation		+5% ~ -5% of the Rated Frequency	
	Rated Auxiliary DC Supply for Control Circuit		220 V DC	
	Auxiliary DC Supply Voltage Limits for Proper Operation		+20% ~ -30% of the Rated Supply Voltage	
	Type of Circuit Breaker operating mechanism (open/close)		Motor- Wound Spring	
	Nos. of operating mechanism per circuit breaker			
a	Line Bays	Pcs	3	
b	Transformer Bays	PCs	1	
c	Bus Coupler Bays	Pcs	1	
	Number of Tripping Coil per operating mechanism	Nos.	2	
	Number of Closing coil per operating mechanism	Nos.	1	
	Power Required for Trip/Closing Coil		< 300 W	
	Minimum Auxiliary Contacts (NO+NC)	Nos.	12NO + 12NC	
	Main Contact:			
	(i) Type of contact		To be mentioned	
	(ii) Material of contact surfaces		To be mentioned	
	(iii) Contact resistance		< 40 $\mu\Omega$	
	Operating Particulars :			
	(i) Breaking Time		< 60 ms	
	(ii) Making Time		< 60 ms	
	Method of Closing		To be mentioned	
	Method of Tripping		To be mentioned	
	Number of Close/ Trip Operation Possible on a Single Spring Charge		To be mentioned	
	Method of Indicating CB ON/ OFF		To be mentioned	

	Pressure in Vacuum Tube		To be mentioned	
	Pressure of Insulating Gas		To be mentioned	
	Creepage Distance		900 mm (Minimum)	
	Guaranteed Number of Operation for Vacuum Interrupter:			
	(i) At full rated interrupting current		≥ 100 Nos.	
	(ii) At 50% of rated interrupting current		≥ 100 Nos.	
	(iii) At 100% of full load current		20,000 Nos.	
	Rated Operating Sequence		O-0.3sec-CO-3m-CO	
	Circuit Breaker Sealing		Hermetically Sealed	
	Operating Temperature		-40°C ~ 60°C	
	Operating Humidity		0 ~ 100 % RH	
	Design Lifetime		To be mentioned	
	Weight and Dimension		To be mentioned	
	Warranty		3 Years (Full Warranty)	
24.	Disconnecter and Earthing Switch			
	Type/ Model	-	Shall be mentioned	
	Rated Voltage	kV	145	
	Rated Current for 132kV Line Feeder	A	2000	
	Rated Current for 132/33kV Transformer Feeder	A	1250	
	Rated Current for 132kV Bus Coupler bay	A	2000	
	Rated short time current for Double Bus.	kA	40	
	Short time current rated duration	Sec	3	
	Rated fault current making capacity	kA	100	
	Rated capacitive breaking current	A	2	
	Switch Position	-	close, open, earth	
	Both Motor and Manual operation	-	Yes	
	Max. operating (open/close) time	Sec.	Shall be mentioned	
	Auxiliary Contacts (NO+NC)	Nos.	To be mentioned	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class		Shall be mentioned	
25.	Fast Acting Earthing Switch			
	Type/ Model	-	Shall be mentioned	
	Rated Voltage	kV	145	

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	Rated short time current for Double Bus.	kA	40	
	Short time current rated duration	Sec	3	
	Rated fault current making capacity	kA	100	
	Rated capacitive breaking current (at 6kV eff.)	A	5	
	Rated inductive breaking current (at 10kV eff.)	A	125	
	Switch Position	-	open, earth	
	Operating mechanism	-	Motor spring	
	Max. charging time	Sec	Shall be mentioned	
	Max. operating time after charging of spring:			
	Closing	ms	60	
	Opening	ms	60	
	Both Motor and Manual operation	-	Yes	
	Auxiliary Contacts (NO+NC)	Nos.	To be mentioned	
	Electrical and Mechanical interlock	-	As per IEC 62271-203	
	Mechanical Endurance Class		Shall be mentioned	
26.	Gas Insulated Current Transformer			
	Type	-	Ring core/block type with sensor	
	Rated Voltage	kV	145	
	Accuracy Class, Metering (Tariff meter)	-	0.2 S	
	Accuracy Class, Metering (MFM)	-	0.5	
	Accuracy Class, Protection	-	5P30	
	Rated Current ratio for 132kV Line Feeder	A	600-1200/1-1-1 A (Bus side) & 600-1200/1-1-1 A (Line side)	
	Rated Current ratio for 132/33kV Transformer Feeder	A	600-1200/1-1-1 A (Bus side) & 600-1200/1-1-1 A (Transformer side)	
	Rated Current ratio for 132kV Bus Coupler bay	A	600-1200/1-1-1 A (Bus-1 side) & 600-1200/1-1-1 A (Bus-2 side)	
	Burden for metering	VA	15 (at max CT ratio)	











	Burden for protection	VA	15 (at max CT ratio)	
	Extended Current Rating for metering	A	120 % of rated Current	
	Instrument Security factor (metering)	-	< 5	
	RCT at 75° C			
	(a) Measuring Core	mΩ	shall be mentioned	
	(b) Protection Core	mΩ	shall be mentioned	
	Knee Point Voltage (Supported by Calculation)			
	(a) Measuring Core	V	shall be mentioned	
	(b) Protection Core	V	shall be mentioned	
	Rated frequency	Hz	50	
	CT burden shall meet the Short Circuit Current (40 kA, 3 Sec)	-	Yes	
27.	Bus Voltage Transformer			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	132/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated Tertiary Voltage	V	110/√3	
	Rated Quaternary Voltage	V	110/√3	
	Rated Quinary Voltage	V	110/3	
	Rated burden: Secondary, Tertiary, Quaternary, Quinary	VA	50	
	Accuracy class of secondary core	-	0.2	
	Accuracy class of tertiary core	-	0.5	
	Accuracy class of Quaternary core	-	0.5	
	Accuracy class of Quinary core	-	3P	
	LV Compartment	-	IP40	
28.	Line Voltage Transformer :			
	Type	-	Induction	
	Model		To be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	132/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated Tertiary Voltage	V	110/√3	
	Rated Quaternary Voltage	V	110/√3	

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	Rated Quinary Voltage	V	110/3	
	Rated Burden	VA	15	
	Accuracy class of secondary core	-	0.2	
	Accuracy class of tertiary core	-	0.2	
	Accuracy class of Quaternary core	-	3P	
	Accuracy class of Quinary core	-	3P	
29.	Local Control Cubicle (LCC)			
	Material		Shall be mentioned	
	Dimension			
	Height	mm	Shall be mentioned	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Control voltage	VDC	220	
	Control switch type		Push button/TNC/On-off Switch	
	Semaphore indication shall be provided		Yes	
	Net weight	kg	Shall be mentioned	
30.	132 kV Conductor Termination SF6 to Air Bushing (For 132 kV Line & 132/33kV Transformer Feeder)			
	Enclosure	-	Single	
	Enclosure material	-	Shall be mentioned	
	Rated Current of conductor connector for 132 kV Line feeder	A	2000	
	Rated Current of conductor connector for 132/33 kV Transformer feeder	A	1250	
	Conductor connection as per scope	-	1x1Cx800mm ² for 132 kV Line feeder and 1x1Cx800mm ² for 132/33kV Transformer feeder as per scope of works section 6. Cable/conductor termination accessories shall be provided.	
	Conductor connector type	-	Shall be mentioned	
31.	Gas Compartment (SF6) Safety and life			







	Nos. of Gas compartment per feeder/bay:	Nos.	Shall be mentioned	
	132kV Line Feeder	Nos.	Shall be mentioned	
	132/33kV Transformer Feeder	Nos.	Shall be mentioned	
	132kV Bus Coupler bay			
	Max. permissible moisture content	ppmv	700	
	Max. permissible air content	vol%	10	
	Moisture absorbent filter	-	Shall be provided	
	Material of filter employed for moisture	-	Shall be mentioned	
	Rated pressure at 20° C	KPa	Shall be mentioned	
	Max. SF6 service pressure at 40° C	KPa	Shall be mentioned	
	Max. SF6 service pressure at 40° C	KPa	Shall be mentioned	
	Bursting Pressure	KPa	Shall be mentioned	
	Gas leakage rate/year (Supported by Type Test report)	KPa	≤0.1%	
	Safety indication	-	To be incorporated	
	Type of gas monitoring		Density monitor	
	Gas pressure Manometer	-	As per IEC 62271-1	
	Bus Bar Gas pressure Manometer	-	As per IEC 62271-1	
	Life/ Endurance of switchgear switches			
	Circuit Breakers	-	As per IEC 62271-100	
	Disconnectors & Earthing switches	-	As per IEC 62271-102	
	Alarm level for insulation	Kpa	Shall be mentioned	
	Rated filling level for insulation	KPa	Shall be mentioned	
	Type of pressure relief device		Rupturing Diaphragm	
32.	Dimension and Weight			
	Height	mm	Shall be mentioned	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Weight including Circuit Breaker	Kg.	Shall be mentioned	
33.	Construction			
	Enclosure:			
	Bus bar	-	Three phase	
	Bay	-	Three phase	
	Enclosure material	-	Shall be mentioned	

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	Mechanical strength of enclosure:			
	Design pressure	-	Three phase	
	Min. bursting pressure	-	Three phase	
	Voltage indication system for each bay	-	Yes	
	Visual live line / voltage indicator device's installation	-	In the front of the panel	
34.	Degree of Protection			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
29.	Insulation level			
	AC withstand voltage, Imin. dry:			
	phase to earth	kV	275	
	phase to phase	kV	275	
	across open isolator	kV	315	
	across open gap C.B.	kV	275	
	Impulse Withstand, full wave:			
	Phase to earth	kV	650	
	Phase to phase	kV	650	
	across open isolator	kV	750	
	across open gap C.B.	kV	650	
35.	Type Test Report (as per IEC 62271-200)			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/ Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	

A. PROTECTION CONTROL & METERING (132 KV EVACUATION LINE)

36.	LINE PROTECTION RELAY			
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	Manufacture's Name Country of Origin		ABB- (Sweden/Switzerland/ Finland)/Siemens- (Germany)/ Schneider-(France/UK) / GE (EU / USA)	
	Manufacture's Model no.		Shall be mentioned	
	Type of relay		Numerical programmable Multifunction	
	Protection function shall be must available (at least)		ANSI-87L, 21, 50, 50N, 51, 51N, 27, 59, 81, 67, 67N, 25, 79 (1P/3P), 50BF, 46PD, etc.	
	The Relay shall be IEC 61850 protocol type.		Yes	
37.	Over Current & Earth Fault Relay			
	Manufacture's Name Country of Origin	-	ABB- (Sweden/Switzerland/ Finland)/Siemens- (Germany)/ Schneider-(France/UK) / GE (EU / USA)	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction	
	Protection function shall be must available (at least)		ANSI-50, 50N, 51, 51N, 67, 67N, 27, 59, 81, 50BF	
	Range of current setting : Phase element b) Earth fault element	% of CT rating	Shall be mentioned	
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
38.	Bay Control Unit (BCU)			
	Manufacture's Name & Country of Origin		ABB- (Sweden/Switzerland/ Finland)/Siemens- (Germany)/ Schneider-(France/UK) / GE	

			(EU / USA)	
	Manufacture's Model no.		Shall be mentioned	
	Type of bay control unit: Separate BCU / IED / Via numerical protection relay	-	Shall be mentioned	
	The BCU shall be IEC 61850 protocol type.		Yes	
39.	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Relay		Shall be mentioned	
40.	Trip Relay (Separate Relay)			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection		Yes	
41.	Annunciator			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
42.	Control Switch			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model/Type No.		Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch		Yes	
43.	METERING AND INSTRUMENTATION			
43.1	KWH & kVARH (Energy) Meter			
	Manufacture's Name & Country		Siemens(Germany/ Switzerland)/ AEG (Germany) / ABB	

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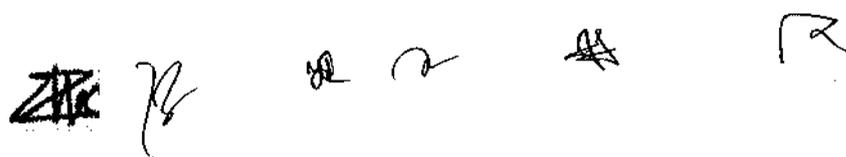
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			(Switzerland)/ Toshiba (JAPAN) /Elster (USA /Romania), Landis+ Gyr (Switzer land/Greece)/ Honeywell (USA)/ CEWE (UK)	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Numerical programmable Multifunction	
	Class of Accuracy		0.2	
43.2	Multifunction Meter			
	Manufacturer's Name and Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Digital, Import/Export	
	Measurement features: Three phase voltage, current, frequency, phase angle MW, MVAR etc.		Yes	
	Class of Accuracy		1.0	
44.	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	

PROTECTION CONTROL & METERING (132/33 KV STEP-UP TRANSFORMER)				
45.	Differential Relay (Main-1) (For Two Winding Transformer)			
	Manufacturer's Name (Manufacturer of Main-1 & Main-2 relay shall be different)	-	ABB/Siemens Schneider/NR/Sifang/ SAC	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable multifunction	
	Protection function shall be must available (at least)	-	ANSI-87T, 50, 50N, 51, 51N, 46, 24, 27, 59, 49T, 50BF, etc.	
	Maximum through fault at which the protective equipment is stable with recommend settings:			

	a) Earth faults	rating	Shall be mentioned	
	b) Phase faults	% of CT rating	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	ms	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
Restricted Earth Fault Relay (in built function of Differential Relay)				
	Manufacturer's Name & Country of Origin	-	ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacturer's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable multifunction	
	Protection function shall be must available (at least)		ANSI-64REF	
	Range of current setting : Earth Faults Phase Faults	% of CT rating	Shall be mentioned	
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	Percentage of current setting at which relay will reset.	%	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
46.	Differential Relay (Main-2) (For Two Winding Transformer)			
	Manufacturer's Name (Manufacturer of Main-1 & Main-2 relay shall be different)	-	ABB/Siemens Schneider/NR/Sifang/ SAC	
	Country of Origin	-	Shall be mentioned	
	Manufacturer's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable multifunction	
	Protection function shall be must	-	ANSI-87T, 50, 50N, 51,	



	available (at least)		51N, 46, 24, 27, 59, 49T, 50BF, etc.	
	Maximum through fault at which the protective equipment is stable with recommend settings:			
	a) Earth faults	rating	Shall be mentioned	
	b) Phase faults	% of CT rating	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	Ms	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
	Restricted Earth Fault Relay (in built function of Differential Relay)			
	Manufacture's Name & Country of Origin	-	ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable multifunction	
	Protection function shall be must available (at least)		ANSI-64REF	
	Range of current setting : Earth Faults Phase Faults	% of CT rating	Shall be mentioned	
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	Percentage of current setting at which relay will reset.	%	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
47.	Bay Control Unit (BCU)			
	Manufacture's Name & Country of Origin		ABB/Siemens Schneider/NR/Sifang/	

			SAC	
	Manufacture's Model no.		Shall be mentioned	
	Type of bay control unit: Separate BCU / IED / Via numerical protection relay	-	Shall be mentioned	
	The BCU shall be IEC 61850 protocol type.		Yes	
48.	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
49.	Trip Relay (Separate Relay) for Differential and O/C & E/F			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	Ms	<10	
	Operating Coil Voltage- 110V DC	-	Yes	
	Self-reset type for O/C, E/F protection	-	Yes	
	Hand & Electrical reset type for Differential, REF and Transformer Self- protection	-	Yes	
50.	Separate Auxiliary Flag Relays for Transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank & OLTC.			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
51.	Annunciator			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	24	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	

52.	Control Switch			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
53.	METERING AND INSTRUMENTATION			
53.1	Multifunction Meter			
	Manufacturer's Name and Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Digital, Import/Export	
	Measurement features: Three phase voltage, current, frequency, phase angle MW, MVAR etc.		Yes	
	Class of Accuracy		1.0	
54	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	

PROTECTION CONTROL & METERING (132 KV BUS COUPLER)				
55.	IDMT Over Current & Earth Fault Relay			
	Manufacture's Name	-	ABB/Siemens	
	Country of Origin	-	Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction with synchro-check function	
	Protection function shall be must available (at least)		ANSI-50, 50N, 51, 51N, 25, 50BF etc.	
	Range of current setting :	-		
	a) Phase element	% of	Shall be mentioned	
	b) Each fault element	CT rating	Shall be mentioned	

	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
56.	Bay Control Unit (BCU)			
	Manufacture's Name & Country of Origin		ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.		Shall be mentioned	
	Type of bay control unit: Separate BCU / IED / Via numerical protection relay	-	Shall be mentioned	
	The BCU shall be IEC 61850 protocol type.		Yes	
57.	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
58.	Trip Relay (Separate Relay)			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	Ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating Coil Voltage- 110V DC	-	Yes	
59.	Annunciator			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
60.	Control Switch			








	Manufacture's Name	-		
	Country of Origin	-		
	Manufacture's Model no.	-		
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
61.	Metering and Instrumentation			
	VOLT METERS with Selector Switch			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	33kV Bus coupler shall be equipped with 2 nos. voltmeter with selector switch (6 pos.) for monitoring two adjacent bus voltage.	-	Yes	
	Multifunctional Meter			
	MFM shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ϕ etc. distinguishing import and export operation.	-	Yes	
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical Programmable Multifunction Meter	
	Class of Accuracy	-	1.0	
62.	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	21

PROTECTION CONTROL & METERING (132 KV GIS BUSBAR)				
63.	BUSBAR PROTECTION RELAY (MAIN-1)			
	Manufacture's Name		ABB/Siemens	







	Country of Origin		Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.		Shall be mentioned	
	Type of relay		Numerical programmable Multifunction	
	Protection function shall be must available (at least)		ANSI-87B, 50BF	
	Busbar protection scheme: Central unit / distributed unit	-	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.		Yes	
64.	BUSBAR PROTECTION RELAY (MAIN-2)			
	Manufacture's Name Country of Origin		ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.		Shall be mentioned	
	Type of relay		Numerical programmable Multifunction	
	Protection function shall be must available (at least)		ANSI-87B, 50BF	
	Busbar protection scheme: Central unit / distributed unit	-	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.		Yes	
65.	Trip Relay (Separate Relay)			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection		Yes	
66.	Annunciator			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	

67.	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	
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6. Circuit Breaker 132 kV, 1250 A outdoor AIS

No.	Description	Minimum Requirements		
		Unit	Data	Guaranteed
1.	Circuit Breaker – General			
1.1.	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-100 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Isolating and quenching medium		SF6	
1.8	Type of circuit breaker		Outdoor	
1.9	Design		Single breaking	
1.10	Operating mechanism		Motor-wound spring	
1.11	Number of poles	pcs.	3	
1.12	Number of operating mechanisms per circuit breaker	pcs.	3	
2.	Circuit Breaker - Characteristics			
2.1	Nominal system voltage	kV rms	132	
2.2	Highest voltage for equipment U_n	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.6	Rated current I_r	A	≥ 1250	
2.7	Rated short-circuit breaking current I_{sc}	kA rms	≥ 40	
2.8	Rated peak withstand current I_p (equal short-circuit making current)	kA	≥ 100	
2.9	D.C. component of the rated short-circuit breaking current	%	> 30	
2.10	First-pole-to-clear factor • Terminal fault • Short-line fault • Out-of-phase	p.u. p.u. p.u.	1.3 1.0	
2.11	Standard value of transient recovery voltage (T100)	kV	Insert	
2.12	Rate of rise recovery voltage	kV/ μ s	Insert	
2.13	Rated operating sequence		O-0.3 s-CO-3 min-CO	
2.14	Duration of short-circuit	s	≥ 1	
2.15	Rated out-of-phase breaking current	kA	Insert	
2.16	Auto reclosing		1p+3p	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.17	Maximum total break time (trip initiation to final arc extinction) pos.3.7.135 acc. to IEC 62271-100)	ms	≤ 60	
2.18	Time of final arc extinction (3.7.134 acc. IEC 62271-100)	ms	20 ± 5	
2.19	Opening time (trip initiation to contact separation) • Without current • With 100 % rated breaking current	ms	Insert	
		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 • 100 % making current	ms	Insert	
		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 • CO at rated current • CO at rated breaking current I _{sc}		≥ 10000	
			≥ 2500	
			≥ 5	
2.26	The frequency of mechanical operations	Class	M2	
2.27	Rated electrical endurance	Class	Min E1	
2.28	Rated pressure of a circuit breaker	Mpa	Insert	
2.29	Total mass of SF ₆ gas in a circuit breaker	kg	Insert	
3.	Circuit Breaker - Design and Construction			
3.1	Circuit Breaker			
3.1.1	Insulator material		Porcelain	
3.1.2	Minimum creepage distance	mm/ kV	Min. ≥ 25	
3.1.3	HV terminal	pcs.	2	
3.1.3.1	Shape		Flat	
3.1.3.2	Dimensions	mm x mm	Min 100 x 100	
3.1.3.3	Number of holes		Min 4	
3.1.3.4	Dimensions of holes	mm	Ø 14	
3.1.3.5	Distance between holes	mm	50	
3.1.3.6	Material suitable for		Al terminal	
3.2	Operating mechanism			
3.2.1	Type		Insert	
3.2.2	Motor - auxiliary supply voltage	V. DC	110	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Control voltage	V. DC	110	
3.2.5	Number of making coils	pcs.	1	
3.2.6	Rated power of making coils	W	Insert	
3.2.7	Number of breaking coils	pcs.	2	
3.2.8	Rated power of breaking coils	W	Insert	
3.2.9	Heater		Yes	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.2.10	Heater supply voltage	V. Hz	230. 50	
3.2.11	Total heater power	W	Insert	
3.2.12	Minimum number of available contacts (NO/NC/V)		12NO+12NC+1V	
3.2.15	Water-tight corrosion-resistant housing		IP54	
3.2.17	Operating mechanism material		Al or stainless steel	
3.2.19	A crank for manual spring loading		Yes	
3.4	Accessories in central control panel			
3.4.1	Anti-pumping relay		Yes	
3.4.2	Local/remote control selector switch		Yes	
3.4.3	Local operation push buttons		Yes	
3.4.4	Minimum pressure lock-out and alarm relays		Yes	
3.4.5	Service outlet (socket) - 230 V, 50 Hz		Yes	
3.4.6	Lighting switch		Yes	
3.4.7	Lighting - 230 V, 50 Hz		Yes	
3.4.8	Heater - 230 V, 50 HZ		Yes	
3.4.9	Operation counter		Yes	
3.4.10	Motor MCB (miniature circuit breakers) (for all operating mechanisms)		Yes	
3.4.11	Time phase discrepancy relay		Yes	
3.4.12	Weatherproof, corrosion resistance enclosure, Al or stainless steel		IP54	
3.2.16	Cu earthing rails inside central control cabinet		Yes	
3.2.18	Detachable plates, the bottom of central control cabinet		Yes	
3.4.13	Set of cables for connection of operating mechanism and central control panel of circuit breaker		Yes	
3.4.14	Galvanized horizontal and vertical metal structure with minimum 70 µm zinc layer		Yes	

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7. Disconnecter 132 kV, 1250 A, with Earthing Switch

No.	Description	Minimum Requirements		Guarantee
		Unit	Data	
1.	Disconnecter- 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 disconnecter		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating		Motor driven	
1.11	Number of main blade operating	pcs.	1	
1.12	Type of earthing blade operating		Motor driven	
1.13	Number of earthing blade operating		1	
2.	Disconnecter - Characteristics			
2.1	Nominal system voltage	kV	132	
2.2	Highest voltage for equipment U_n	kV	145	
2.3	Rated lightning impulse withstand	kV	650	
2.4	Rated short duration power frequency	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	≥ 1250	
2.8	Rated short withstand current I_k	kA	≥ 40	
2.9	Rated duration of short-circuit on main	s	3	
2.10	Rated duration of short-circuit on	s	3	
2.11	Rated maximum withstand current I_p	kA	≥ 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V	A	1600	
2.13	Nominal supply voltage			
2.13.	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.	Motors	V d.c.	110	
2.13.	Heaters	V a.c.	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
3.	Disconnecter - Design and Construction			
3.1	Disconnecter			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/	Min. ≥ 25 mm/ kV	
3.1.3	Quality of insulator		Min. C130	
		Minimum Requirements		
No.	Description	Unit	Data	Guaranteed
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	

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3.1.5.2	Dimensions	mm x	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1+1	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
Overall compliance with the requirements (yes/no)				

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8. Disconnecter 132 kV, 1250 A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Disconnecter- General			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 62271-102 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001 ISO 14001 ISO 18001	
1.7	Type of disconnector		Outdoor	
1.8	Design		Centre break	
1.9	Number of poles	pcs.	3	
1.10	Type of main blade operating mechanism		Motor driven	
1.11	Number of main blade operating mechanisms	pcs.	1	
1.12	Type of earthing blade operating mechanism		Not applicable	
1.13	Number of earthing blade operating mechanism		Not applicable	
2.	Disconnecter - Characteristics			
2.1	Nominal system voltage	kV rms	132	
2.2	Highest voltage for equipment U_N	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.7	Rated current I_r	A	≥ 1250	
2.8	Rated short withstand current I_k	kA rms	≥ 40	
2.9	Rated duration of short-circuit on main blades	s	3	
2.10	Rated duration of short-circuit on earthing blades	s	Not applicable	
2.11	Rated maximum withstand current I_p	kA	> 100	
2.12	Capacity of making and breaking transfer load of busbar system at 300 V (rms)	A	1600	
2.13	Nominal supply voltage			
2.13.1	Controls and alarm (signalling) circuits	V d.c.	110	
2.13.2	Motors	V d.c.	110	
2.13.3	Heaters	V a.c. / Hz	230 / 50	
2.14	Opening time	s	Insert	
2.15	Closing time	s	Insert	
2.16	Mechanical endurance	Class	M2	
3.	Disconnecter - Design and Construction			
3.1	Disconnecter			
3.1.1	Insulator material		Porcelain, brown	
3.1.2	Minimum creepage distance	mm/ kV	Min. ≥ 25 mm/ kV	
3.1.3	Quality of insulator		Min. C130	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.1.4	Rated failing load of insulator (C10)	N	Min. 10000	
3.1.5	HV terminals			
3.1.5.1	Shape		Flat	
3.1.5.2	Dimensions	mm x mm	Min 100 x 100	
3.1.5.3	Number of holes		Min 4	
3.1.5.4	Dimensions of holes	mm	Ø 14	
3.1.5.5	Distance between holes	mm	50	
3.1.5.6	Material suitable for		Al terminal	
3.2	Operating mechanism			
3.2.1	Number of operating mechanism	pcs.	1	
3.2.2	Type		Insert	
3.2.3	Rated power of motor	W	Insert	
3.2.4	Total heater power	W	Insert	
3.2.5	Minimum number of available contacts (NO/NC/V)		12NO+12NC	
3.2.9	Motor - auxiliary supply voltage	V, DC	110	
3.2.10	Heater, 230 V, 50 Hz		Yes	
3.2.11	Water-tight corrosion-resistant housing		IP54	
3.2.12	Selection switch (local/neutral/remote)		Yes	
3.2.13	Manual closing button		Yes	
3.2.14	Manual opening button		Yes	
3.2.15	Anti-condensation heater inside the operating mechanism cabinet		Yes	
3.2.16	Single-phase socket		Yes	
3.2.17	Voltage presence controller		Yes	
3.2.18	Motor MCB (miniature circuit breakers)		Yes	
3.2.19	Heater MCB (miniature circuit breaker)		Yes	
3.2.20	Single-phase socket MCB (miniature circuit breaker)		Yes	
3.2.21	Equipotential bonding rails		Yes	
3.2.22	Housing of Al or stainless steel		Yes	
Overall compliance with the requirements (yes/no)				

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9. Current Transformer 132 kV, 1200-600/1 A/A

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Current Transformers - General			
1.1.	Manufacturer		Insert	
1.2.	Type		Insert	
1.3.	Model designation		Insert	
1.4.	Country of origin		Insert	
1.5.	Standards		IEC 60044-1	
1.6.	Quality control		ISO 9001	
1.7.	Type		Outdoor	
1.8.	Shape / design		Head type	
1.9.	Sealing		Hermetically closed	
2.	Current Transformers - Characteristics			
2.1.	Nominal system voltage	kV _{rms}	132	
2.2.	Highest voltage for equipment U _n	kV _{rms}	145	
2.3.	Rated lightning impulse withstand voltage	kV _{peak}	650	
2.4.	Rated short duration power frequency voltage	kV	275	
2.5.	Rated frequency f _r	Hz	50	
2.6.	Rated short-time thermal current I _{th} , 1 s	kA	40	
2.7.	Rated dynamic current I _{dyn}	kV peak	100	
2.8.	Rated continuous thermal current (40°C):			
	• I core	% I _n	200	
	• II core	% I _n	200	
	• III core	% I _n	120	
	• IV core	% I _n	120	
2.9.	Rated transformer ratio:			
	• I core	A/A	1200-600/1	
	• II core	A/A	1200-600/1	
	• III core	A/A	1200-600/1	
	• IV core	A/A	1200-600/1	
2.10.	Accuracy class:			
	• I core		0.2	
	• II core		0.2	
	• III core		5P20	
	• IV core		5P20	
2.11.	Security factor:			
	• I core		F _s =10	
2.12.	Rated power:			
	• I core	VA	10	
	• II core	VA	15	
	• III core	VA	30	
	• IV core	VA	30	

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

10. Voltage Transformer 132 kV

No	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Voltage Transformers - General			
1.1	Manufacturer		Insert	
1.2	Type		Capacitive	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60044-2 IEC 60273 IEC 60694 IEC 60815	
1.6	Quality control		ISO 9001	
1.7	Type		Outdoor	
1.8	Shape		Insert	
1.9	Sealing		Hermetically closed	
2.	Voltage Transformers - Characteristics			
2.1	Nominal system voltage	kV rms	132	
2.2	Highest voltage for equipment U_N	kV rms	145	
2.3	Rated lightning impulse withstand voltage	kV peak	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f_r	Hz	50	
2.8	Rated primary voltage	kV	$132/\sqrt{3}$	
2.9	Rated secondary voltage			
	• I winding	V	$110\sqrt{3}$	
	• II winding	V	$110\sqrt{3}$	
2.10	Accuracy class:			
	• I winding		0.2	
	• II winding		1/3P	
2.11	Rated power:			
	• I winding	V	25	
	• II winding	A	75	
2.12	Load		Simultaneously	
3.	Voltage Transformers - Design and Construction			
3.1	Insulator material		Porcelain, brown	
3.2	Insulating medium		Oil-paper - Mixed dielectric	
3.3	Minimum creepage distance	mm/ kV	Min. ≥ 25 mm/ kV	
3.4	Max. radio interference voltage at 0.5-2 MHz (acc. IEC 60694)	μ V	Max. 2500	
3.5	Permissible level of partial discharges:			
	• Test voltage $1.2 \cdot U_M/\sqrt{3}$	pC	Max. ≤ 5	
	• Test voltage U_M	pC	< 10	
3.7	Min. LV enclosure protection		IP54	
3.8	HV terminals			
3.8.1	Shape		Flat	
3.8.2	Position		Vertical or horizontal	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.8.3	Dimensions	mm x mm	Min 100 x 100	
3.8.4	Number of holes		Min 4	
3.8.5	Dimensions of holes	mm	Ø 14	
3.8.6	Distance between holes	mm	50	
3.8.7	Material suitable for		Al terminal	
3.10	Oil drain cock and sampling device		Yes	
3.11	Enable sealing after accuracy class checks (sealing possibilities)		Yes	
3.13	Outdoor metal part made of aluminium or stainless steel		Yes	
3.14	Mass and dimensions			
3.14.1	Total mass	kg	Insert	
3.14.2	Height	mm	Insert	
Overall compliance with the requirements (yes/no)				

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11. Surge Arrester 132 kV

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

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12. Post Insulator 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	Post Insulators - General			
1.1	Manufacturer		Insert	
1.2	Type		Insert	
1.3	Model designation		Insert	
1.4	Country of origin		Insert	
1.5	Standards		IEC 60168 IEC 60273 IEC 60672 IEC 60694	
1.6	Quality control		ISO 9001	
1.7	Design		Solid core, porcelain, outdoor	
2	Post Insulators - Characteristics			
2.1	Nominal system voltage	kV _{rms}	132	
2.2	Highest voltage for equipment U _n	kV _{rms}	145	
2.3	Rated lightning impulse withstand voltage	kV _{peak}	650	
2.4	Rated short duration power frequency voltage	kV	275	
2.5	Rated frequency f _r	Hz	50	
2.6	Minimum creepage distance	mm/ kV	Min. ≥ 25 mm/ kV	
2.7	Failing load bending (p0) (C10)	N	≥ 10000	
2.8	Failing load torsion	Nm	≥ 4000	
3	Post Insulators - Design and Construction			
3.1	Insulation material		Porcelain, brown	
3.2	Material quality acc. IEC 60672		Min. C130	
3.3	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	
3.13	Insulator weight	kg	Insert	
Overall compliance with the requirements (yes/no)				

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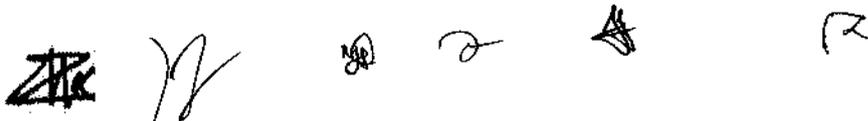
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13. 33KV Equipment

Guaranteed Technical Particulars of 33kV Indoor Type Gas insulated switchgear (GIS) with Protection, Control and Metering Equipment

Sl. No	DESCRIPTION	UNIT	BPDB REQUIREMENT	BIDDER'S GUARANTEED VALUES
1.	a) Manufacturer's name & address With website, official domain email.	-	Shall be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2023	
2.	Manufacturer's Model no.	-	To be mentioned	
3.	Manufacturer & country of origin	-	To be mention	
4.	Applied Standard	-	Latest version of IEC 62271 fully complied	
5.	System nominal Voltage	kV	33	
6.	Rated Voltage	kV	36	
7.	Rated Frequency	Hz	50	
8.	Material of Bus-Bar	-	HDHC Copper	
9.	Busbar Scheme	-	Single Bus with Bus Sectionalizer and Riser	
10	Installation	-	Free Standing	
11.	Rated Current for Main Bus: Single Bus (As per scope)	Amps	2000	
12.	Cross Section of bus bar	mm ²	Min 1600 for 2000A Bus or (As per IEC62271)	
13.	Rated symmetrical short circuit breaking current for Single Bus	KA	31.5	
14.	Short time current rated duration	Sec.	3	
15.	Pressure relief device is integrated with each gas chamber	-	Yes	
16.	Mimic diagram is depicted in front of switchgear panel	-	Yes	
17.	Electrical and Mechanical interlock between Circuit breaker, isolator and earth switch	-	Yes	



18.	Capacitive Voltage Indicator with Interlock contact for ES operation	-	Yes	
19.	Circuit Breaker:			
	Type of interrupter	-	VCB	
	Class of Circuit Breaker (Supported by Type Test report)	-	E2M2 or better	
	Designation of Internal Arc Classification (Supported by Type Test Report)	-	IAC AFLR 31.5 kA, 1 Sec	
	Insulation media	-	SF6	
	Interrupting media	-	Vacuum	
	Manufacturer's name and country of origin of vacuum interrupter	-	To be mentioned	
	Manufacturer's model no. of Vacuum Interrupter (Model no. shall be supported by Type Test)	-	To be mentioned	
	Guaranteed nos. of operation for Vacuum Interrupter			
	a) at rated Current switching	Nos.	Min. 10,000	
	b) at Short circuit current switching	Nos.	≥ 50	
	Rated Voltage	kV	36	
	Rated Current for 132/33kV Transformer incoming feeder	A	2000	
	Rated Current for Photovoltaic collection feeder	A	1250	
	Rated Current for SVG outgoing feeder	A	1250	
	Rated Current for Bus Sectionalizer (Single Bus) as per scope.	A	2000	
	Rated Current for Grounding Transformer feeder	A	1250	
	Rated Short Circuit Breaking Current for Single Bus.	kA	31.5	
	Rated duration of short circuit current	sec	3	
	Rated Short Circuit Making Current for Single Bus.	kA	80	
	Rated Breaking time	Cycle	< 3	
	Opening time	Sec.	shall be mentioned	
	Closing time	Sec.	shall be mentioned	
	Rated operating Sequence	-	O-0.3 sec-CO-3 min-CO	







	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 230	
	Power Consumption of Charging motor	W	Max 250	
	Power consumption of opening/trip coil	W	Max 300	
	Nos. of Trip coils	Nos.	2	
20.	Three position disconnecter Switch (Both Motor and Manual operation)			
	Type/ Model	-	Shall be mentioned	
	Rated Voltage	kV	36	
	Rated Current for 132/33kV Transformer incoming feeder	A	2000	
	Rated Current for Photovoltaic collection feeder	A	1250	
	Rated Current for SVG outgoing feeder	A	1250	
	Rated Current for Bus Sectionalizer and Riser (Single Bus) as per scope.	A	2000	
	Rated Current for Grounding Transformer feeder	A	1250	
	Rated Current for Bus PT	A		
	Rated short time current for Single Bus.	kA	31.5	
	Short time current rated duration	Sec	3	
	Switch Position	-	close, open, earth	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class		Shall be mentioned	
21.	Current Transformer :			
	Type	-	Ring core/block type with sensor	
	Rated Voltage	kV	36	
	Accuracy Class, Metering (Tariff meter)	-	0.2 S	
	Accuracy Class, Metering (MFM)	-	0.5	
	Accuracy Class, Protection	-	5P30	
	Rated Current ratio for 132/33kV Transformer incoming feeder	A	2500/1-1-1-1-1 A	
	Rated Current ratio for Photovoltaic collection feeder	A	500/1-1-1-1 A & 800/1 A	
	Rated Current ratio for SVG outgoing feeder	A	1000/1-1-1-1-1 A	

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	Rated Current ratio for Bus Sectionaliser and Riser (Single Bus) as per scope.	A	2500/1-1-1-1-1 A	
	Rated Current ratio for Grounding Transformer feeder	A	50/1-1-1-1 A & 800/1 A	
	Burden for metering	VA	15 (at max CT ratio)	
	Burden for protection	VA	15 (at max CT ratio)	
	Extended Current Rating for metering	A	120 % of rated Current	
	Instrument Security factor (metering)	-	< 5	
	RCT at 75° C			
	(a) Measuring Core	mΩ	shall be mentioned	
	(b) Protection Core	mΩ	shall be mentioned	
	Knee Point Voltage (Supported by Calculation)			
	(a) Measuring Core	V	shall be mentioned	
	(b) Protection Core	V	shall be mentioned	
	Rated frequency	Hz	50	
	CT burden shall meet the Short Circuit Current (31.5 kA, 3 Sec)	-	Yes	
22.	Bus Voltage Transformer :			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated Tertiary Voltage	V	110/√3	
	Rated Quaternary Voltage	V	110/√3	
	Rated Quinary Voltage	V	110/3	
	Rated burden: Secondary, Tertiary, Quaternary, Quinary	VA	15	
	Accuracy class of secondary core	-	0.2	
	Accuracy class of tertiary core	-	0.5	
	Accuracy class of Quaternary core	-	0.5	
	Accuracy class of Quinary core	-	3P	
	LV Compartment	-	IP40	
23	Line Voltage Transformer :			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	

	Rated Secondary Voltage	V	110/√3	
	Rated Tertiary Voltage	V	110/√3	
	Rated Quaternary Voltage	V	110/√3	
	Rated Quinary Voltage	V	110/3	
	Rated Burden	VA	15	
	Accuracy class of secondary core	-	0.2	
	Accuracy class of tertiary core	-	0.5	
	Accuracy class of Quaternary core	-	3P	
	Accuracy class of Quinary core	-	3P	
24	33 kV Cable Compartment (For 132/33kV Transformer incoming, Photovoltaic collection, SVG outgoing and 33/0/415kV Grounding Transformer feeder)			
	Material	-	Highly Conductive Copper	
	Bus bar type	-	Single	
	Cross Section of main Bus bar	mm ²	Min 1600 for 2000A Bus or (As per IEC62271)	
	Nominal Current of main Bus bar	A	2000	
	Rated Current of cable connector or Insulated bus duct for 132/33kV Transformer incoming feeder	A	2000	
	Rated Current of cable connector for Photovoltaic collection feeder	A	1250	
	Rated Current of cable connector for SVG outgoing feeder	A	1250	
	Rated Current of cable connector for Grounding Transformer feeder	A	1250	

	Cable connection as per scope	-	1x1Cx800mm ² for 132/33kV Transformer incoming feeder Panels or Insulated bus duct; 2x1Cx500mm ² for Photovoltaic collection and SVG outgoing Feeder Panels; 3Cx95mm ² for Grounding Transformer XLPE armoured copper cable per phase as per scope of works section 6. Cable termination plug and socket with all accessories required for cable termination, suitable for terminating with proper cable support shall be provided. One spare cable connection facility for each GIS panel and Sealing/cap for unused cable termination shall also to be provided.	
	Cable connector type	-	Shall be mentioned	
25.	SF6 Safety and life			
	SF6 Pressure	KPa	Shall be mentioned	
	Rated pressure at 20° C	KPa	Shall be mentioned	
	Bursting Pressure	KPa	Shall be mentioned	
	Gas leakage rate/year (Supported by Type Test report)	KPa	≤0.1%	
	Safety indication	-	To be incorporated	
	Capacitive voltage indicator	-	In the front of the panel	
	Gas pressure Manometer	-	As per IEC 62271-1	
	Bus Bar Gas pressure Manometer	-	As per IEC 62271-1	
	Life/ Endurance of switchgear switches			
	Circuit Breakers	-	As per IEC 62271-100	

	Disconnectors & Earthing switches	-	As per IEC 62271-102	
	Alarm level for insulation	Kpa	Shall be mentioned	
	Rated filling level for insulation	KPa	Shall be mentioned	
26.	Dimension and Weight			
	Height	mm	Shall be mentioned	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Weight including Circuit Breaker	Kg.	Shall be mentioned	
27.	Construction :			
	Stainless steel tank	-	Shall be mentioned	
	Equipped with disconnecter and earthing switch. The earthing switch shall have full fault-making capacity.	-	Shall be mentioned	
	Each gas filled compartment shall be equipped with density sensors giving alarm by low gas density.	-	Shall be mentioned	
	Voltage indication system for each bay	-	Yes	
28.	Degree of Protection			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
29.	Insulation level :			
	AC withstand voltage 1min. dry	kV	70	
	Impulse Withstand, full wave	kV	170	
30.	Type Test Report (as per IEC 62271-200)			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/ Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	
PROTECTION CONTROL & METERING (132/33kV TRANSFORMER INCOMER, PHOTOVOLTAIC COLLECTION, SVG OUTGOING & 33/0.415kV GROUNDING TRANSFORMER FEEDER)				

31.	Over Current & Earth Fault Relay		
	Manufacture's Name Country of Origin	-	ABB/Siemens Schneider/NR/Sifang/ SAC
	Manufacture's Model no.	-	Shall be mentioned
	Type of relay	-	Numerical programmable Multifunction
	Protection function shall be must available (at least)		ANSI-50, 50N, 51, 51N, 67, 67N, 27, 59, 81, 50BF
	Range of current setting : Phase element Earth fault element	% of CT rating	Shall be mentioned
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned
	Burden of relay at 10 time CT rating	VA	Shall be mentioned
	The Relay shall be IEC 61850 protocol type.	-	Yes
32	Bay Control Unit (BCU)		
	Manufacture's Name & Country of Origin		ABB/Siemens Schneider/NR/Sifang/ SAC
	Manufacture's Model no.		Shall be mentioned
	Type of bay control unit: Separate BCU / IED / Via numerical protection relay	-	Shall be mentioned
	The BCU shall be IEC 61850 protocol type.		Yes
33	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)		
	Manufacture's Name	-	Shall be mentioned
	Country of Origin	-	Shall be mentioned
	Manufacture's Model no.	-	Shall be mentioned
	Type of Relay	-	Shall be mentioned
34	Trip Relay (Separate Relay)		
	Manufacture's Name	-	Shall be mentioned
	Country of Origin	-	Shall be mentioned
	Manufacture's Model no.	-	Shall be mentioned
	Type of Relay	-	Shall be mentioned

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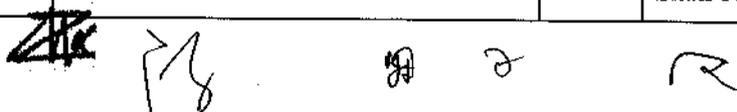
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	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating Coil Voltage- 110V DC	-	Yes	
35	Annunciator			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
36	Control Switch			
	Manufacture's Name	-		
	Country of Origin	-		
	Manufacture's Model no.	-		
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
37	Metering and Instrumentation			
	Energy Meter (Multi Tariff Programmable Meter)			
	Manufacture's Name	-	Shall be mentioned	
	Manufacture's Country		ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical programmable	
	Class of Accuracy	-	0.2 S	
	Multifunctional Meter			
	MFM shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ϕ etc. distinguishing import and export operation.	-	Yes	
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical Programmable Multifunction Meter	
	Class of Accuracy	-	1.0	

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38	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	
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PROTECTION CONTROL & METERING (33 KV BUS SECTIONALISER WITH RISER)				
39.	IDMT Over Current & Earth Fault Relay			
	Manufacture's Name Country of Origin	-	ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction with synchro-check function	
	Protection function shall be must available (at least)		ANSI-50, 50N, 51, 51N, 25, 50BF	
	Range of current setting :	-		
	a) Phase element	% of	Shall be mentioned	
	b) Each fault element	CT rating	Shall be mentioned	
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
40	Bay Control Unit (BCU)			
	Manufacture's Name & Country of Origin		ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacture's Model no.		Shall be mentioned	
	Type of bay control unit: Separate BCU / IED / Via numerical protection relay	-	Shall be mentioned	
	The BCU shall be IEC 61850 protocol type.		Yes	
41	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	



	Type of Relay	-	Shall be mentioned	
42	Trip Relay (Separate Relay)			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating Coil Voltage- 110V DC	-	Yes	
43	Annunciator			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
44	Control Switch			
	Manufacture's Name	-		
	Country of Origin	-		
	Manufacture's Model no.	-		
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
45	Metering and Instrumentation			
	VOLT METERS with Selector Switch			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	33kV Bus coupler shall be equipped with 2 nos. voltmeter with selector switch (6 pos.) for monitoring two adjacent bus voltage.	-	Yes	
	Multifunctional Meter			
	MFM shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ϕ etc. distinguishing import and export operation.	-	Yes	

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	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacturer's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical Programmable Multifunction Meter	
	Class of Accuracy	-	1.0	
46	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	21
PROTECTION CONTROL & METERING (FOR EACH 33 KV GIS BUSBAR)				
47	BUSBAR PROTECTION RELAY			
	Manufacturer's Name Country of Origin		ABB/Siemens Schneider/NR/Sifang/ SAC	
	Manufacturer's Model no.		Shall be mentioned	
	Type of relay		Numerical programmable Multifunction	
	Protection function shall be must available (at least)		ANSI-87B, 50BF	
	Busbar protection scheme: Central unit / distributed unit	-	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.		Yes	
48	Trip Relay (Separate Relay)			
	Manufacturer's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacturer's Model no.		Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection		Yes	
49	Annunciator			
	Manufacturer's Name & Country		Shall be mentioned	
	Manufacturer's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
50	The switchgear Panel Shall be complied all the technical specification mentioned in Section-6.		Yes	

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14. 33/0.415 kV 200 kVA, Dyn11, Auxiliary Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.	General			
1.1	Manufacturer		Insert	
1.2	Type		Auxiliary station transformer, three-phase, oil immersed, two windings, without tertiary winding, with off-load tap changer	
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	250	
2.2	Type of cooling ONAN / ONAF	-	ONAN	
2.3	Rated voltage	kV/V	33 ± 2 x 2.5 % / 415	
2.4	Tap changer: • Type of tap changing • Tapping range • Tapping step • Rating	% %	Off-load ±5 2.5 Rated power 200 kVA, all taps	
2.5	Frequency	Hz	50	
2.6	Connection of three-phase windings (group of vector IEC 60076)		Dyn11	
3.	Special technical requirements			
3.1	Power transformer capacity to withstand external short circuits			
3.1.1	Short-circuit duration	s	3	
3.1.2	Symmetrical short-circuit withstand capacity and asymmetrical short-circuit withstand capacity during indicated period: • MV winding • LV winding	kA kA	25 25	
3.2	Guaranteed losses			
3.2.1	No-load losses with tap changer in normal position, at rated voltage and rated frequency	kW	Insert	
3.2.2	Tolerance to be applied to no-load losses in % of the guaranteed value	%	10	
3.2.3	On-load losses at 75°C, at rated voltage and rated frequency, with tap changer in normal position	kW	Insert	

3.2.4	Tolerance to be applied to on-load losses in % on the guaranteed value	%	10	
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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
3.3	Insulation level			
3.3.1	Medium voltage (MV)		LI 170 AC 70	
3.3.2	Low voltage (LV)		LI - AC 3	
3.4	The highest voltage for equipment (effective value)			
3.4.1	Medium voltage (MV)	kV	36	
3.4.2	Low voltage (LV)	kV	1.1	
3.5	Temperature rise limits, at rated power, with complete cooling system in service and at low- est voltage tap			
3.5.1	Top oil	K	≤ 50	
3.5.2	Winding	K	≤ 55	
3.5.3	Hottest spot	K	≤ 65	
4.	Oil			
4.1	New		Insert	
4.2	Manufacturer		Insert	
4.3	Type		Insert	
4.4	Standard		IEC 60296	
4.5	Minimum flash point	°C	Insert	
4.6	Viscosity at 20°C	mm ² /s	Insert	
4.7	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		Insert	
5.1.5	Rated current	A	≥ 100	
5.1.6	Minimum creepage distance (25 mm/ kV)	mm/ kV	≥ 25 mm/ kV	
5.2	LV bushings (3 kV)			
5.2.1	Quantity		3 + 1	
5.2.2	Class	kV	3	
5.2.3	Manufacturer		Insert	
5.2.4	Type		Insert	
5.2.5	Rated current	A	≥ 400	
5.2.6	Minimum creepage distance (25 mm/ kV)	mm/ kV	≥ 25 mm/ kV	
6.	Weights and dimensions			
6.1	Total weight of transformer, ready for service	kg	Insert	
6.2	Outer dimensions: • Length • Width	mm mm	Insert 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	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
8.	Conservator			
8.1	Type		With dehydrating	
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	+ 45	
9.3	Average daily temperature	°C	+ 35	
9.4	Average annual temperature	°C	+ 30	
9.5	Minimum ambient temperature	°C	- 5	
Overall compliance with the requirements (yes/no)				

15. Energy meter

Sl. No.	Description	Required Specification	Manufacture's particulars
1	Reference Standard	Relevant ANSI / IEC Standard	
2	Manufacturer's name & address	Shall be mentioned	
3	Manufacturer's type & model	Shall be mentioned	
4	Construction/connection	3-Phase 4-wire solidly grounded neutral	
5	Installation	Indoor installation in A socket [for socket type]	
6	Number of element	3 (Three)	
7	Rated Voltage , Volt	110V	
8	Minimum Biasing Voltage , Volt	40V	
9	Variation of Frequency, %	± 2.5%	
10	Variation of Voltage, %	-20% to + 10%	
11	Accuracy class	0.2 (point two)S	
12	Rated Current		
	i)	Nominal Current , A	= 5
	ii)	Maximum Current , A	> 6
13	Resister Type	LCD Display	

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14	Number of Digits (Integer with Decimal), Nos.	5 with 3 (Programmable)	
15	Starting Current , ma	0.1% of Nominal Current	
16	Losses at Nominal Load , Watt	Shall be mentioned	
17	Meter Constant , Imp./	Shall be mentioned	
18	Integration Period	30 (Thirty) Minutes	
	Resetting Period	1 (one) month	
	Cumulative MD transfer	Built in	
	Cycle Timing Device	Built in	
19	Size of the Digit of Display, E x H in mm	4 x 8	
20	No. of Terminal , Nos.	10 (Ten) min	
21	Type of socket and country of origin	To be mentioned	
22	Battery Service life and shelf Life (minimum), Year	10 (ten) & 15 (fifteen)	
23	Year of manufacture	Shall be mentioned	
24	List of Recommended spare parts (if any) , any	Shall be mentioned	
25	Warranty , Year	3 (three)	
26	Meter Service Life (Min), Year	15 (fifteen)	
27	Weight of meter , Kg	Shall be mentioned	
28	Dimensions , mm x mm x mm	Shall be mentioned	
29	Outlines, Drawings & Leaflets	Shall be mentioned	
30	Performance Curve for Balanced & Unbalanced load	Shall be mentioned	
31	Meter sealing condition	Hermetically or Ultrasonic welded (Break to open)	
32	Meter parameter configuration	To be configured (Both software and hardware lock)	
33	Losses of nominal Load, Watt & VA	To be mentioned	
34	Current circuit loss at rated current, VA	To be mentioned	
35	Application protocol	DLMS/COSEM	
36	Communication (if required)	Plug & play 4G communication module	

37	a) Country of Origin b) Place of Manufacture c) Place of Testing	Shall be mentioned	
38	Memory Storage	Shall be mentioned by putting Yes/ No.	
	i) Equipment Identification Code		
	ii) Security code		
	iii) Access code		
	iv) Number of Power Interruption with Date & Time		
	V Latest Power Failure- Time & Date		
	Vi Event logs		
	vii) Cumulative kWh, kVarh (Q1 + Q4) Reading for previous two months		
	viii) Load profile with 30 min interval at least 90 days for:		
			KWh, kVarh (Q1+Q4)
	Phase Voltage or Vh		
	Phase Amps or Ah		

16. Control, Relay Protection, Substation Automation System & Metering

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

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

The central unit for busbar protection must be supported for min. 16 bays. The design proposal of the cubicles is subject of approval.

The cubicles shall be delivered completely wired and tested.

17. Control Cubicle for OHL & Bus Coupler

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

18. Control Cubicle for Power Transformers HV Side

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






19. Control Cubicle for Power Transformers LV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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	pcs.	1	
1.1.2	Back-up control panel	pcs.	1	
1.1.3	Front panel annunciation for OHL & TR	pcs.	1	
1.1.4	Ethernet switch-process LAN	pcs.	1	
1.1.5	AVR	pcs.	1	
1.2	Other equipment (specify if any)		Insert	
Overall compliance with the requirements (yes/no)				

20. Control Cubicle for LV AC & DC Switchgear

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Control Cubicle for LV AC & DC SWG				
1.1	Control cubicle for LV AC&DC SWG			
1.1.1	Bay control unit for LV AC&DC SWG	pcs.	4	
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)				

21. Control Cubicle for SCADA Server

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Control Cubicle for SCADA Server				
1.1	Cubicle for SCADA servers			
1.1.1	SCADA server	pcs.	2	
1.1.2	Ethernet switch-process LAN	pcs.	2	
1.1.3	Ethernet switch-control room LAN	pcs.	2	
Overall compliance with the requirements (yes/no)				

22. Protection Cubicle No. 3 for 132 kV OHL

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

23. Protection Cubicle for Power Transformer HV Side

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

24. Protection Cubicle for Power Transformer LV Side

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Cubicle for Power Transformer LV Side				
1.1	Protection cubicle for Power Transformer LV Side			
1.1.1	Protection terminal for power transformer Main 2	pcs.	1	
1.1.2	Protection terminal for power transformer LV Side	pcs.	1	
1.1.3	Busbar & breaker failure protection bay	pcs.	1	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
1.1.4	Trip circuit supervision relay	pcs.	2	
1.1.5	Tripping unit	pcs.	3 (To be confirmed with detailed design)	
1.1.6	Test socket	pcs.	3	
Overall compliance with the requirements (yes/no)				

25. Protection Cubicle for Bus Couplers 132 kV

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

26. Bay Control Unit for OHL and Bus Couplers

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Bay Control Unit for OHL and Bus Couplers				
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	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.2.2	Rated current I _r	A	I	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Min. 16	
2.6.2	Multi-colour LEDs	Yes/No	Insert	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface			
2.8.1	HMI with single line diagram, measurement, signalling and control		Yes	
2.9	Synchronism & energising check			
2.9.1	Frequency difference range	mHz.	Insert	
2.9.2	Voltage difference range	% U _r	Insert	
2.9.3	Phase difference range	°	Insert	

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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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.

27. Bay Control Unit for Power Transformers HV & LV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Bay Control Unit for Power Transformers HV&LV				
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2.	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms	> 50	
		s	Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current I _r	A	1	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Min. 16	
2.7.2	Multi-colour LEDs	Yes/No	Insert	

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

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



28. Bay Control Unit for LV AC & DC

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7.2	Multi-colour LEDs	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 synchronization		SNTP	
2.9	Human-machine interface			
2.9.1	HMI with single line diagram, measurement, signalling and control		Yes	
2.10	Event recorder			
2.10.1	Max. number of events		Insert	
2.10.2	Time tagging resolution	ms	1	
2.11	Self-supervision		Yes	
2.12	Measurement			
2.12.1	Voltage measurement		Yes	
2.12.2	Frequency measurement		Yes	
2.12.3	Current measurement		Yes	
Overall compliance with the requirements (yes/no)				

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

29. Back-Up Control Panel

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Back-up Control Panel			
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.

30. Front Panel Annunciation for OHL & Power Transformers

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14255	Front Panel annunciation for OHL & TR			
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 <ul style="list-style-type: none"> • via front indication • via relay contact 		Yes	
1.6	Response delay time		Adjustable	
1.7	Bright LED technology		Yes	
1.8	Audible device output		Yes	
1.9	Lamp test button		Yes	
1.10	Acknowledgement button		Yes	
1.11	Horn acknowledgement button		Yes	
	Overall compliance with the requirements (yes/no)			

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

31. Front Panel Annunciation for Control Room

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

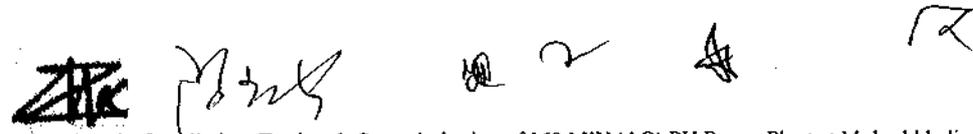
Front panel annunciation must be parameterized, configured and delivered as per Engineer's requirements.

32. SCADA Server

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

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

SCADA servers must be in hot-standby redundant configuration.



 Design, Supply, Installation, Testing & Commissioning of 160 MW (AC) PV Power Plant at Moheshkhali.

33. Operator Workstation

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

34. Printer

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

35. Monitoring Workstation

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

36. Ethernet Switch Process LAN

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

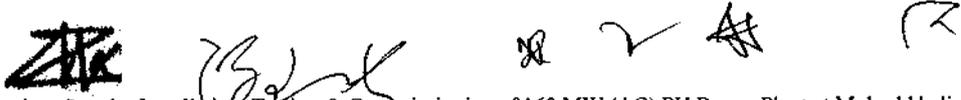
Technical characteristics of optical ports of process LAN Ethernet switches must comply with appropriate characteristics of fibre optic cables for protection and control (see Code No. 14296).

37. Ethernet Switch Control Room

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

38. Protection Monitoring Software

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
	Protection Monitoring Software			
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)			



 Design, Supply, Installation, Testing & Commissioning of 160 MW (AC) PV Power Plant at Moheshkhali.

39. SCADA Software

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

40. Fibre Optic Cables & Terminal Equipment

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

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

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

41. Special Control Equipment and Tools

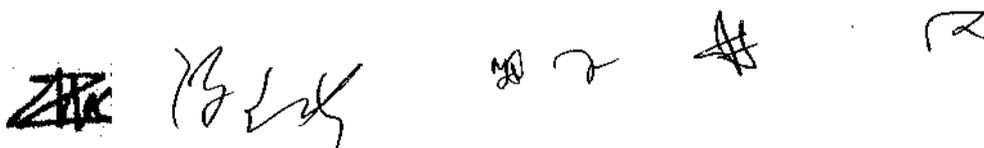
No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Special Control Equipment and Tools / Code number: 14299				
1.1	Special Control Equipment and Tools			
1.1.1	Special equipment and tools for setting, repairing, handling and maintaining of control system	set	1	
1.1.2	Software needed for configuration,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

42. Protection Terminal 132 kV OHL Main 1

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

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

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



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

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






43. Protection Terminal 132 kV OHL Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Terminal 132 kV OHL Main 2				
1.1	Manufacturer		Different than Main 1	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2.	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms s	> 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current I _r	A	1	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	<0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Insert	
2.6.2	Multi-colour LEDs	Yes/No	Insert	

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

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

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

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44. Protection Terminal for Power Transformers Main 1

No	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Terminal for Power Transformers Main 1				
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2.	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ± 15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms	> 50	
		s	Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 9	
2.2.2	Rated current I _r	A	1	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Insert	
2.6.2	Multi-colour LEDs	Yes/No	Insert	

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

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

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45. Protection Terminal for Power Transformers Main 2

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Terminal for Power Transformers Main 2				
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 dc.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms s	> 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 9	
2.2.2	Rated current I _r	A	1	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Insert	
2.6.2	Multi-colour LEDs	Yes/No	Insert	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.7	Communication ports		Yes	
2.7.1	Port for front-connected PC			
2.7.1.1	Protocols supported		Insert	
2.7.1.2	Communication speed	Kbit/s	Insert	
2.7.1.3	PC side connector type		Insert	
2.7.2	System interface			
2.7.2.1	Number of rear ports		2	
2.7.2.2	Protocols supported		IEC 61850	
2.7.2.3	Communication speed	Mbit/s	Min. 100	
2.7.2.4	Connector type		RJ45 or FO	
2.7.3	Time synchronisation		SNTP	
2.8	Human-machine interface		Yes	
2.8.1	LCD alphanumeric display, No. of rows		Insert	
2.9	Number of setting parameter groups		Min. 4	
2.10	Autotransformer / Transformer Differential protection			
2.10.1	Inrush restraint		Yes	
2.10.2	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 auto-transformer / transformer			
2.11.1	Low Impedance		Yes	
2.11.2	Internal CT ratio vector group compensation		Yes	
2.11.3	Basic differential current range	% Ir	Insert	
2.11.4	Operating time	ms	< 30	
2.12	Current negative sequence protection			
2.12.1	Number of stages		Insert	
2.12.2	Setting range	% Ir	Insert	
2.12.3	Characteristic		Insert	
2.13	Multistage three-phase overcurrent 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 $I > 10 \cdot I_{set}$	Ms	< 30	
2.13.2	Time delayed overcurrent protection			
2.13.2.1	Setting range	% Ir	Insert	
2.13.2.2	Type of protection		Non-directional	
2.13.2.3	Characteristics			
2.13.2.3.1	Definite time delayed	Yes/no	Yes	

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

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46. Protection Terminal for LV side of Power Transformer

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Terminal for LV side of Power Transformer				
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2.	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms s	> 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current I_r	A	1	
2.2.3	Permissible overload, continuous		4x I_r	
2.2.4	Permissible overload, 1 s		100x I_r	
2.2.5	Burden at I_r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph U_r	V	100	
2.3.3	Permissible overload, continuous	% U_r	150	
2.3.4	Permissible overload, 1 s	% U_r	250	
2.3.5	Burden at U_r	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 LEDs		Insert	
2.6.2	Multi-colour LEDs	Yes/No	Insert	

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

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

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47. Automatic Voltage Regulation

No	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Automatic Voltage Regulation				
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2. Characteristics				
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms s	> 50 Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		1	
2.2.2	Rated current for 110 kV	A	1	
2.2.3	Permissible overload, continuous		3xIr	
2.2.4	Permissible 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	Permissible overload, continuous	% Ur	150	
2.3.4	Permissible overload, 1 s	% Ur	250	
2.3.5	Burden at Ur	VA	< 0.3	
2.4	Voltage control function			
2.4.1	Set voltage range	% U _{r2}	Insert	
2.4.2	Set voltage dead-band range	% U _{r2}	Insert	
2.4.3	Upper limit busbar voltage range	% U _{r2}	Insert	
2.4.4	Lower limit busbar voltage range	% U _{r2}	Insert	
2.4.5	Line voltage drop compensation	Yes/No	Insert	
2.4.6	Regulation for capacitive load	Yes/No	Insert	
2.4.7	Undervoltage blocking range	% U _{r2}	Insert	
2.4.8	Overcurrent blocking range	% I _r	Insert	
2.4.9	Parallel operation		Yes	
2.4.10	Parallel operation principal		Insert	
2.5	Communication ports		Yes	
2.5.1	Port for front-connected PC			
2.5.1.1	Protocols supported		Insert	
2.5.1.2	Communication speed	Kbit/s	Insert	
2.5.1.3	PC side connector type		Insert	
2.5.2	System interface			
2.5.2.1	Number of rear ports		Min. 1	
2.5.2.2	Protocols supported		IEC 61850	
2.5.2.3	Communication speed	Mbit/s	Min. 100	
2.5.2.4	Connector type		RJ45 or FO	

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







48. Protection Terminal for Bus couplers 132 kV

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Protection Terminal for Bus couplers 132 kV				
1.1	Manufacturer		Insert	
1.2	Country of origin		Insert	
1.3	Terminal type		Insert	
1.4	Terminal version (software version)		Insert	
1.5	Standards		IEC	
2.	Characteristics			
2.1	Auxiliary supply voltage			
2.1.1	Rated auxiliary supply voltage	V d.c.	110 ±15 %	
2.1.2	Interruption in auxiliary d.c. voltage: • Without resetting • Restart time	ms	> 50	
		s	Insert	
2.2	a.c. current inputs			
2.2.1	Number of inputs		Min. 4	
2.2.2	Rated current I _r	A	1	
2.2.3	Permissible overload, continuous		4xI _r	
2.2.4	Permissible overload, 1 s		100xI _r	
2.2.5	Burden at I _r	VA	< 0.5	
2.3	a.c. voltage inputs			
2.3.1	Number of inputs		Min. 4	
2.3.2	Rated voltage Ph-Ph U _r	V	100	
2.3.3	Permissible overload, continuous	% U _r	150	
2.3.4	Permissible overload, 1 s	% U _r	250	
2.3.5	Burden at U _r	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 LEDs		Insert	
2.6.2	Multi-colour LEDs	Yes/No	Insert	

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



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

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49. Busbar and Breaker Failure Protection for 132 kV Busbars

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

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
2.6	Communication ports CU, BU			
2.6.1	Port for front-connected PC			
2.6.1.1	Protocols supported		Insert	
2.6.1.2	Communication speed	Kbit/s	Insert	
2.6.1.3	PC connector type		Insert	
2.6.2	CU, BU communication media		FO	
2.6.3	CU rear station (system) communication ports			
2.6.3.1	Number of rear ports		Insert	
2.6.3.2	Protocols supported		IEC 61850	
2.6.3.3	Communication speed	Mbit/s	Insert	
2.6.3.4	Connector type		RJ45	
2.6.4	Time synchronisation		SNTP	
2.7	Busbar differential protection			
2.7.1	Operating time	ms	< 20	
2.7.2	Internal CT ratio adaptability		Yes	
2.7.3	Multiple tripping criteria, check and bus zone		Yes	
2.7.4	Current transformer supervision		Yes	
2.7.5	External signal of load transfer starting		Insert	
2.7.6	Busbar protection system should be suitable/adaptable for future switchgear extension or modification		Yes	
2.7.7	Bay-selective intertripping		Yes	
2.7.8	Phase-segregated measurement system		Yes	
2.8	Breaker failure protection			
2.8.1	Setting range	% Ir	Insert	
2.8.2	Re-trip time delay range	s	0-1	
2.8.3	Re-trip operation mode 1/3ph		Yes	
2.8.4	Back-up time delay range	s	0-1	
2.8.5	Trip operating time setting resolution	ms	1	
2.8.6	Trip delay range	s	0-1	
2.8.7	Single-phase with/without current		Yes	
2.8.8	2-stage operation bay trip repeat/trip busbar		Insert	
2.8.9	Selectable operation mode (current, unbalance, low current)		Insert	
2.8.10	Independent settable delay times for all operation modes		Yes	
2.8.11	Low current mode using the circuit breaker auxiliary contact		Yes	
2.8.12	End fault protection		Yes	
2.8.13	Independent breaker failure protection per bay unit		Yes	
2.9	Disturbance recorder CU, BU			
2.9.1	Number of digital signals		Insert	
2.9.2	Number of analogue signals		Insert	
2.9.3	External/manual initiation of recording		Insert	
2.9.4	Sampling rate	kHz	Insert	
2.9.5	Pre-fault time	ms	≥ 300	

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
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)				

50. Trip Circuit Supervision Relay

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
14011	Trip Circuit Supervision Relay			
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)				

51. Tripping Unit - High-Speed Tripping Relay

No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
Trip Circuit Supervision Relay				
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)				

52. 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 <ul style="list-style-type: none"> • Line main 1 and 2 • Line back-up and bus coupler • Transformer main 1 and 2 • Bay unit BBF • Distance protection (code 14007) 		Insert	
1.4	Standards		IEC	
1.5	Each protection device must have its own test socket		Yes	
1.6	Test socket must obtain safe online protection testing and maintaining, and performing whole tripping test with following AR		Yes	
1.7	Test socket should have enough contacts to: <ul style="list-style-type: none"> • Short-circuit current inputs from CT's • Isolate voltage inputs from VT's • Isolate trip circuit for each phase separately • Isolate CB close command • Isolate signalling voltage • Inhibit breaker failure initialising • Inhibit sending of communication signal • Allow functional testing of protection 		Yes	
1.8	Socket should be designed for 4 mm banana plugs access		Yes	
Overall compliance with the requirements (yes/no)				








53. Battery

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



54. Battery Charger

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

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55. Fibre Optic Multiplexer Equipment

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

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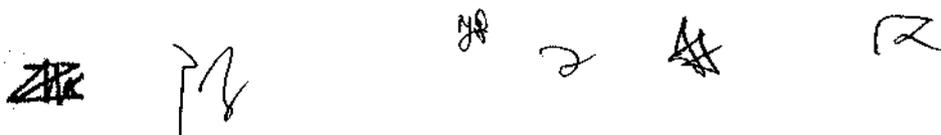
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No.	Description	Minimum Requirements		Guaranteed
		Unit	Data	
4.4	Data: channels per module			
4.4.1	1 + 1 com path protection, available for all		yes	
4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	No.	4	
4.4.3	V.11/X.24 (RS-422): 64kbit/s	No.	4	
4.4.4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

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



56. Digital Fault and Disturbance Recorder (DFDR)

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

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

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

57. PV Panel Support and other foundation PHC Pile specification:

01	Name & Address of the Manufacturer	To be mentioned	Manufacturer Data
02	Type	to be mentioned	
03	Overall Length, m	9	
04	Depth of Plantation (m)	5	
05	Outer Diameter of the Pole, mm	350	
06	Inner Diameter of the Pole, mm	210	
07	Thickness, mm	70	
08	Number of Pre-stressing wire, mm	9	
09	Size of Pre-stressing wire, mm	9	
10	Diameter of spiral, mm	4	
11	Cracking Bending moment, KN-m	49	
12	Crushing Bending moment, KN-m	88.20	
13	Wind load on pile to p, kN	7.48	
14	Straightness ratio	To be mentioned	
15	Weight of Pole (Kg)	To be mentioned	

58. UPS Specification Sheet

Sl. No.	Item	To be Proposed by the Bidder
1.	Manufacturer	
2.	Country of Manufacture	
3.	Model	
4.	Voltage output (V)	
5.	Regulation (\pm %)	
6.	Frequency (Hz)	
7.	Power Rating (VA)	
8.	Load Power Factor	
9.	Load Crest Factor	
10.	Transfer Time (ms)	
11.	Current (A)	
12.	Overload Capability (%)	
13.	Waveform	
14.	Distortion (< %)	
15.	Transient Regulation (\pm 5%)	
UPS Input		
16.	Voltage (V)	
17.	Voltage Range (+% -%)	
18.	Frequency (Hz)	
19.	Maximum Current (A)	
20.	Power Factor	
UPS Battery		
21.	Type	
22.	Rating (V – Ah)	
23.	Number of Cells	
24.	Autonomy Time at full load (min)	
25.	Recharge Time to 90% capacity as multiple of outage time	



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59. Guaranteed Technical Particulars of 33KV Single Phase Post Type Lightning Arrester

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
01	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2023	
02	Country of Origin		To be mentioned	
03	Place of manufacture		To be mentioned.	
04	Manufacturer's model No.	-	To be mentioned	
05	Type of the Arrester	-	Metal Oxide (ZnO), Gapless-Outdoor (Single Unit.)	
06	Nominal System Voltage	KVrms	33 KVrms	
	Highest Voltage for equipment Un	KVrms	36	
	Rated Voltage for Surge Arrester, Ur	KVrms	30	
07	Max Continuous Operating Voltage (COV, Uc)	kVrms	24	
08	Nominal Discharge Current (8/20micro sec)	KA	10	
09	Type of Lightning Arrester housing	-	Porcelain/polymer	
10	Power Frequency withstand voltage of the Arrester Housing, Dry & Wet	kV	>105	
11	Impulse withstand Voltage of the Arrester Housing.	kV (peak)	170	
12	Lightning Impulse Residual Voltage (8/20 micro-second wave at 5KA)	kVrms	75	
13	Housing insulation material		Composite / Silicon	
14	Insulating basement		Yes	
15	Temporary Over voltage capability:			
	a) 0.1 Second	kV (peak)	Shall be mentioned	
	b) 1.0 Second	kV (peak)	Shall be mentioned	
16	c) 10 Second	kV (peak)	Shall be mentioned	
	d) 100 Second	kV (peak)	Shall be mentioned	
	Leakage Current at rated voltage	mA	< 1 mA	
17	Total Creepage distance (minimum)	mm/ kV	31	

18	Overall dimension :			
	a) Height	mm	Shall be mentioned	
19	b) Diameter	mm	Shall be mentioned	
	Total weight of Arrester	Kg.	Shall be mentioned	
20	Line discharge class	-	Shall be mentioned	
21	Short Circuit Current Withstand duration	Sec	31.5kA, 1 sec	
22	Minimum Energy Discharge capability (KJ/KV) at rated voltage	-	5	
23	Min. Bending load (kgm)		500	
24	Surge Counter /Monitor		Shall be provided	
25	Cable for Connecting Surge Counter		Shall be provided	
26	Reference Standard		IEC 60099-4	

60. Pyranometer and Data Logger

SL No	Description	Purchaser's Requirement	Manufacturer's Particulars
Pyranometer			
01	Description of the Item	Pyranometer	
02	Name of the Manufacturer	To be mentioned	
03	Standard	Design, manufacturing, performance & testing shall be in accordance to the IEC or equivalent international standards.	
04	Model number	To be mentioned	
05	Spectral Range	285 to 2800 nm	
06	Sensitivity	7 to 14 μ V/W/m ²	
07	Response Time	< 5 s	
08	Zero Offset A	< 7 W/ m ²	
09	Zero Offset B	< 2 W/ m ²	
10	Direction Error (up to 80° with 1 Sun irradiance)	< 10 W/ m ²	
11	Operating Temperature Range	-40° C to +80° C	
12	Temperature Dependence of	< 1%	



	Sensitivity (-40° C to +80° C)		
13	Maximum Solar Irradiance	4000 W/ m2	
14	Field of View	180 °	
Data Logger			
01	Description of the Item	Data Logger	
02	Name of the Manufacturer		
03	Standard	Design, manufacturing, performance & testing shall be in accordance to the IEC or equivalent international standards.	
04	Model number	To be mentioned	
05	Local Communication	USB 2/ Optical Port	
06	Remote Access	RS232/485 modem interface port	
07	Display	Alphanumeric LCD	

61. 132 kV Evacuation Line

132 kV Evacuation Line: ACSR Grosbeak

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
ACSR Grosbeak			
1	Name of the Item	ACSR GROSBEAK	
2	Name of the Manufacturer	Shall be mentioned	
3	Address of the Manufacturer	Shall be mentioned	
4	Standard	Performance Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent International standards.	
5	Installation	Overhead	
6	Type	Stranded	
7	Material	Hard drawn Aluminium steel reinforced	
8	Overall diameter, mm	25.15	
9	Nominal cross sectional area of conductor, mm ²	374.70	

10	Number/diameter of Aluminium Strand, No./mm	26/3.97	
11	Nominal Aluminium cross sectional area, mm ²	321.68	
12	Number/diameter of Steel Strand, No./mm	7/3.09	
13	Nominal Steel cross sectional area, mm ²	53.02	
14	Weight of conductor, Kg/KM	1304	
15	Drum wound length, M	500	
16	Net weight, Kg	Shall be mentioned	
17	Gross weight, Kg	Shall be mentioned	
18	Maximum DC Resistance of Conductor at 20 °C, Ω/KM	0.0900	
19	Minimum breaking Load of Conductor, Kg	11400	
20	Maximum working tension of conductor, KN	Shall be mentioned	
21	Current rating at 35°C rise over 40°C ambient temperature (75°C), Amps.	538 (min)	
22	Practical (final) modulus of elasticity, hbar	7700	
23	Co-efficient of linear expansion , /°C	18.9 x 10 ⁻⁶	
24	Aluminum to Steel Ratio	Shall be mentioned	
25	Lay length, mm	Shall be mentioned	
26	Lay direction	Right hand	
27	Lay ratio	10-14	
28	Treated Wooden Drum Standard	AWPA C1 – 82, C2 –83, C16 –82, P5 –83.	



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63. Transmission Line

132kV double circuit tower

Parameter	Tower Type			
	1DL	1D1	1D25	1DT6
Tower Dimensions:				
Total Height of Tower (Standard)				
Vertical Spacing between Conductor-Earthwire				
Horizontal Phase Separation				
Vertical Phase Separation				
Base width (Standard height tower)				
Mass of Tower excluding stubs:				
Total mass of Standard height Tower				
Total mass of E1.5 Tower				
Total mass of E3.0 Tower				
Total mass of E4.5 Tower				
Total mass of E6.0 Tower				
Total mass of E9.0 Tower				
Total mass of E12.0 Tower				
Total mass of E15.0 Tower				
Total mass of E18.0 Tower				
Total mass of E21.0 Tower				
Total mass of E25.0 Tower				
Approximate Ultimate Compression Load/leg (E9.0)				
Approximate Ultimate Uplift Load/leg (E9.0)				

64. 132kV Four circuit tower

Parameter	Tower Type			
	1QL	1Q15	1Q30	1QT6
Tower Dimensions:				
Total Height of Tower (Standard)				
Vertical Spacing between Conductor-Earthwire				
Horizontal Phase Separation				
Vertical Phase Separation				
Base width (Standard height tower)				
Mass of Tower excluding stubs:				
Total mass of Standard height Tower				
Total mass of E1.5 Tower/M10 for 2DR				
Total mass of E3.0 Tower/M30 for 2DR				
Total mass of E4.5 Tower/M4.5 for 2DAX				
Total mass of E6.0 Tower				
Total mass of E9.0 Tower				
Total mass of E12.0 Tower				
Total mass of E15.0 Tower				
Total mass of E18.0 Tower				
Total mass of E21.0 Tower				
Total mass of E25.0 Tower				



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Parameter	Tower Type			
	1QL	1Q15	1Q30	1QT6
Approximate Ultimate Compression Load/leg (E9.0)				
Approximate Ultimate Uplift Load/leg (E9.0)				

65. 132kV Double Circuit Tower

Tower Type Particulars	1DL (Standard)	1D1 (Standard)	1D25 (Standard)	1DT6 (Standard)
Type of piled foundation				
No. of piles per leg*				
Length of pile* (mm)				
Diameter of pile (mm)				

66. 132kV Four Circuit Tower

Tower Type Particulars	1QL (Standard)	1Q15 (Standard)	1Q30 (Standard)	1QT6 (Standard)
Type of piled foundation				
No. of piles per leg*				
Length of pile* (mm)				
Diameter of pile (mm)				

*The final figures shall be attained during detailed design of tower foundations and their approval thereof, after award of contract and the foundations shall be supplied accordingly within the contract price.

67. CONDUCTOR & EARTHWIRE

132kV Line

Parameter	Unit	Conductor	Earthwire (if used)

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Conductor Designation & Type		ACSR Grosbeak	7 x 3.25 Steel
Reference standard		ASTM B232	
Number & Diameter of strands	No. x mm		
Overall Diameter	mm		
Guaranteed Ultimate Tensile Strength	kN		
Final Modulus of elasticity	N/mm ²		
Coefficient of Linear Expansion	1/degree		
D.C. Resistance at 20°C	ohm/m		
Standard Weight	Kg/m		
Weight of grease	Kg/m		
Drop point of grease	°C		
Standard length on drum	m		
Lay Direction			
Weight of complete drum	kg		
Percentage of random short drum lengths(not more than 4 percent)	%		

68. OPGW & FITTINGS

Parameter	Unit	7×3.25mm Steel Earthwire equivalent OPGW
OPGW Designation & Type		
Number of fiber		24
Reference standard		
Number and Diameter of Aluminium strands	mm	
Number and Diameter of Steel strands	mm	
Corrosion Protection of Steel Strands		
Internal Fibre tube diameter	mm	
Overall diameter	mm	
Guaranteed Ultimate Tensile strength	kN	
Final Modulus of Elasticity	N/mm ²	
Co-efficient of linear Expansion	1/degree	
DC Resistance at 20°C	ohms/m	
Maximum short circuit current capacity	kA ² sec	25
Assumed temperature rise	°C	
Standard Weight	kg/m	
Weight of grease	kg/m	
Standard length on drum *	m	
Weight of complete drum	kg	
Maximum drum length	m	
Installation minimum bending radius	m	
OPTICAL CHARACTERISTICS:		
Cut off Wave length	nm	
Attenuation at Nm	dB/km	
Zero dispersion wave length	nm	
Chromatic dispersion at nm	ps/km	
Individual splice loss	dB	
Bit error rate		
OPGW FITTINGS:		
Guaranteed Ultimate Tensile strength		
Suspension set	kN	
Tension set	kN	
Overall length of set		
Suspension set	mm	
Tension set	mm	
Mass of set		
Suspension set	kg	
Tension set	kg	
Drawing Numbers :		
Cross section of OPGW		
Cross section of Non metallic cable		
Joint box		
Fixing Clamps		
OPGW Suspension set		
OPGW Tension set		
OPGW Vibration Damper		

* Drum length to be finalized after finalization of tower locations as per check survey.



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69. INSULATOR SETS & FITTINGS

132kV Line

Parameter	Unit	Insulator Set Type				
		Suspension/ Jumper Suspension	Heavy Suspension	Tension	Upright Low Duty	Inverted Low Duty
Insulator Unit Type No.		U70B	U120B	U120B	U70B	U70B
Dielectric Material		{ Porcelain }				
Total creepage per unit	(mm)					
Spacing	(mm)					
Overall shed diameter	(mm)					
Puncture Voltage of unit	(kV)					
Electro Mechanical Failing Load of unit	(kN)					
Drawing No. of Unit						
Type test Certificate No. of Unit						
Number of string and units per string		1x11	1x11	1 x 11	1 x 11	1 x 11
Total creepage of string	(mm)					
Overall length of set	(mm)					
Sag adjuster type and step	(mm)					
Ultimate strength of set	(kN)					
Mass of set	(kg)					
Anticipated -Lightning impulse withstand Voltage	(kV)					
-Power Frequency withstand Voltage	(kV)					
-Corona extinction level	(kV)					

70. SPACERS AND SPACER DAMPERS

Spacer Dampers

Parameter	Unit
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Unit Weight	kg	
Material	-	
No. of spacer dampers to be used for each phase per span*	nos.	
Total quantities of spacer dampers for one basic span*	nos.	

These quantities shall be based on the design of the proposed spacer dampers. The quantities mentioned above may increase at the contractor's cost, if during design approval such increase is necessary.

71. VIBRATION DAMPERS

Parameter	Unit	
Unit Weight of Vibration Dampers		
- for ACSR Grosbeak	kg	
- for 7 x 3.25 S earthwire	kg	
- for 7 x 3.25 S earthwire equivalent OPGW	kg	
Nos. of Vibration dampers to be used for ACSR Grosbeak per standard span	Nos.	
Nos. of Vibration dampers to be used for 7 x 3.25 S earthwire per standard span (Not applicable)	Nos.	
Nos. of Vibration dampers to be used for 7 x 3.25 S earthwire equivalent OPGW per standard span	Nos.	

* These quantities shall be based on the design of the proposed vibration dampers. Actual number of vibration damper will be decided according to the Manufacturer's recommendation for each span.

72. Technical Parameters for 33KV Static VAR Generator:

Description	Minimum Requirements	Manufacturer's Guaranteed Data
Name of the Manufacturer	To be mentioned	
Country of origin	To be mentioned	
Model Number	To be mentioned	
Rated voltage	33 kV	
Input voltage range	To be mention	
Grid frequency	50±0.5Hz	
Rated capacity	Min. 32.5Mvar	
Full load power loss	<0.8%	
Total harmonic current distortion	≤3%,	
Total PCC harmonic voltage distortion	≤3%	
Response time	<5ms	
Overload capacity	1.1 times over-load, long time operation; 1.2times over-load for 1minute, trip	
Fault treatment	Redundancy design meeting automatic N-1 operation	
Operation mode	Constant reactive power mode, constant voltage mode, constant power factor mode, load compensation mode, Voltage & Reactive power integrated control mode	
Communication protocol	Modbus, IEC104	
Monitoring mode	Local/remote control	
HMI	LCD touch screen in English	
Signal transmission	Optical-fiber communication	
Key technology	Instantaneous reactive power theory, SPWM theory, decoupling control technology, capacitor voltage balance control technology, three-phase independent control technology, single pole multiple frequency technology, carrier phase-shifting SPWM theory, chain link temperature real-time monitoring technology	
Power interface	380VAC, 220VDC dual circuits dual redundancy power supply	
Main protection function	Over-current, Over-voltage, drive fault, Power unit over voltage, over-current, over-temperature, communication faults etc. water-cooling failure	
Wiring method	Star connection or Delta connection	
Cooling method	Air cooling, water cooling	
Protection class	Indoor IP30 Container: IP54	
Installation method	Indoor Outdoor	
Service life	20Years	
Operation environment		
Ambient temperature	-25°C~+50°C	
Storage environment temperature	-40°C~+70°C	
Altitude	2000m(To be customized in case of > 2000m	



Description	Minimum Requirements	Manufacturer's Guaranteed Data
Relative humidity	≤90%, no condensation	
Pollution grade	Class IV	

73. Automatic Robot Cleaner:

Description	Minimum requirement	Guaranteed
Name of the manufacturer	To be mentioned	
Country of Origin	To be mentioned	
Model Number	To be mentioned	
Modules types	Adapted to most available modules (framed, glass/glass)	
Width of the solar array	Adjustable to offered module	
Total weight	To be mentioned	
Nominal speed of movement - adjustable	0.3 m/s	
Mean autonomy (working time)	4 hours per battery, 2 batteries provided per robot	
Battery		
Type	24V cc 20Ah lithium iron phosphate battery	
Weight	To be mentioned	
Life cycle	2	
Operation temperature	0°C to 50°C	
Discharge temperature	-20°C to 60°C	
Charge time	Max 3h 30Hours	
Low battery detection	Yes	
Working temperature	12°C to 50°C	
IP protection	IP 65 [water & dustproof]	
Corrosion	10-year lifetime in a C3 environment	
Humidity	5% to 100%	
Mode	Automatic system (Round-trip)	
Switches and visuals	Mode selection switch / START / STOP / warning light	
End panel sensor	2 on each side	
Night operations	1 light on robot	
Connectivity	To be mentioned	
Monitoring	Access to a web-monitoring by plugging the robot to a digital tablet. (Modification of the cleaning parameters, troubleshooting & spare parts procurement)	

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Description	Minimum requirement	Guaranteed
Number of safety systems	1 emergency stop button on each side	
Standards	Machinery directive 2006/42/EC	
Brush type	Adapted to projects specificities,	
Movement transmission	Drive track (caterpillar-type)	
Carry handles	2	
Service Life	10 years	
Certification	Third party cycling test	
Dimension	To be mentioned	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder



