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a) SITE CONDITIONS		UNIT	DATA	
			Required	Offered
	General Requirement			
1	Climate		Arid	
2	Pollution		Very Heavy	
2.1	Creepage distance (based on Um)	mm/kV	31	
3	Isokeraunic Level	thunderstorm days/year	80	
4	Altitude of Area	m	1850	
5	Seismic Acceleration	g	0.25	
6	Air Temperature			
6.1	- Absolute maximum	°C	40	
6.2	- Absolute minimum	°C	1	
6.3	- max. mean daily	°C	25	
7	Humidity (Maximum average per day)	%	60	
8	Precipitation	Days per year	50	
9	Wind velocity			
9.1	- Normal wind	m/s	20	
9.2	- Gust (design basis)	m/s	40	
10	Maximum Snowy	days per year	10	
11	Ave. annual sum of direct normal irradiation	kWh/m2	1200	
12	Thickness of ice	mm	5	

a) SITE CONDITIONS		UNIT	DATA	
			Required	Offered
13	Average annual rainfall	mm	1000	
14	Minimum factors of safety for switchgear			
14.1	Busbars or other connections based on elastic limit		2.5	
14.2	Complete insulators based on electro-mechanical test		2.5	
14.3	Insulator metal fittings based on elastic limit		2.5	
14.4	Steel structures based on elastic limit of tension members and on crippling loads of compression members		2.5	
14.5	Foundations for structures against overturning or uprooting under maximum simultaneous working loadings		2.5	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.	400KV Circuit Breaker			
	<u>General</u>			
1.1	Manufacturer		Based on bidder's offer	
1.2	Place of manufacturing		Based on bidder's offer	
1.3	Type designation for breaker		Based on bidder's offer	
1.4	Type designation for operating mechanism		Based on bidder's offer	
1.5	Type of operation mechanism		Spring Charge motor operated	
1.6	Type of interrupting chamber		Based on bidder's offer	
1.7	Applicable standard		IEC 62271-100, 62271-101, 62271-110, 62271-302, 60376, 60480	
1.8	Rated voltage	kV	420	
1.9	System Voltage	kV	400	
1.10	Rated current at maximum site temperature	A		
1.10.1	For line feeder		4000	
1.10.2	For Transformer feeder		4000	
1.10.3	For Diameters		4000	
1.11	Rated frequency	Hz	50	
1.12	Media of breaking chamber		SF6	
1.13	Single pressure, low pressure or others		Based on bidder's offer	
1.14	Quantity of poles per breaker		3 Poles	
1.15	Rated operating sequence		O -0.3 sec- CO - 3 min - CO	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.16	Single pole or three pole operation			
1.16.1	For line feeder		1 pole operated	
1.16.2	For Transformer feeder		1 pole operated	
1.16.3	For Diameter		1 pole operated	
Note	All 400 kV circuit breakers should be capable of both Single pole and three pole operation			
1.17	Number of interrupting chambers per pole		One/Two	
1.18	Class (indoor / outdoor)		Outdoor	
1.19	Circuit breaker type (live tank / dead tank)		Live tank	
1.20	Type of system earthing		Effective	
1.21	Withstanding in load combinations of earthquake, wind , short circuit , etc as mentioned in Technical Specification	(Yes/ No)	Yes	
1.22	Maximum and Minimum ambient temperature for design	°C	Acc. to section 1	
1.23	Design altitude above sea level	m	Acc. to section 1	
1.24	Pollution level	mm/kV	Acc. to section 1	
1.25	Design seismic acceleration	g	Acc. to section 1	
	Insulation Rating			
1.26	Type of Insulator (porcelain/silicon rubber)		porcelain	
1.27	Basic Insulation level (at site condition)	kV peak		
1.27.1	Common value (Phase-phase, Phase-ground)		1425	
1.27.2	Across the isolating distance		1425+240	
1.28	One minute power frequency withstand voltage (at IEC condition)	kV rms		
1.28.1	Common value (Phase-phase, Phase-ground)		520	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.28.2	Across isolating distance		610	
1.29	Switching Impulse Withstand Voltage at IEC conditions	kV peak		
1.29.1	Phase to ground and across open switching device		1050	
1.29.2	Phase to phase		1575	
1.29.3	Across isolating distance		900+345	
1.30	Rated transient recovery voltage for terminal faults	kV peak	624	
1.31	Rated recovery voltage	kV peak		
1.31.1	Amplitude factor		Based on bidder's offer	
1.31.2	Rate of rise	kV/ μ s	Based on bidder's offer	
1.32	Rate of rise of restriking voltage			
1.32.1	For 30% breaking capacity	kV/ μ s	Based on bidder's offer	
1.32.2	For 60% breaking capacity	kV/ μ s	Based on bidder's offer	
1.32.3	For 100% breaking capacity	kV/ μ s	Based on bidder's offer	
1.33	Maximum recovery voltage on breaking a synchronous system	kV	Based on bidder's offer	
1.34	Rated characteristics for short line faults	kV rms	Based on bidder's offer	
1.35	First pole to clear factor		1.3	
1.36	Whether circuit breaker is restrike free?		Yes	
1.37	Maximum overvoltage factor on any switching duty	pu	2.3	
1.38	Maximum overvoltage factor when interrupting rated line/cable/capacitor bank charging currents	pu	2.3	
1.39	Maximum overvoltage factor when switching small inductive/reactor currents	pu	2.3	
1.40	Maximum total break time (trip initiation to final arc extinction)	ms	60	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
	Current Ratings			
1.41	Rated short time withstand current & duration	kA rms/sec	40/1	
1.42	Rated short circuit making current	kA peak	2.5*40	
1.43	Rated out of phase breaking current	kA rms	12.5	
1.44	Rated small inductive breaking current	A rms	Acc. To IEC	
1.45	Rated capacitive breaking current			
1.45.1	Rated line-charging breaking current	A rms	Acc. To IEC	
1.45.2	Rated cable charging breaking current	A rms	Acc. To IEC	
1.45.3	Rated Single/Back to Back Capacitor bank breaking current	A rms	Acc. To IEC	
1.46	Rated short circuit breaking current			
1.46.1	AC component	kA rms	40	
1.46.2	DC component	%	Acc. To IEC	
1.47	Maximum current on breaking asynchronous system	kA peak	Based on bidder's offer	
1.48	180° out of phase switching duty as a percentage of rated	%	Based on bidder's offer	
	Other Characteristics			
1.49	Voltage drop across HV terminals of one pole at 100 A dc	mV	Based on bidder's offer	
1.50	Maximum temperature rise at normal current over maximum	°C	Based on bidder's offer	
1.51	Opening time (from trip contact closing to the primary contacts separation in all poles)			
1.51.1	Without current	ms	Based on bidder's offer	
1.51.2	With 100% rated breaking current	ms	Based on bidder's offer	
1.52	Opening time from trip contact closing to primary contact separation	ms	≤25	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.53	Closing time (from energization of close coil to latching of circuit breaker in fully closed position)	ms	≤75	
1.54	Rated break or interrupting time (opening time plus arcing time)	ms	Based on bidder's offer	
1.55	Making time (energization of close coil to contact touch)			
1.55.1	Without current	ms	Based on bidder's offer	
1.55.2	100% making current	ms	Based on bidder's offer	
1.56	Maximum break time	ms	40	
1.57	Maximum close time	ms	< 70	
1.58	Dead time (during auto-reclosing)	ms	Based on bidder's offer	
1.59	Reclosing	ms	Based on bidder's offer	
1.60	Arcing time	ms	Based on bidder's offer	
1.61	Maximum time interval between opening of first and last phase of three phase circuit breakers	ms	3.3	
1.62	Maximum time interval between opening of interrupters of one phase	μs	Based on bidder's offer	
1.63	Maximum time interval between closure of interrupters of one phase	μs	Based on bidder's offer	
1.64	Minimum time from extinction of main arc to contact make during auto-reclosing duty	ms	Based on bidder's offer	
1.65	Closing time from energisation of close coil to latching of circuit breaker in fully closed position	ms	Based on bidder's offer	
1.66	Making time (energisation of close coil to contact touch)			
1.66.1	Without current	ms	Based on bidder's offer	
1.66.2	100% making current	ms	Based on bidder's offer	
	Operating Mechanism			
1.67	Type of spring		spring operated	
1.68	Motor type		DC Motor charged,	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.69	Motor			
1.69.1	Rated voltage	V	110 VDC	
1.69.2	Power demand	W	Based on bidder's offer	
1.69.3	Full-load current	A	Based on bidder's offer	
1.69.4	Maximum starting current	A	Based on bidder's offer	
1.69.5	Speed	rpm	Based on bidder's offer	
1.69.6	Required time by motor to charge the spring completely	s	Based on bidder's offer	
1.69.7	Type of protection of motor		Based on bidder's offer	
1.70	Hand operating facility	Yes/No	Yes	
1.70.1	Manual spring charging facility to be accessible from ground respectively platform to be provided	Yes/No	Yes	
1.70.2	Manual spring release (suitably positioned to avoid accidental operation)	Yes/No	Yes	
1.70.3	Manual mechanism charging torque	Nm	Based on bidder's offer	
1.71	Mechanical on/off indicator	Yes/No	Yes	
1.72	Mechanical spring charge/discharge indication	Yes/No	Yes	
1.73	Charging time	S	≤12	
1.74	Number of trip coils per phase		2	
1.75	Number of close coils per phase		1	
1.76	Reclosing suitable for 1 pole and/or 3 pole		3pole and 1pole	
1.77	Whether circuit breaker is trip free or others?		Yes	
1.78	Number and type of spare auxiliary reversible contacts		18NO+18NC	
1.79	Opening and closing nominal control voltage	V dc	110	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.80	Control cabinet			
1.80.1	Power Socket in Control cabinet		British Standard	
1.80.2	cabinet Light (Compact LED)	Yes/No	Yes	
1.80.3	Number, type & power of cabinet heater		Based on bidder's offer	
1.80.4	cabinet space heaters (thermostat Controlled)	Yes/No	Yes	
1.80.5	Degree of protection (IP) of control cabinet		IP55	
1.80.6	Minimum thickness of steel control cabinet	mm	2	
1.81	Tripping and closing coils			
1.81.1	Number of closing coils		1	
1.81.2	Number of tripping coils		2	
1.81.3	Tripping coil current	A, DC	Based on bidder's offer	
1.81.4	Closing coil current	A, DC	Based on bidder's offer	
1.81.5	Rated power of trip coil	W	Based on bidder's offer	
1.81.6	Rated power of close coil	W	Based on bidder's offer	
1.81.7	Tripping and closing coils' nominal control voltage	V, DC	110	
1.81.8	Variation of closing / opening coils' operating voltage	%	85-110 / 70-110	
1.81.9	Minimum voltage for proper operation of trip & close coils	%	40	
1.81.10	- Pick up range of control voltage		Based on bidder's offer	
1.82	Whether antipumping device is provided?	Yes/No	Yes	
1.83	Whether operating counter is provided?	Yes/No	Yes	
1.84	Whether emergency trip is provided?	Yes/No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.85	Whether circuit breaker is equipped with Local/remote/ maintenance change over switch?	Yes/No	Yes	
1.86	Whether circuit breaker is equipped with manually spring charge facilities?	Yes/No	Yes	
1.87	Whether Pre-insertion resistor is provided?	Yes/No	No	
1.87.1	Closing resistor value	Ω	N/A	
1.87.2	Insertion time	ms	Based on bidder's offer	
1.88	Whether Switching Control Relay or point on wave (POW switching) is provided?	Yes/No	Yes	
1.89	Pole discrepancy feature	Yes/No	Yes	
	Insulating Medium			
1.90	Insulating medium		SF6 gas	
1.91	Rated pressure SF6 at 20°C	Absolute bar	Based on bidder's offer	
1.92	Limits of gas pressure for correct operation of breaker	Absolute bar	Based on bidder's offer	
1.93	Signal loss of SF6 at 20°C	Absolute bar	Based on bidder's offer	
1.94	General lockout at 20°C	Absolute bar	Based on bidder's offer	
1.95	Leakage rate of SF6 at rated pressure per annum	%	< 0.5	
1.96	Type and material of gasket used to gas tightening the joints			
1.96.1	Metal to metal joints		Based on bidder's offer	
1.96.2	Metal to porcelain joints		Based on bidder's offer	
1.97	Supplier of SF6 gas		Based on bidder's offer	
1.98	Supplier of Density meter		Based on bidder's offer	
1.99	Toxicological test		Based on bidder's offer	
1.100	Storage capacity of each gas cylinder	m³	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.101	Whether sufficient gas plus 20% supplied for first filling?	Yes / No	Yes	
1.102	Mass of gas stored cylinder	kg	Based on bidder's offer	
1.103	Time required to fill the circuit breaker with SF6 gas ready	hour	Based on bidder's offer	
1.104	Time required to empty gas of the circuit breaker	hour	Based on bidder's offer	
1.105	Total mass of transportable gas handling equipment	kg	Based on bidder's offer	
1.106	Whether SF6 is stored as gas or liquid?		Gas	
	Insulator Columns			
1.107	Manufacturer		Based on bidder's offer	
1.108	Type		Based on bidder's offer	
1.109	Color		Based on bidder's offer	
1.110	Creepage distance phase to ground	mm	13020	
1.111	Creepage distance between terminals of one pole	mm	31mm/kV	
1.112	Protected creepage distance (90° shadow)	mm	31mm/kV	
1.113	Clearance (phase to phase)	mm	Acc to IEC	
1.114	External striking distance			
1.114.1	Phase to ground	mm	Acc to IEC	
1.114.2	Phase to phase	mm	Acc to IEC	
1.115	Ultimate strength of columns			
1.115.1	Cantilever	N	Based on bidder's offer	
1.115.2	Tension	N	Based on bidder's offer	
1.115.3	Torsion	N.m	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.115.4	Compression	N	Based on bidder's offer	
1.116	Permissible force at HV terminals			
1.116.1	Static at any direction	N	Based on bidder's offer	
1.116.2	Dynamic at any direction	N	Based on bidder's offer	
1.117	Washable in service	Yes / No	Yes	
	Miscellaneous			
1.118	Mechanical life of CB and mechanism in No. of operations	time	10000	
1.119	Electrical contact life in number of operations at:			
1.119.1	Rated current	time	10000	
1.119.2	Breaking current	time	15 to 20	
1.119.3	Cumulative ampere rating	time	Acc to IEC	
1.120	Whether a lock out device for preventing circuit breaker to close is provided?	Yes / No	Yes	
1.121	Whether Switching Control Relay is provided?	Yes/No	Yes	
1.122	Number and type of free auxiliary contacts for main contact monitoring		18NO and 18NC	
1.123	Number and type of free auxiliary contacts for SF6 gas pressure monitoring		4	
1.124	Number and type of free auxiliary contacts for local/remote selector switch monitoring		6	
1.125	Whether circuit breaker is equipped with rings?	Yes/No	Based on bidder's offer	
1.126	Whether circuit breaker is equipped with grading capacitors?	(Yes/ No)	Based on bidder's offer	
1.127	Mechanical on/off indicator	Yes/No	Yes	
1.128	Gas supervision	Yes/No	Yes	
1.129	Circuit breaker Operating platform (from ground level)	Yes/No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.130	Type and material for main contacts		Based on bidder's offer	
1.131	Material of HV conductor		Aluminum	
1.132	Whether contacts are silver plated?	Yes / No	Yes	
1.133	Un-galvanized metal parts shall primed, undercoated and finished with outdoor corrosion-resistant paint.	Yes/No	Yes	
1.134	Galvanizing parts accordance with ISO 1461 standards		As per ISO-1461	
1.135	CB weight			
1.135.1	Weight of single pole breaker	kg	Based on bidder's offer	
1.135.2	Total weight of complete circuit breaker	kg	Based on bidder's offer	
1.135.3	Maximum weight of package ready for shipment	kg	Based on bidder's offer	
1.136	CB main dimensions			
1.136.1	Overall height of assembled circuit breaker	mm	Based on bidder's offer	
1.136.2	Phase spacing	mm	Based on bidder's offer	
1.136.3	Minimum vertical distance between upper and lower terminal of the circuit breaker	mm	Based on bidder's offer	
1.136.4	Minimum vertical distance between lower side of the circuit breaker and metallic support	mm	Based on bidder's offer	
1.137	Mechanical endurance class		M2	
1.138	Electrical endurance class		E2	
1.139	Restrike probability class due to capacitive current breaking		C2	
2.	400KV ISOLATOR			
	<u>General</u>			
2.1	Manufacturer		Based on bidder's offer	
2.2	Place of manufacturing		Based on bidder's offer	
2.3	Type designation for Isolator		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.4	Type designation for grounding switch		Based on bidder's offer	
2.5	Type of Isolator		Horizontal Double Break/Centre break	
2.6	Applicable standard		IEC 62271-102	
2.7	Quantity of poles		3 poles. 3 Poles simultaneous operation	
2.8	Rated voltage	kV	420	
2.9	Rated current	A		
2.9.1	At maximum site temperature			
2.9.1.1	For line feeder		4000	
2.9.1.2	For Transformer feeder		4000	
2.9.1.3	For Diameter		4000	
2.9.2	At IEC condition			
2.9.2.1	For line feeder		4000	
2.9.2.2	For Transformer feeder		4000	
2.9.2.3	For Diameter		4000	
2.10	Rated frequency	Hz	50	
2.11	Class (outdoor / indoor)		Outdoor	
2.12	Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No)	Yes / No	Yes	
2.13	Hand operating facility is provided? (Yes / No)	Yes / No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.14	Accessibility to operating mechanism from ground level	Yes / No	Yes	
2.15	Mechanical Endurance Class		M2	
2.16.1	Electrical Endurance Class		E2	
2.16.2	Capacitive switching at maximum temporary overvoltage		C2	
2.17	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	
2.17.1	Date of issue		Latest	
2.17.2	Validity		Yes	
2.17.3	Certificate attached to the offer	Yes / No	Yes	
2.18	Type test certificate to be issued by independent laboratory or independently witnessed type test	Yes / No	Yes	
2.18.1	Certificate to be attached to the offer		Yes	
2.18.2	Report to be attached to the offer		Yes	
	<u>Insulation Rating</u>			
2.19	Basic Insulation level (at site condition)			
2.19.1	Common value	kV peak	1425	
2.19.2	Across the isolating distance	kV peak	1425+240	
2.20	One minute power frequency withstand voltage (at site condition)			
2.20.1	Common value	kV rms	520	
2.20.2	Across the isolating distance	kV rms	610	
2.21	Switching impulse withstand voltage (at site condition)			
2.21.1	Common value	kV peak	1050	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.21.2	Across the isolating distance	kV peak	900+345	
2.22	Type of Insulation (porcelain/silicon rubber)		porcelain	
	<u>Current Rating</u>			
2.23	Rated short time withstand current			
2.23.1	For Isolator	kA rms/sec	40/1	
2.23.2	For grounding switch	kA rms/sec	40/1	
2.24	Rated short circuit making current for grounding switches	kA rms	2.5*40	
2.25	Rated peak short circuit withstand current	kA peak	Based on bidder's offer	
2.26	Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102)	kVA	Based on bidder's offer	
2.27	Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102)	kVA	Based on bidder's offer	
	<u>Other Characteristic</u>			
2.28	Rated Supply Voltage			
2.28.1	For motor, control and interlock	Vdc	110	
2.28.2	For AC auxiliaries	Vac	240	
2.29	Voltage drop across terminals of one pole at 100 A.dc for Isolator and ground switches	mV	Based on bidder's offer	
2.30	Maximum temperature rise at normal current over Maximum ambient temperature	°C	Based on bidder's offer	
2.31	Maximum and minimum ambient temperature for design	°C	Acc. to section 1	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.32	Altitude above sea level	m	Acc. to section 1	
	<u>Operating Mechanism</u>			
2.33	Type of operating mechanism			
2.33.1	For Isolator		DC Motor and Manual	
2.33.2	For grounding switch		DC Motor and Manual	
2.34	Motor type		Based on bidder's offer	
2.35	Motor			
2.35.1	Rated voltage	V	110 VDC	
2.35.2	Power demand	W	Based on bidder's offer	
2.35.3	Full load current	A	Based on bidder's offer	
2.35.4	Speed	rpm	Based on bidder's offer	
2.36	Type of motor protection		Based on bidder's offer	
2.37	Total time from initiation of opening operation to Isolator in fully open position	sec	≤15	
2.38	Time from contact separation to extinct of capacitive arc	sec	Based on bidder's offer	
2.39	Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage		Based on bidder's offer	
2.40	Breaking and closing of:			
2.40.1	Magnetizing current of power transformers	Yes / No	Yes	
2.40.2	Mutual inductive/capacitive current of parallel circuit in double circuit line	Yes / No	Yes	
2.40.3	Charging current of unloaded lines and/or cables	Yes / No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.41	Minimum guaranteed no. of operations for Isolators or grounding switches before maintenance	No	Based on bidder's offer	
2.42	Maximum required force for hand operation with supplied handle		Based on bidder's offer	
2.43	Thickness of steel control cabinet	mm	Min (2)	
2.44	Degree of protection (IP) of mechanism housing		IP55	
2.45	Cubicle space heaters (thermostat Controlled)	Yes / No	Yes	
2.46	Cabinet heater			
2.46.1	Power	W	Based on bidder's offer	
2.46.2	Nominal Voltage	V	240 AC	
2.47	Whether local/ remote/ disconnect selector switch is provided? (Yes / No)	Yes / No	Yes	
2.48	Whether open/neutral /close control switch is provided? (Yes / No)	Yes / No	Yes	
2.49	Whether under voltage relay is provided for motor supply?	Yes / No	Yes	
2.50	Whether all of the heaters are equipped with a M.C.B ?	Yes / No	Yes	
2.51	Rated power of operation coil	W	Based on bidder's offer	
2.52	Total load of heaters for Isolator	W	Based on bidder's offer	
	<u>Insulators</u>			
2.53	Manufacturer		Based on bidder's offer	
2.54	Place of manufacturing		Based on bidder's offer	
2.55	Type (porcelain /composite)		porcelain	
2.56	Color		Based on bidder's offer	
2.57	Creepage distance	mm	13020	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.58	Protected creepage distance	mm	Based on bidder's offer	
2.59	Permissible cantilever working load	N	C12	
2.60	Operating handle or lever mounting height above ground	m	1.2	
2.61	Permissible tensional strength	N.m	Based on bidder's offer	
2.62	Minimum clearance	mm		
2.62.1	Between poles when Isolator is closed		Based on bidder's offer	
2.62.2	Between poles when Isolator is open		Based on bidder's offer	
2.62.3	Between phase and ground		Based on bidder's offer	
2.62.4	Between one pole terminals at open condition		Based on bidder's offer	
	<u>Interlocks</u>			
2.63	Type of interlock between Isolator and associated ground switch		Electrical and Mechanical	
2.64	Type of interlock between ground switch and related circuit breakers		Electrical	
2.65	Type of interlock between Isolator and related circuit breaker		Electrical	
2.66	Locking arrangement in on/off position	Yes / No	Yes	
2.67	Automatic isolation of control supplies when lock off	Yes / No	Yes	
	<u>Miscellaneous</u>			
2.68	Type of main contacts			
2.68.1	For Isolator		Based on bidder's offer	
2.68.2	For grounding switch		Based on bidder's offer	
2.69	Material of main contacts			
2.69.1	For Isolator		Copper	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.69.2	For grounding switch		Copper	
2.70	Material of blades			
2.70.1	For Isolator		Based on bidder's offer	
2.70.2	For grounding switch		Based on bidder's offer	
2.71	Whether main contacts are silver plated?			
2.71.1	For Isolators.		Yes	
2.71.2	For grounding switches		Yes	
2.72	Quantity and type of free auxiliary contacts			
2.72.1	For Isolators		10NO+10NC	
2.72.2	For grounding switches		10NO+10NC	
2.73	Permissible force on HV terminals			
2.73.1	Static in any direction	N	Based on bidder's offer	
2.73.2	Dynamic in any direction	N	Based on bidder's offer	
2.74	Weight of maximum package ready for shipment	kg	Based on bidder's offer	
2.75	Weight of complete			
2.75.1	Isolator	kg	Based on bidder's offer	
2.75.2	Isolator with associated grounding switch	kg	Based on bidder's offer	
2.75.3	Single phase	kg	Based on bidder's offer	
2.76	Cubicle Light (Compact LED)	Yes / No	Yes	
2.77	Number of grounding switch		1 / 2	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
Note: The table should be filled and submitted for each of the following equipment separately: 1. Isolator with 2 Ground Switches 2. Isolator with 1 Ground Switches				
3.	400KV , EARTHING SWITCH			
	<u>General</u>			
3.1	Manufacturer		Based on bidder’s offer	
3.2	Place of manufacturing		Based on bidder’s offer	
3.3	Type designation		Out door	
3.4	Type of operating mechanism		DC Motor	
3.5	Applicable standard		IEC 62271-102	
3.6	Rated voltage	kV	420	
3.7	Rated current	A	4000	
3.8	At maximum site temperature		4000	
3.9	At IEC condition		4000	
3.9.1	Rated frequency	Hz	50	
3.9.2	Class (outdoor / indoor)		Outdoor	
3.10	Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No)	Yes / No	Yes	
3.11	Hand operating facility is provided? (Yes / No)	Yes / No	Yes	
3.12	Accessibility to operating mechanism from ground level	Yes / No	Yes	
3.13	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	
3.14	Date of issue		Latest	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.15	Validity		Yes	
3.16	Certificate attached to the offer	Yes / No	Yes	
3.17	Type test certificate to be issued by independent laboratory or independently witnessed type test	Yes / No	Yes	
3.17.1	Certificate to be attached to the offer		Yes	
3.17.2	Report to be attached to the offer		Yes	
	<u>Insulation Rating</u>			
3.18	Basic Insulation level (at site condition)			
3.18.1	Common value	kV peak	1425	
3.18.2	Across the isolating distance	kV peak	1425+240	
3.19	One minute power frequency withstand voltage (at site condition)			
3.19.1	Common value	kV rms	520	
3.19.2	Across the isolating distance	kV rms	610	
3.20	Switching impulse withstand voltage (at site condition)			
3.20.1	Common value	kV peak	1050	
3.20.2	Across the isolating distance	kV peak	900+345	
3.21	Type of Insulation(porcelain/silicon rubber)		porcelain	
	<u>Current Rating</u>			
3.22	Rated short time withstand current			
3.22.1	For grounding switch	kA rms/sec	40/1	
3.22.2	Rated short circuit making current for grounding switches	kA rms	2.5*40	
3.23	Rated peak short circuit withstand current	kA peak	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.24	Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102)	kVA	Based on bidder's offer	
3.25	Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102)	kVA	Based on bidder's offer	
	<u>Other Characteristic</u>			
3.26	Rated Supply Voltage			
3.26.1	For motor, control and interlock	Vdc	110	
3.26.2	For AC auxiliaries	Vac	240	
3.27	Voltage drop across terminals of one pole at 100 A.dc for ground switches	mV	Based on bidder's offer	
3.28	Maximum temperature rise at normal current over Maximum ambient temperature	°C	Based on bidder's offer	
3.29	Maximum and minimum ambient temperature for design	°C	Acc. to section 1	
3.30	Altitude above sea level	m	Acc. to section 1	
	<u>Operating Mechanism</u>			
3.31	Type of operating mechanism		DC Motor	
3.31.1	Motor type		Based on bidder's offer	
3.31.2	Motor			
3.32	Rated voltage	V	110V DC	
3.33	Power demand	W	Based on bidder's offer	
3.33.1	Full load current	A	Based on bidder's offer	
3.33.2	Speed	rpm	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.34	Type of motor protection		Based on bidder's offer	
3.35	Total time from initiation of opening operation in fully open position	sec	≤15	
3.36	Breaking and closing of:			
3.36.1	Magnetizing current of power transformers	Yes / No	Yes	
3.36.2	Mutual inductive/capacitive current of parallel circuit in double circuit line	Yes / No	Yes	
3.36.3	Charging current of unloaded lines and/or cables	Yes / No	Yes	
3.37	Minimum guaranteed no. of operations for grounding switches before maintenance	N	Based on bidder's offer	
3.38	Maximum required force for hand operation with supplied handle		Based on bidder's offer	
3.39	Thickness of steel control cabinet	mm	Min (2)	
3.40	Degree of protection (IP) of mechanism housing		IP55	
3.41	Cubicle space heaters (thermostat Controlled)	Yes / No	Yes	
3.42	Cabinet heater			
3.42.1	Power	W	Based on bidder's offer	
3.42.2	Nominal Voltage	V	240 AC	
3.43	Whether local/ remote/ disconnect selector switch is provided? (Yes / No)	Yes / No	Yes	
3.44	Whether open/neutral /close control switch is provided? (Yes / No)	Yes / No	Yes	
3.45	Whether under voltage relay is provided for motor supply?	Yes / No	Yes	
3.46	Whether all of the heaters are equipped with a M.C.B ?	Yes / No	Yes	
3.47	Rated power of operation coil	W	Based on bidder's offer	
3.48	Total load of heaters	W	Based on bidder's offer	
	<u>Insulators</u>			

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.49	Manufacturer		Based on bidder's offer	
3.50	Place of manufacturing		Based on bidder's offer	
3.51	Type (porcelain /composite)		porcelain	
3.52	Colour		Based on bidder's offer	
3.53	Creepage distance	mm	13020	
3.54	Protected creepage distance	mm	Based on bidder's offer	
3.55	Permissible cantilever working load	N	C12	
3.56	Operating handle or lever mounting height above ground	m	1.2	
3.57	Permissible tensional strength	N.m	Based on bidder's offer	
3.58	Minimum clearance	mm		
3.58.1	Between poles when earth switch is closed		Based on bidder's offer	
3.58.2	Between poles when earth switch is open		Based on bidder's offer	
3.58.3	Between phase and ground		Based on bidder's offer	
3.58.4	Between one pole terminals at open condition		Based on bidder's offer	
	<u>Interlocks</u>			
3.59	Type of interlocking		Electrical and Mechanical	
3.60	Locking arrangement in on/off position	Yes / No	Yes	
3.61	Automatic isolation of control supplies when lock off	Yes / No	Yes	
	<u>Miscellaneous</u>			
3.62	Type of main contacts		Based on bidder's offer	
3.63	For grounding switch		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.64	Material of main contacts			
3.64.1	For grounding switch		Based on bidder's offer	
3.65	Material of blades			
3.65.1	For grounding switch		Based on bidder's offer	
3.66	Whether main contacts are silver plated			
3.66.1	For grounding switches		Yes	
3.67	Quantity and type of free auxiliary contacts			
3.67.1	For grounding switches		10NO+10NC	
3.68	Permissible force on HV terminals			
3.68.1	Static in any direction	N	Based on bidder's offer	
3.68.2	Dynamic in any direction	N	Based on bidder's offer	
3.69	Weight of maximum package ready for shipment	kg	Based on bidder's offer	
3.70	Weight of complete earth switch	kg	Based on bidder's offer	
3.71	Cubicle Light (Compact LED)	Yes / No	Yes	
4.	400KV CURRENT TRANSFORMERS			
	General			
4.1	Manufacturer		Based on bidder's offer	
4.2	Place of manufacturing		Based on bidder's offer	
4.3	Type designation		Post	
4.4	Number of phases		3 phase	
4.5	Type of neutral grounding		Effective	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.6	Applicable standard		IEC 61869-1/-2	
4.7	Class (indoor / outdoor)		Outdoor	
4.8	Type (Oil-immersed / dry)		Oil-immersed / Oil impregnated paper	
4.9	Construction (tank / inverted)		Tank	
4.10	Rated voltage	kV rms	420	
4.11	Rated current at max. site temperature :	A		
4.11.1	For line feeders		4000	
4.11.2	For transformer feeders		4000	
4.11.3	For Diameters		4000	
4.11.4	Power transformer neutral		500	
4.12	Rated frequency	Hz	50	
4.13	Max. and min. ambient temperatures used for design	°C	Acc. to section1	
4.14	Rated short time withstand current	kA rms	40/1sec	
4.15	Rated short time dynamic current	kA peak	2.5*40	
4.16	Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No)	(Yes / No)	Yes	
4.17	Altitude above sea level	m	Acc. to section1	
4.18	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
4.18.1	Date of issue		Latest	
4.18.2	Validity			
4.18.3	Certificate attached to the offer	Yes/No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.19	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
4.19.1	Certificate to be attached to the offer	Yes/No	Yes	
4.19.2	Report to be attached to the offer	Yes/No	Yes	
	Insulation	-	-	
4.20	Maximum continuous line to line operating voltage	kV rms	420	
4.21	Basic Insulation level (at site condition)	kV peak	1425	
4.22	Switching impulse withstand level (at site condition)	kV peak	1050	
4.23	One minute power frequency withstand voltage (at site condition)	kV rms		
4.23.1	Dry		520	
4.23.2	Wet		Based on bidder's offer	
4.24	One minute power frequency withstand voltage for secondary winding	kV rms	Based on bidder's offer	
4.25	Highest value of partial discharge when tested acc. to IEC	pc	5	
4.26	Voltage at secondary winding terminals with normal primary load current , and secondary open	kV	Based on bidder's offer	
4.27	Time permitted with open circuit secondary	sec	Based on bidder's offer	
4.28	Dielectric dissipation factor		Based on bidder's offer	
	Ratings and Accuracies	-	-	
4.29	Rated primary current	A		
4.29.1	Line feeder		2000/1000	
4.29.2	diameter		4000/2000	
4.30	Rated continous primary current		120%	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.31	Rated secondary current	A	1	
4.32	Change of CT ratio shall be possible at the secondary circuit only	Yes/No	Yes	
4.33	specification of CTs on: Line feeders, Auxiliary transformer, Power transformer neutral, Core balance			
4.33.1	Number of cores		Acc. to PS LD	
4.33.2	Ratio (TR – turns ratio)	A	Acc. to PS LD	
4.33.3	Class		Acc. to PS LD	
4.33.4	Knee point voltage (Ek)	V	Based on bidder’s offer	
4.33.5	Exciting current (IE) at Ek	mA	Based on bidder’s offer	
4.33.6	Rated output (burden to be 25-100% rated burden)	VA	Acc. to PS LD	
	External Insulation	-	-	
4.34	Material		Based on bidder’s offer	
4.35	Manufacturer		Based on bidder’s offer	
4.36	Place of manufacturing		Based on bidder’s offer	
4.37	Type designation		Based on bidder’s offer	
4.38	Minimum creepage distance	mm	13020	
4.39	Color		Brown	
4.40	Protected creepage distance (90 shadow)	mm	Based on bidder’s offer	
4.41	Shortest flash-over distance	mm	Based on bidder’s offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.42	Whether washable in service ? (Yes / No)	(Yes / No)	Yes	
	Miscellaneous	-	-	
4.43	Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107	μv	2500	
4.44	Whether oil level indicator/oil sampling valve/oil filling valve are provided? (Yes / No)		Yes	
4.45	Means for compensation of oil expansion		Based on bidder's offer	
4.46	Temperature rise at rated continuous thermal current	°C		
4.47	Rated continuous thermal current (% of rated primary current)		Rated extended primary current	
4.48	Electrostatic capacity of complete current transformer. PF		Based on bidder's offer	
4.49	Loss angle at rated voltage		Based on bidder's offer	
4.50	Permissible force at HV terminals		Based on bidder's offer	
4.50.1	Static at any direction	N	3000	
4.50.2	Dynamic at any direction	N	5000	
4.51	Type , grade and manufacturer of oil		Based on bidder's offer	
4.52	Weight of oil	kg	Based on bidder's offer	
4.53	Primary conductor material		Based on bidder's offer	
4.54	Secondary conductor material		Based on bidder's offer	
4.55	Overall height	mm	Based on bidder's offer	
4.56	Overall width	mm	Based on bidder's offer	
4.57	Overall length	mm	Based on bidder's offer	
4.58	Total weight of complete current transformer	Kg	Based on bidder's offer	
4.59	Max. package weight ready for shipment	Kg	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.60	Whether lugs for lifting up of CT are provided ? (Yes / No)		Yes	
4.61	Permitted inclination refer to vertical axis during transport or storage	Degree	Based on bidder's offer	
4.62	Degree protection of Terminal box		IP55	
5.	400KV CAPACITIVE VOLTAGE TRANSFORMERS			
	General			
5.1	Manufacturer		Based on bidder's offer	
5.2	Place of manufacturing		Based on bidder's offer	
5.3	Type of CVT		Single-phase/self cooled	
5.4	Applicable standard		IEC 61869-1/-5	
5.5	Rated voltage	kV rms	420	
5.6	Rated frequency	Hz	50	
5.7	Max. and min. ambient temperatures used for design	°C	Acc. to Section1	
5.8	Class (indoor/ outdoor)		Outdoor	
5.9	Type (Oil-immersed / dry)		Oil-immersed/ Oil-impregnated paper	
5.8	Maximum permissible partial discharge level at Um	pC	10	
5.9	Maximum permissible partial discharge level at 1.2Um /Ö3	pC	5	
5.10	Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No)	(Yes / No)	Yes	
5.11	Altitude above sea level	m	Acc. to Section1	
5.12	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
5.12.1	Date of issue		Latest	
5.12.2	Validity			

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.12.3	Certificate attached to the offer	Yes/No	Yes	
	Insulation ratings			
5.13	Basic insulation level (at site condition)	kV peak	1425	
5.14	Switching impulse withstand voltage (at site condition)	kV peak	1050	
5.15	One minute power frequency withstand voltage (at site condition)	kV rms	520	
5.16	Power frequency withstand voltage between secondaries and secondary to earth	kV rms	Based on bidder's offer	
5.17	Rated voltage factor			
5.17.1	Continuous		1.2	
5.17.2	30 seconds		1.5	
5.18	Minimum HV terminal withstand			
5.18.1	Static terminal load	N	2000	
5.18.2	Dynamic terminal load	N	3000	
5.19	Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR	μV	Based on bidder's offer	
	Burdens and accuracies			
	<ul style="list-style-type: none"><u>3-Winding CVT</u>			
5.20	Number of secondary windings		3	
5.21	Accuracy class for			
5.21.1	Winding 1		Acc. to PSLD	
5.21.2	Winding 2		Acc. to PSLD	
5.21.3	Winding 3		Acc. to PSLD	
5.22	Rated primary voltage	KVrms	400/√3	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.23	Rated secondary voltage	KVrms	$0.110/\sqrt{3}$	
5.24	Rated burden for			
5.24.1	Winding 1	VA	Acc. to PSLD	
5.24.2	Winding 2	VA	Acc. to PSLD	
5.24.3	Winding 3	VA	Acc. to PSLD	
5.25	Continuous thermal burden of			
5.25.1	Winding 1 alone	VA	Based on bidder's offer	
5.25.2	Winding 2 alone	VA	Based on bidder's offer	
	<ul style="list-style-type: none"> • <u>2-Winding CVT</u> 			
5.26	Number of secondary windings		2	
5.27	Accuracy class for			
5.27.1	Winding 1		Acc. to PSLD	
5.27.2	Winding 2		Acc. to PSLD	
5.28	Rated primary voltage	KVrms	$400/\sqrt{3}$	
5.29	Rated secondary voltage	KVrms	$0.110/\sqrt{3}$	
5.30	Rated burden for			
5.30.1	Winding 1	VA	Acc. to PSLD	
5.30.2	Winding 2	VA	Acc. to PSLD	
5.31	Continuous thermal burden of			
5.31.1	Winding 1 alone	VA	Based on bidder's offer	
5.31.2	Winding 2 alone	VA	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.32	Type of system grounding		Effective	
5.33	Type of connection		phase to ground	
5.34	Connections			
5.34.1	Primary		Stud type	
5.34.2	Secondary		Standard terminal block (screw and bolt)	
5.35	Type of protection device in secondary side		MCB with auxiliary contact	
5.36	Total continuous thermal burden of secondary windings	VA		
5.36.1	Primary		Based on bidder's offer	
5.36.2	Secondary		Based on bidder's offer	
	Other Characteristics			
5.37	Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature	K	60K Wind. 50K Oil	
5.38	Permissible secondary short circuit time with rated primary voltage	sec	1	
5.39	Short circuit impedance	Ohm	Max(0.25)	
5.40	Method of suppressing for ferro resonance		RLC Dumping	
5.41	Available ranges of high voltage capacitor	pF	Based on bidder's offer	
5.42	Coupling capacitor *	pF	Max (10000)	
5.43	Loss angle at rated voltage		35*10-4	
5.44	Frequency range for PLC use	KHz	Based on bidder's offer	
5.45	Equipment series resistance for 35-450 KHz	Ohm	Max(40)	
5.46	Natural frequency	MHz	Based on bidder's offer	
5.47	Intermediate stage voltage	kV	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.48	Attenuation of intermediate voltage transformer within 35-450 KHz	dB	Based on bidder's offer	
5.49	Max. insertion loss when used for PLC	dB	Based on bidder's offer	
5.50	Whether intermediate tap is brought out? (Yes / No)		Based on bidder's offer	
* Min. coupling capacitance of CVT could be changed by manufacture				
	Insulator columns			
5.51	Manufacturer		Based on bidder's offer	
5.52	Place of manufacturing		Based on bidder's offer	
5.53	Type designation		Based on bidder's offer	
5.54	Material		Based on bidder's offer	
5.55	Min. creepage distance	mm	13020	
5.56	Protected creepage distance	mm		
5.57	Color		Brown	
	Miscellaneous			
5.58	Type and manufacturer of oil for capacitor section		Based on bidder's offer	
5.59	Type and manufacturer of oil for intermediate section		Based on bidder's offer	
5.60	Whether oil level indicator is provided? (Yes / No)	(Yes / No)	YES	
5.61	Class and grade of insulation material used in capacitors		Based on bidder's offer	
5.62	Permitted inclination during transport/ storage	Degree	Based on bidder's offer	
5.63	Material of windings		Based on bidder's offer	
5.64	Whether CVT is designed to mount line trap on top? (Yes / No)		NO	
5.65	Permissible force at HV terminals			

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.65.1	Static at any direction	N	Based on bidder's offer	
5.65.2	Dynamic at any direction	N	Based on bidder's offer	
5.66	Total weight	kg	Based on bidder's offer	
5.67	Total oil weight	kg	Based on bidder's offer	
5.68	Overall height	mm	Based on bidder's offer	
5.69	Overall width	mm	Based on bidder's offer	
5.70	Max. package dimensions ready for shipment	m³	Based on bidder's offer	
5.71	Washable in service? (Yes / No)		Based on bidder's offer	
6.	400kV Conductors			
	<u>General</u>			
6.1	Rated current	A		
6.1.1	Line feeders		4000	
6.1.2	Trans feeders		4000	
6.1.3	Busbars		4000	
6.1.4	Rated frequency	Hz	50	
6.2	Rated voltage	kV	420	
6.2.1	Basic insulation level of equipment at site condition	kV peak	1425	
6.2.2	Rated one minute power frequency withstand voltage at site condition	kV rms	520	
6.2.3	Rated short circuit withstand current and its duration	kA/sec	40kA/3sec	
6.3	Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No)	(Yes / No)	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.4	Maximum permissible temperature of conductors at rated current and Max. ambient temperature	°C	80	
6.5	Minimum assumed tension for each stranded conductor at E.D.S condition	% of UTS	3	
6.6	Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase)	% of UTS	20	
6.7	Minimum tension of incoming and outgoing shield wires	% of UTS	10	
6.8	Maximum permissible surface gradient	kV/cm	16	
6.9	Maximum permissible angle for incoming and outgoing overhead lines		±30	
6.10	Ambient condition			
6.10.1	Minimum ambient temperature		Acc. to section 1	
6.10.2	Maximum ambient temperature		Acc. to section 1	
6.10.3	Solar radiation		Acc. to section 1	
6.10.4	Seismic acceleration		Acc. to section 1	
6.10.5	Wind speed		Acc. to section 1	
6.10.6	Ice thickness		Acc. to section 1	
6.11	Solar radiation absorption coefficient (Y)		Acc. to section 1	
6.12	Emissivity coefficient in respect to black body (Ke)		0.5	
6.13	Altitude above sea level	m	Acc. to section 1	
	<u>Stranded Conductors</u>			
6.14	Manufacturer		Based on bidder's offer	
6.15	Place of manufacturing		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.16	Material and alloy type		AAAC/AAC	
6.17	Nominal cross section	mm²	Based on bidder's offer	
6.18	Number of strands		Based on bidder's offer	
6.19	Overall diameter of conductor	mm	Based on bidder's offer	
6.20	Ultimate strength of conductor	kN	Based on bidder's offer	
6.21	Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature	A	Based on bidder's offer	
	Note: The stranded conductor size adequacy shall be determined by calculation.			
	<u>Tubular Conductors</u>			
6.22	Manufacturer		Based on bidder's offer	
6.23	Place of manufacturing		Based on bidder's offer	
6.24	Material and alloy type		Aluminum alloy	
6.25	Outside diameter	mm	For main busbar:250 For bay busbar:160 For Aframe :120	
6.26	Thickness	mm	For main busbar:6 For bay busbar:6 For Aframe : 6	
6.27	Weight	kg/m	Based on bidder's offer	
6.28	Max. deflection after installation	mm	Based on bidder's offer	
6.29	Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C	A	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.30	Moment of inertia	cm	Based on bidder's offer	
6.31	Minimum yield strength	kg/cm²	Based on bidder's offer	
	Note: The tubular conductor size adequacy shall be determined by calculation.			
	<u>Shield wires</u>			
6.32	Manufacturer		Based on bidder's offer	
6.33	Place of manufacturing		Based on bidder's offer	
6.34	Material		Al. clad steel	
6.35	Cross section	mm²	58.56	
6.36	Diameter	mm	9.78	
6.37	Number of strands		7 no.8	
6.38	Resistance (at 20 °C)	ohm/km	1.463	
6.39	Ultimate strength	kN	70.76	
6.40	Modulus of elasticity	kg/mm2	16000	
6.41	Coefficient of linear expansion	1/°C	13* 10 ⁽⁻⁶⁾	
6.42	Aluminium coating thickness	µm	Based on bidder's offer	
	<u>Connectors and Hardware</u>			
6.43	Manufacturer		Based on bidder's offer	
6.44	Place of manufacturing		Based on bidder's offer	
6.45	Material of connectors		Based on bidder's offer	
6.46	Material of bolts and nuts		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.47	Material of washers		Based on bidder's offer	
6.48	Applicable standard for connectors		Based on bidder's offer	
6.49	Type of contact paste		Based on bidder's offer	
	<u>Minimum Clearances</u> (Not applicable for equipment subject to impulse voltage tests)			
6.50	Clearance between live parts and ground (Basic value)	mm	5730	
6.51	Clearance between different phases in bays	mm	6500	
6.52	Minimum Spacing between phases of rigid buses	mm	6500	
6.53	Minimum height of energized parts above ground	mm	6000	
6.54	Height of energized parts above access roads	mm	13000	
6.55	Minimum Distance between over-span phases	mm	7500	
6.56	Shield wire clearance over bus conductors	mm	7000	
7.	Insulators			
	<u>General</u>			
7.1	Rated current	A		
7.1.1	Line feeders		4000	
7.1.2	Trans feeders		4000	
7.1.3	Busbars		4000	
7.1.4	Rated frequency	Hz	50	
7.2	Rated voltage	kV	420	
7.2.1	Basic insulation level of equipment at site condition	kV peak	1425	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.2.2	Rated one minute power frequency withstand voltage at site condition	kV rms	520	
7.2.3	Rated short circuit withstand current and its duration	kA/sec	40/3	
7.3	Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No)	(Yes / No)	Yes	
7.4	Maximum permissible temperature of conductors at rated current and Max. ambient temperature	°C	80	
7.5	Maximum permissible surface gradient	kV/cm	16	
7.6	Maximum permissible angle for incoming and outgoing overhead lines		±30	
7.7	Ambient condition			
7.7.1	Minimum ambient temperature		Acc. to section 1	
7.7.2	Maximum ambient temperature		Acc. to section 1	
7.7.3	Solar radiation		Acc. to section 1	
7.7.4	Seismic acceleration		Acc. to section 1	
7.7.5	Wind speed		Acc. to section 1	
7.7.6	Ice thickness		Acc. to section 1	
7.7	Solar radiation absorption coefficient (Y)		Acc. to section 1	
7.8	Emissivity coefficient in respect to black body (Ke)		0.5	
7.9	Altitude above sea level	m	Acc. to section 1	
7.10	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	
7.10.1	Date of issue		Latest	
7.10.2	Validity			
7.10.3	Certificate attached to the offer	Yes / No	Yes	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.11	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes / No	Yes	
7.11.1	Certificate to be attached to the offer		Yes	
	<u>String Insulators</u>			
7.12	Manufacturer		Based on bidder's offer	
7.13	Place of manufacturing		Based on bidder's offer	
7.14	Type designation		ball & socket	
7.15	Applicable standard		IEC	
7.16	Insulator material		Glazed porcelain	
7.17	Color		Based on bidder's offer	
7.18	Wet power frequency withstand voltage of each unit	kV	47	
7.19	Lightning impulse withstand voltage of each unit	kV	125	
7.20	Electromechanical failing load of each unit	kN	160	
7.21	Puncture voltage of each unit	kV	130	
7.22	Minimum creepage distance of each unit	mm	370	
7.23	Total creepage distance of string	mm	13020	
7.24	Nominal spacing	mm	170	
7.25	Protected (90) creepage distance	mm	Based on bidder's offer	
7.26	Size of ball and socket	mm	Based on bidder's offer	
7.27	IEC coupling ball		Based on bidder's offer	
7.28	Material of fittings		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.29	Minimum quantity of disks per string		35	
7.30	Power frequency withstand voltage of complete String	kV rms		
7.30.1	Dry		520	
7.30.2	Wet		Based on bidder's offer	
7.31	Basic Insulation level of complete string	KV peak		
7.31.1	Positive		1425	
7.31.2	Negative		Based on bidder's offer	
7.32	Max. R.I.V. at 1MHz as per CISPR no.1	μ V	Based on bidder's offer	
7.33	Overall length of string with accessories	mm	Based on bidder's offer	
7.34	Ultimate tensile strength of string	kN	Based on bidder's offer	
7.35	Total weight of string	kg	Based on bidder's offer	
7.36	Whether arcing ring at ground side Provided? (Yes / No)	(Yes / No)	Yes	
7.37	Whether corona ring at live side Provided? (Yes / No)	(Yes / No)	Yes	
7.38	Arcing distance	mm	Based on bidder's offer	
7.39	Whether washable in service? (Yes / No)	(Yes / No)	Yes	
	Note: The string insulator and each insulator size adequacy shall be determined by calculation.			
	<u>String Insulator Accessories</u>			
7.40	Manufacturer		Based on bidder's offer	
7.41	Place of manufacturing		Based on bidder's offer	
7.42	Material		Based on bidder's offer	
7.43	Applicable standard		IEC 60305 IEC 60383-1 IEC 60383-2	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.44	Rated ultimate tensile strength	kN	160	
	<u>Post Insulators</u>			
7.45	Manufacturer		Based on bidder's offer	
7.46	Place of manufacturing		Based on bidder's offer	
7.47	Type designation		Post type	
7.48	Applicable standard		Based on bidder's offer	
7.49	One minute power frequency withstand Voltage (at IEC condition)	kV rms		
7.49.1	Dry		520	
7.49.2	Wet		Based on bidder's offer	
7.48	Basic Insulation level (at IEC condition)	kV peak	1425	
7.49	Basic Insulation level (at site condition)	kV peak	Based on bidder's offer	
7.50	Switching impulse withstand voltage	kV peak	1050	
7.51	Color		Based on bidder's offer	
7.52	Insulator material		Ceramic	
7.53	Top metal fitting material		Based on bidder's offer	
7.54	Bottom metal fitting material		Based on bidder's offer	
7.55	Bonding material		Based on bidder's offer	
7.56	Minimum creepage distance	mm	13020	
7.57	Protected (90) creepage distance	mm	Based on bidder's offer	
7.58	Maximum cantilever working load (complete post insulator)	kN	Based on bidder's offer	
7.59	Minimum cantilever breaking load, upright (complete post insulator)	kN	Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.60	Minimum torsion strength	kNm	Based on bidder's offer	
7.61	Minimum compression strength	kN	Based on bidder's offer	
7.62	Total height	mm	Based on bidder's offer	
7.63	Arcing distance	mm	Based on bidder's offer	
7.64	Fixing bolts			
7.64.1	Quantity per post insulator		Based on bidder's offer	
7.64.2	Diameter		Based on bidder's offer	
7.65	Bolt circle diameter (Top / Bottom)	mm	Based on bidder's offer	
7.66	Total weight	kg	Based on bidder's offer	
7.67	Maximum R.I.V. at 100 KHz	μv	500	
7.68	Whether washable in service? (Yes / No)		Yes	
7.69	Maximum weight of one package ready for Shipment	kg	Based on bidder's offer	
7.70	Whether corona ring at live side Provided? (Yes / No)		Yes	
7.71	Number of units in complete post insulator		Based on bidder's offer	
7.72	Length of each unit	mm	Based on bidder's offer	
	Note: The post insulator size adequacy shall be determined by calculation.			
	<u>Connectors and Hardware</u>			
7.73	Manufacturer		Based on bidder's offer	
7.74	Place of manufacturing		Based on bidder's offer	
7.75	Material of connectors		Based on bidder's offer	
7.76	Material of bolts and nuts		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.77	Material of washers		Based on bidder's offer	
7.78	Applicable standard for connectors		Based on bidder's offer	
7.79	Type of contact paste		Based on bidder's offer	
	<u>Minimum Clearances</u> (Not applicable for equipment subject to impulse voltage tests)			
7.80	Height of base of post insulator from ground	mm	2500	
7.81	Clearance between live parts and ground (Basic value)	mm	3350	
7.82	Minimum height of energized parts above ground	mm	6000	
7.83	Height of energized parts above access roads	mm	13000	
8.	400KV SURGE ARRESTERS			
	General			
8.1	Manufacturer of surge arrester:			
8.1.1	Name		Based on bidder's offer	
8.1.2	Country		Based on bidder's offer	
8.2	Manufacturer of surge counter:			
8.2.1	Name		Based on bidder's offer	
8.2.2	Country		Based on bidder's offer	
8.3	Type designation for surge arresters		Based on bidder's offer	
8.4	Type designation for surge counter (equipped with leakage current measuring device)		Based on bidder's offer	
8.5	Applicable standard		IEC 60099-4	
8.6	Rated frequency	Hz	50	
8.7	Nominal line to line voltage rating	kV	420	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.8	Type		Metal oxide	
8.9	Class of surge arrester		Very Heavy	
8.10	Maximum and Minimum ambient temperature for design	°C	Acc. to section 1	
8.11	Altitude above sea level	m	Acc. to section 1	
8.12	Design seismic acceleration	g	Acc. to section 1	
8.13	Ice thickness	mm	Acc. to section 1	
8.14	Wind velocity	m/s	Acc. to section 1	
8.15	Maximum overvoltage factor on the system due to any switching duty	pu	2.3	
8.16	Whether withstanding in load combinations of earthquake, wind, short circuit, as mentioned In Technical Specification?	(Yes / No)	Yes	
	Surge Arresters			
8.17	Rated voltage	kV rms	360	
8.18	Continuous operating voltage	kV rms	260 (minimum)	
8.19	Long duration discharge class as per IEC 99-1	Class	4	
8.20	Number of phases		3	
8.21	Type of system earthing		Effective	
8.22	Nominal discharge current with 8/20 us wave	kA peak	20	
8.23	Arrester designation		SH	
8.24	Type of housing in the case of utilizing porcelain and its classification acc. to Std. 60672		Brown glazed Aluminum porcelain class C130	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.25	Type of housing in the case of utilizing composite polymer and its resistance classification acc to IEC 60587		Silicon rubber (LSR,HCR or RTV type) class 3.4	
8.26	Earth fault factor		1.4	
8.27	Place of installation		Line/Transformer/GIS Feeders	
8.28	Pressure relief class			
8.28.1	High current 0.2 sec	kA	50	
8.28.2	Low current 1 sec		600±200	
8.29	Thermal energy rating (Wth)	(kJ / kV) of U rated	> 10	
8.30	Repetitive charge transfer rating (Qrs)	C	> 2.4	
8.31	Reference voltage	kV rms	Acc. to IEC 60099-4	
8.32	Reference current	mA	Acc. to IEC 60099-4	
8.33	TOV capability for			
8.33.1	1 sec	kV	Acc. to IEC 60099-4	
8.33.2	10 sec	kV	Acc. to IEC 60099-4	
8.34	Continuous current under ambient temperature	mA	Based on bidder's offer	
8.35	Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks			
8.35.1	Switching surges-1kA/2kA	kV peak	Acc. to IEC 60099-4	
8.35.2	5 KA	kV peak	Acc. to IEC 60099-4	
8.35.3	10 KA	kV peak	Acc. to IEC 60099-4	
8.35.4	20 KA	kV peak	Acc. to IEC 60099-4	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.36	Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks			
8.36.1	500 A	kV peak	Acc. to IEC 60099-4	
8.36.2	1 KA	kV peak	Acc. to IEC 60099-4	
8.36.3	2 KA	kV peak	Acc. to IEC 60099-4	
8.37	Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak	kV peak	Acc. to IEC 60099-4	
8.38	High current 4/10 microsecond impulse withstand level	kA peak	Acc. to IEC 60099-4	
8.39	Low current 2000 microsecond withstand level	kA peak	Acc. to IEC 60099-4	
8.40	Number of arrester units		Based on bidder's offer	
8.41	Rated voltage of each arrester unit	kV rms	Based on bidder's offer	
8.42	Number of parallel non-linear MO resistance block		1	
8.43	Power frequency voltage versus time characteristics included?	(Yes/No)	Yes	
8.44	Maximum internal partial discharge	pC	Acc. to IEC 60099	
8.45	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
8.45.1	Date of issue		Latest	
8.45.2	Validity			
8.45.3	Certificate attached to the offer	Yes/No	Yes	
8.46	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
8.46.1	Certificate to be attached to the offer	Yes/No	Yes	
8.46.2	Report to be attached to the offer	Yes/No	Yes	
	Miscellaneous			

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.47	Insulator			
8.47.1	Manufacturer		Based on bidder's offer	
8.47.2	Country		Based on bidder's offer	
8.47.3	Type		Based on bidder's offer	
8.47.4	Material		Based on bidder's offer	
8.48	Creepage distance of insulator	mm	13020	
8.49	Basic insulation level of insulator at site condition	kV peak	1.3*LIPL	
8.50	One minute power frequency withstand voltage of insulator at site condition	kV rms	1.06*SIWL/ $\sqrt{2}$	
8.51	Switching Impulse withstand voltage of insulator at site condition	kV peak	1.25*SIWL	
8.52	Filling medium		Based on bidder's offer	
8.53	Method used for sealing test		Based on bidder's offer	
8.54	Whether washable in service (Yes/ No)	(Yes/ No)	Yes	
8.55	Permissible force at HV terminals			
8.55.1	Static Horizontal	N	Based on bidder's offer	
8.55.2	Static Vertical	N	Based on bidder's offer	
8.55.3	Dynamic Horizontal	N	Based on bidder's offer	
8.55.4	Dynamic vertical	N	Based on bidder's offer	
8.56	Whether isolating pads for surge arresters with surge counter provided? (Yes/No)	(Yes/ No)	Yes, separated	
8.57	Non Linear MO resistor			
8.57.1	Manufacturer		Based on bidder's offer	
8.57.2	Country		Based on bidder's offer	

b) 400 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.57.3	Type		Based on bidder's offer	
8.58	Dimension of each non-linear MO resistance block			
8.58.1	Diameter	mm	Based on bidder's offer	
8.58.2	Height	mm	Based on bidder's offer	
8.59	Total weight of single unit	kg	Based on bidder's offer	
8.60	Total weight of complete surge arrester	kg	Based on bidder's offer	
8.61	Total height of surge arrester	mm	Based on bidder's offer	
8.62	Total width of surge arrester	mm	Based on bidder's offer	
8.63	Whether grading ring for high voltage terminal required?	(Yes/ No)	Yes	
8.64	Maximum Package weight ready for shipment	kg	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.	220KV Circuit Breaker			
	<u>General</u>			
1.1	Manufacturer		Based on bidder's offer	
1.2	Place of manufacturing		Based on bidder's offer	
1.3	Type designation for breaker		Based on bidder's offer	
1.4	Type designation for operating mechanism		Based on bidder's offer	
1.5	Type of operation mechanism		Spring Charge motor operated	
1.6	Type of interrupting chamber		Based on bidder's offer	
1.7	Applicable standard		IEC 62271-100, 62271-101, 62271-110, 62271-302, 60376, 60480	
1.8	Rated voltage	kV	245	
1.9	System Voltage	kV	220	
1.10	Rated current at maximum site temperature	A		
1.10.1	For line feeder		2500	
1.10.2	For Transformer feeder		2500	
1.10.3	For Diameters		2500	
1.11	Rated frequency	Hz	50	
1.12	Media of breaking chamber		SF6	
1.13	Single pressure, low pressure or others		Based on bidder's offer	
1.14	Quantity of poles per breaker		3 Poles	
1.15	Rated operating sequence		O -0.3 sec- CO - 3 min - CO	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.16	Single pole or three pole operation			
1.16.1	For line feeder		1 pole operated	
1.16.2	For Transformer feeder		3 pole operated	
1.16.3	For Diameter		1 pole operated	
Note	All 220 kV circuit breakers should be capable of both Single pole and three pole operation			
1.17	Number of interrupting chambers per pole		Based on bidder's offer	
1.18	Class (indoor / outdoor)		Outdoor	
1.19	Circuit breaker type (live tank / dead tank)		Live tank	
1.20	Type of system earthing		Effective	
1.21	Withstanding in load combinations of earthquake, wind , short circuit , etc as mentioned in Technical Specification	(Yes/ No)	Yes	
1.22	Maximum and Minimum ambient temperature for design	°C	Acc. to section 1	
1.23	Design altitude above sea level	m	Acc. to section 1	
1.24	Pollution level	mm/kV	Acc. to section 1	
1.25	Design seismic acceleration	g	Acc. to section 1	
	Insulation Rating			
1.26	Type of Insulator (porcelain/silicon rubber)		porcelain	
1.27	Basic Insulation level (at site condition)	kV peak		
1.27.1	Common value (Phase-phase, Phase-ground)		1050	
1.27.2	Across the isolating distance		1200	
1.28	One minute power frequency withstand voltage (at IEC condition)	kV rms		

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.28.1	Common value (Phase-phase, Phase-ground)		460	
1.28.2	Across isolating distance		530	
1.29	Switching Impulse Withstand Voltage at IEC conditions	kV peak	N.A.	
1.29.1	Phase to ground and across open switching device		Acc to IEC	
1.29.2	Phase to phase		Acc to IEC	
1.29.3	Across isolating distance		Acc to IEC	
1.30	Rated transient recovery voltage for terminal faults	kV peak	364	
1.31	Rated recovery voltage	kV peak		
1.31.1	Amplitude factor		Based on bidder's offer	
1.31.2	Rate of rise	kV/μs	Based on bidder's offer	
1.32	Rate of rise of restriking voltage			
1.32.1	For 30% breaking capacity	kV/μs	Based on bidder's offer	
1.32.2	For 60% breaking capacity	kV/μs	Based on bidder's offer	
1.32.3	For 100% breaking capacity	kV/μs	Based on bidder's offer	
1.33	Maximum recovery voltage on breaking a synchronous system	kV	Based on bidder's offer	
1.34	Rated characteristics for short line faults	kV rms	Based on bidder's offer	
1.35	First pole to clear factor		1.3	
1.36	Whether circuit breaker is restrike free?		Yes	
1.37	Maximum overvoltage factor on any switching duty	pu	2.3	
1.38	Maximum overvoltage factor when interrupting rated line/cable/capacitor bank charging currents	pu	2.3	
1.39	Maximum overvoltage factor when switching small inductive/reactor currents	pu	2.3	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.40	Maximum total break time (trip initiation to final arc extinction)	ms	Based on bidder's offer	
	Current Ratings			
1.41	Rated short time withstand current & duration	kA rms/sec	40/1	
1.42	Rated short circuit making current	kA peak	2.5*40	
1.43	Rated out of phase breaking current	kA rms	12.5	
1.44	Rated small inductive breaking current	A rms	Acc. To IEC	
1.45	Rated capacitive breaking current			
1.45.1	Rated line-charging breaking current	A rms	Acc. To IEC	
1.45.2	Rated cable charging breaking current	A rms	Acc. To IEC	
1.45.3	Rated Single/Back to Back Capacitor bank breaking current	A rms	Acc. To IEC	
1.46	Rated short circuit breaking current			
1.46.1	AC component	kA rms	40	
1.46.2	DC component	%	Acc. To IEC	
1.47	Maximum current on breaking asynchronous system	kA peak	Based on bidder's offer	
1.48	180° out of phase switching duty as a percentage of rated breaking current	%	Based on bidder's offer	
	Other Characteristics			
1.49	Voltage drop across HV terminals of one pole at 100 A dc	mV	Based on bidder's offer	
1.50	Maximum temperature rise at normal current over maximum	°C	Based on bidder's offer	
1.51	Opening time (from trip contact closing to the primary contacts separation in all poles)			
1.51.1	Without current	ms	Based on bidder's offer	
1.51.2	With 100% rated breaking current	ms	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.52	Opening time from trip contact closing to primary contact separation	ms	21	
1.53	Closing time (from energization of close coil to latching of circuit breaker in fully closed position)	ms	35	
1.54	Rated break or interrupting time (opening time plus arcing time)	μs	Based on bidder's offer	
1.55	Making time (energization of close coil to contact touch)			
1.55.1	Without current	ms	Based on bidder's offer	
1.55.2	100% making current	ms	Based on bidder's offer	
1.56	Maximum break time	ms	40	
1.57	Maximum close time	ms	< 70	
1.58	Dead time (during auto-reclosing)	ms	Based on bidder's offer	
1.59	Reclosing	ms	Based on bidder's offer	
1.60	Arcing time	ms	Based on bidder's offer	
1.61	Maximum time interval between opening of first and last phase of three phase circuit breakers	ms	Based on bidder's offer	
1.62	Maximum time interval between opening of interrupters of one phase	μs	Based on bidder's offer	
1.63	Maximum time interval between closure of interrupters of one phase	μs	Based on bidder's offer	
1.64	Minimum time from extinction of main arc to contact make during auto-reclosing duty	ms	Based on bidder's offer	
1.65	Closing time from energisation of close coil to latching of circuit breaker in fully closed position	ms	Based on bidder's offer	
1.66	Making time (energisation of close coil to contact touch)			
1.66.1	Without current	ms	Based on bidder's offer	
1.66.2	100% making current	ms	Based on bidder's offer	
	Operating Mechanism			
1.67	Type of spring		spring operated	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.68	Motor type		DC Motor charged,	
1.69	Motor			
1.69.1	Rated voltage	V	110 VDC	
1.69.2	Power demand	W	Based on bidder's offer	
1.69.3	Full-load current	A	Based on bidder's offer	
1.69.4	Maximum starting current	A	Based on bidder's offer	
1.69.5	Speed	rpm	Based on bidder's offer	
1.69.6	Required time by motor to charge the spring completely	s	Based on bidder's offer	
1.69.7	Type of protection of motor		Based on bidder's offer	
1.70	Hand operating facility	Yes/No	Yes	
1.70.1	Manual spring charging facility to be accessible from ground respectively platform to be provided	Yes/No	Yes	
1.70.2	Manual spring release (suitably positioned to avoid accidental operation)	Yes/No	Yes	
1.70.3	Manual mechanism charging torque	Nm	Based on bidder's offer	
1.71	Mechanical on/off indicator	Yes/No	Yes	
1.72	Mechanical spring charge/discharge indication	Yes/No	Yes	
1.73	Charging time	S	≤12	
1.74	Number of trip coils per phase		2	
1.75	Number of close coils per phase		1	
1.76	Reclosing suitable for 1 pole and/or 3 pole		3pole and 1pole	
1.77	Whether circuit breaker is trip free or others?		Yes	
1.78	Number and type of spare auxiliary reversible contacts		18NO+18NC	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.79	Opening and closing nominal control voltage	V dc	Based on bidder's offer	
1.80	Control cabinet			
1.80.1	Power Socket in Control cabinet		British Standard	
1.80.2	cabinet Light (Compact LED)	Yes/No	Yes	
1.80.3	Number, type & power of cabinet heater		Based on bidder's offer	
1.80.4	cabinet space heaters (thermostat Controlled)	Yes/No	Yes	
1.80.5	Degree of protection (IP) of control cabinet		IP55	
1.80.6	Minimum thickness of steel control cabinet	mm	2	
1.81	Tripping and closing coils			
1.81.1	Number of closing coils		1	
1.81.2	Number of tripping coils		2	
1.81.3	Tripping coil current	A, DC	Based on bidder's offer	
1.81.4	Closing coil current	A, DC	Based on bidder's offer	
1.81.5	Rated power of trip coil	W	Based on bidder's offer	
1.81.6	Rated power of close coil	W	Based on bidder's offer	
1.81.7	Tripping and closing coils' nominal control voltage	V, DC	110	
1.81.8	Variation of closing / opening coils' operating voltage	%	85-110 / 70-110	
1.81.9	Minimum voltage for proper operation of trip & close coils	%	40	
1.81.10	- Pick up range of control voltage		Based on bidder's offer	
1.82	Whether antipumping device is provided?	Yes/No	Yes	
1.83	Whether operating counter is provided?	Yes/No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.84	Whether emergency trip is provided?	Yes/No	Yes	
1.85	Whether circuit breaker is equipped with Local/remote/ maintenance change over switch?	Yes/No	Yes	
1.86	Whether circuit breaker is equipped with manually spring charge facilities?	Yes/No	Yes	
1.87	Whether Pre-insertion resistor is provided?	Yes/No	No	
1.87.1	Closing resistor value	Ω	Based on bidder's offer	
1.87.2	Insertion time	ms	Based on bidder's offer	
1.88	Whether Switching Control Relay is provided?	Yes/No	No	
1.89	Pole discrepancy feature	Yes/No	Yes	
	Insulating Medium			
1.90	Insulating medium		SF6 gas	
1.91	Rated pressure SF6 at 20°C	Absolute bar	Based on bidder's offer	
1.92	Limits of gas pressure for correct operation of breaker	Absolute bar	Based on bidder's offer	
1.93	Signal loss of SF6 at 20°C	Absolute bar	Based on bidder's offer	
1.94	General lockout at 20°C	Absolute bar	Based on bidder's offer	
1.95	Leakage rate of SF6 at rated pressure per annum	%	< 0.5	
1.96	Type and material of gasket used to gas tightening the joints			
1.96.1	Metal to metal joints		Based on bidder's offer	
1.96.2	Metal to porcelain joints		Based on bidder's offer	
1.97	Supplier of SF6 gas		Based on bidder's offer	
1.98	Supplier of Density meter		Based on bidder's offer	
1.99	Toxicological test		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.100	Storage capacity of each gas cylinder	m³	Based on bidder's offer	
1.101	Whether sufficient gas plus 20% supplied for first filling?	Yes / No	Yes	
1.102	Mass of gas stored cylinder	kg	Based on bidder's offer	
1.103	Time required to fill the circuit breaker with SF6 gas ready for operation	hour	Based on bidder's offer	
1.104	Time required to empty gas of the circuit breaker	hour	Based on bidder's offer	
1.105	Total mass of transportable gas handling equipment	kg	Based on bidder's offer	
1.106	Whether SF6 is stored as gas or liquid?		Gas	
	Insulator Columns			
1.107	Manufacturer		Based on bidder's offer	
1.108	Type		Based on bidder's offer	
1.109	Color		Based on bidder's offer	
1.110	Creepage distance phase to ground	mm	7595	
1.111	Creepage distance between terminals of one pole	mm	Based on bidder's offer	
1.112	Protected creepage distance (90° shadow)	mm	Based on bidder's offer	
1.113	Clearance (phase to phase)	mm	Acc to IEC	
1.114	External striking distance			
1.114.1	Phase to ground	mm	Acc to IEC	
1.114.2	Phase to phase	mm	Acc to IEC	
1.115	Ultimate strength of columns			
1.115.1	Cantilever	N	Based on bidder's offer	
1.115.2	Tension	N	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.115.3	Torsion	N.m	Based on bidder's offer	
1.115.4	Compression	N	Based on bidder's offer	
1.116	Permissible force at HV terminals			
1.116.1	Static at any direction	N	Based on bidder's offer	
1.116.2	Dynamic at any direction	N	Based on bidder's offer	
1.117	Washable in service	Yes / No	Yes	
	Miscellaneous			
1.118	Mechanical life of CB and mechanism in No. of operations	time	10000	
1.119	Electrical contact life in number of operations at:			
1.119.1	Rated current	time	10000	
1.119.2	Breaking current	time	≥ 30	
1.119.3	Cumulative ampere rating	time	Based on bidder's offer	
1.120	Whether a lock out device for preventing circuit breaker to close is provided?	Yes / No	Yes	
1.121	Whether Switching Control Relay is provided?	Yes/No	No	
1.122	Number and type of free auxiliary contacts for main contact monitoring		18NC and 18NO	
1.123	Number and type of free auxiliary contacts for SF6 gas pressure monitoring		4	
1.124	Number and type of free auxiliary contacts for local/remote selector switch monitoring		6	
1.125	Whether circuit breaker is equipped with rings?	Yes/No	Based on bidder's offer	
1.126	Whether circuit breaker is equipped with grading capacitors?	(Yes/ No)	Yes	
1.127	Mechanical on/off indicator	Yes/No	Yes	
1.128	Gas supervision	Yes/No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
1.129	Circuit breaker Operating platform (from ground level)	Yes/No	Yes	
1.130	Type and material for main contacts			
1.131	Material of HV conductor		Aluminum	
1.132	Whether contacts are silver plated?	Yes / No	Yes	
1.133	Un-galvanized metal parts shall primed, undercoated and finished with outdoor corrosion-	Yes/No	Yes	
1.134	Galvanizing parts accordance with ISO 1461 standards		As per ISO-1461	
1.135	CB weight			
1.135.1	Weight of single pole breaker	kg	Based on bidder's offer	
1.135.2	Total weight of complete circuit breaker	kg	Based on bidder's offer	
1.135.3	Maximum weight of package ready for shipment	kg	Based on bidder's offer	
1.136	CB main dimensions			
1.136.1	Overall height of assembled circuit breaker	mm	Based on bidder's offer	
1.136.2	Phase spacing	mm	Based on bidder's offer	
1.136.3	Minimum vertical distance between upper and lower terminal of the circuit breaker	mm	Based on bidder's offer	
1.136.4	Minimum vertical distance between lower side of the circuit breaker and metallic support	mm	Based on bidder's offer	
1.137	Mechanical endurance class		M2	
1.138	Electrical endurance class		E2	
1.139	Restrike probability class due to capacitive current breaking		C2	
2.	220KV ISOLATOR			
	<u>General</u>			
2.1	Manufacturer		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.2	Place of manufacturing		Based on bidder's offer	
2.3	Type designation for Isolator		Based on bidder's offer	
2.4	Type designation for grounding switch		Based on bidder's offer	
2.5	Type of Isolator		Horizontal Double Break/Centre break	
2.6	Applicable standard		IEC 62271-102	
2.7	Quantity of poles		Single pole op.	
2.8	Rated voltage	kV	245	
2.9	Rated current	A		
2.9.1	At maximum site temperature			
2.9.1.1	For line feeder		Acc. to SLD	
2.9.1.2	For Transformer feeder		Acc. to SLD	
2.9.1.3	For Diameter		Acc. to SLD	
2.9.2	At IEC condition		Acc. to SLD	
2.9.2.1	For line feeder		Acc. to SLD	
2.9.2.2	For Transformer feeder		Acc. to SLD	
2.9.2.3	For Diameter		Acc. to SLD	
2.10	Rated frequency	Hz	50	
2.11	Class (outdoor / indoor)		Outdoor	
2.12	Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No)	Yes / No	Yes	
2.13	Hand operating facility is provided? (Yes / No)	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.14	Accessibility to operating mechanism from ground level	Yes / No	Yes	
2.15	Mechanical Endurance Class		M2	
2.16.1	Electrical Endurance Class		E2	
2.16.2	Capacitive switching at maximum temporary overvoltage		C2	
2.17	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	
2.17.1	Date of issue		Latest	
2.17.2	Validity			
2.17.3	Certificate attached to the offer	Yes / No	Yes	
2.18	Type test certificate to be issued by independent laboratory or independently witnessed type test	Yes / No	Yes	
2.18.1	Certificate to be attached to the offer		Yes	
2.18.2	Report to be attached to the offer		Yes	
	<u>Insulation Rating</u>			
2.19	Basic Insulation level (at site condition)			
2.19.1	Common value	kV peak	1050	
2.19.2	Across the isolating distance	kV peak	1200	
2.20	One minute power frequency withstand voltage (at site condition)			
2.20.1	Common value	kV rms	460	
2.20.2	Across the isolating distance	kV rms	530	
2.21	Switching impulse withstand voltage (at site condition)			

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.21.1	Common value	kV peak	N.A.	
2.21.2	Across the isolating distance	kV peak	N.A.	
2.22	Type of Insulation(porcelain/silicon rubber)		porcelain	
	<u>Current Rating</u>			
2.23	Rated short time withstand current			
2.23.1	For Isolator	kA rms/sec	40/1	
2.23.2	For grounding switch	kA rms/sec	40/1	
2.24	Rated short circuit making current for grounding switches	kA rms	2.5*40	
2.25	Rated peak short circuit withstand current	kA peak	Based on bidder's offer	
2.26	Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102)	kVA	Based on bidder's offer	
2.27	Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102)	kVA	Based on bidder's offer	
	<u>Other Characteristic</u>			
2.28	Rated Supply Voltage			
2.28.1	For motor, control and interlock	Vdc	110	
2.28.2	For AC auxiliaries	Vac	240	
2.29	Voltage drop across terminals of one pole at 100 A.dc for Isolator and ground switches	mV	Based on bidder's offer	
2.30	Maximum temperature rise at normal current over Maximum ambient temperature	°C	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.31	Maximum and minimum ambient temperature for design	°C	Acc. to section 1	
2.32	Altitude above sea level	m	Acc. to section 1	
	<u>Operating Mechanism</u>			
2.33	Type of operating mechanism			
2.33.1	For Isolator		DC Motor	
2.33.2	For grounding switch		DC Motor	
2.34	Motor type		Based on bidder's offer	
2.35	Motor		110 VDC	
2.35.1	Rated voltage	V	Based on bidder's offer	
2.35.2	Power demand	W	Based on bidder's offer	
2.35.3	Full load current	A	Based on bidder's offer	
2.35.4	Speed	rpm	Based on bidder's offer	
2.36	Type of motor protection		Based on bidder's offer	
2.37	Total time from initiation of opening operation to Isolator in fully open position	sec	≤15	
2.38	Time from contact separation to extinct of capacitive arc	sec	Based on bidder's offer	
2.39	Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage		Based on bidder's offer	
2.40	Breaking and closing of:		Based on bidder's offer	
2.40.1	Magnetizing current of power transformers	Yes / No	Yes	
2.40.2	Mutual inductive/capacitive current of parallel circuit in double circuit line	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.40.3	Charging current of unloaded lines and/or cables	Yes / No	Yes	
2.41	Minimum guaranteed no. of operations for Isolators or grounding switches before maintenance	N	Based on bidder's offer	
2.42	Maximum required force for hand operation with supplied handle		Based on bidder's offer	
2.43	Thickness of steel control cabinet	mm	Min (2)	
2.44	Degree of protection (IP) of mechanism housing		IP55	
2.45	Cubicle space heaters (thermostat Controlled)	Yes / No	Yes	
2.46	Cabinet heater			
2.46.1	Power	W	Based on bidder's offer	
2.46.2	Nominal Voltage	V	240AC	
2.47	Whether local/ remote/ disconnect selector switch is provided? (Yes / No)	Yes / No	Yes	
2.48	Whether open/neutral /close control switch is provided? (Yes / No)	Yes / No	Yes	
2.49	Whether under voltage relay is provided for motor supply?	Yes / No	Yes	
2.50	Whether all of the heaters are equipped with a M.C.B ?	Yes / No	Yes	
2.51	Rated power of operation coil	W	Based on bidder's offer	
2.52	Total load of heaters for Isolator	W	Based on bidder's offer	
	<u>Insulators</u>			
2.53	Manufacturer		Based on bidder's offer	
2.54	Place of manufacturing		Based on bidder's offer	
2.55	Type (porcelain /composite)		porcelain	
2.56	Colour		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.57	Creepage distance	mm	7595	
2.58	Protected creepage distance	mm	Based on bidder's offer	
2.59	Permissible cantilever working load	N	C12	
2.60	Operating handle or lever mounting height above ground	m	1.2	
2.61	Permissible tensional strength	N.m		
	Minimum clearance	mm		
2.61.1	Between poles when Isolator is closed		Based on bidder's offer	
2.61.2	Between poles when Isolator is open		Based on bidder's offer	
2.61.3	Between phase and ground		Based on bidder's offer	
2.61.4	Between one pole terminals at open condition		Based on bidder's offer	
	<u>Interlocks</u>			
2.62	Type of interlock between Isolator and associated ground switch		Electrical and Mechanical	
2.63	Type of interlock between ground switch and related circuit breakers		Electrical	
2.64	Type of interlock between Isolator and related circuit breaker		Electrical	
2.65	Locking arrangement in on/off position	Yes / No	Yes	
2.66	Automatic isolation of control supplies when lock off	Yes / No	Yes	
	<u>Miscellaneous</u>			
2.67	Type of main contacts			
2.67.1	For Isolator		Based on bidder's offer	
2.67.2	For grounding switch		Based on bidder's offer	
2.68	Material of main contacts			

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
2.68.1	For Isolator		Copper	
2.68.2	For grounding switch		Copper	
2.69	Material of blades			
2.69.1	For Isolator		Based on bidder's offer	
2.69.2	For grounding switch		Based on bidder's offer	
2.70	Whether main contacts are silver plated			
2.70.1	For Isolators		Yes	
2.70.2	For grounding switches		Yes	
2.71	Quantity and type of free auxiliary contacts			
2.71.1	For Isolators		10NO+10NC	
2.71.2	For grounding switches		10NO+10NC	
2.72	Permissible force on HV terminals			
2.72.1	Static in any direction	N	Based on bidder's offer	
2.72.2	Dynamic in any direction	N	Based on bidder's offer	
2.73	Weight of maximum package ready for shipment	kg	Based on bidder's offer	
2.74	Weight of complete			
2.74.1	Isolator	kg	Based on bidder's offer	
2.74.2	Isolator with associated grounding switch	kg	Based on bidder's offer	
2.74.3	Single phase	kg	Based on bidder's offer	
2.75	Cubicle Light (Compact LED)	Yes / No	Yes	
2.76	Number of grounding switch		1/2	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
Note: The table should be filled and submitted for each of the following equipment separately: 1. Isolator with 2 Ground Switches 2. Isolator with 1 Ground Switches				
3.	220KV EARTHING SWITCH			
	<u>General</u>			
3.1	Manufacturer		Based on bidder's offer	
3.2	Place of manufacturing		Based on bidder's offer	
3.3	Type designation		Based on bidder's offer	
3.4	Type of operating mechanism		DC Motor	
3.5	Applicable standard		IEC 62271-102	
3.6	Rated voltage	kV	245	
3.7	Rated current	A	Based on bidder's offer	
3.8	At maximum site temperature		Acc. to SLD	
3.9	At IEC condition		Acc. to SLD	
3.9.1	Rated frequency	Hz	50	
3.9.2	Class (outdoor / indoor)		Outdoor	
3.10	Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No)	Yes / No	Yes	
3.11	Hand operating facility is provided? (Yes / No)	Yes / No	Yes	
3.12	Accessibility to operating mechanism from ground level	Yes / No	Yes	
3.13	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.14	Date of issue		Latest	
3.15	Validity			
3.16	Certificate attached to the offer	Yes / No	Yes	
3.17	Type test certificate to be issued by independent laboratory or independently witnessed type test	Yes / No	Yes	
3.17.1	Certificate to be attached to the offer		Yes	
3.17.2	Report to be attached to the offer		Yes	
	<u>Insulation Rating</u>			
3.18	Basic Insulation level (at site condition)			
3.18.1	Common value	kV peak	1050	
3.18.2	Across the isolating distance	kV peak	1200	
3.19	One minute power frequency withstand voltage (at site condition)			
3.19.1	Common value	kV rms	460	
3.19.2	Across the isolating distance	kV rms	530	
3.20	Switching impulse withstand voltage (at site condition)			
3.20.1	Common value	kV peak	-	
3.20.2	Across the isolating distance	kV peak	-	
3.21	Type of Insulation(porcelain/silicon rubber)		porcelain	
	<u>Current Rating</u>			
3.22	Rated short time withstand current			
3.22.1	For grounding switch	kA rms/sec	40/1	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.22.2	Rated short circuit making current for grounding switches	kA rms	2.5*40	
3.23	Rated peak short circuit withstand current	kA peak	Based on bidder's offer	
3.24	Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102)	kVA	Based on bidder's offer	
3.25	Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102)	kVA	Based on bidder's offer	
	<u>Other Characteristic</u>			
3.26	Rated Supply Voltage			
3.26.1	For motor, control and interlock	Vdc	110	
3.26.2	For AC auxiliaries	Vac	240	
3.27	Voltage drop across terminals of one pole at 100 A.dc for ground switches	mV	Based on bidder's offer	
3.28	Maximum temperature rise at normal current over Maximum ambient temperature	°C	Based on bidder's offer	
3.29	Maximum and minimum ambient temperature for design	°C	Acc. to section 1	
3.30	Altitude above sea level	m	Acc. to section 1	
	<u>Operating Mechanism</u>			
3.31	Type of operating mechanism		DC Motor	
3.31.1	Motor type		Based on bidder's offer	
3.31.2	Motor			
3.32	Rated voltage	V	Based on bidder's offer	
3.33	Power demand	W	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.33.1	Full load current	A	Based on bidder's offer	
3.33.2	Speed	rpm	Based on bidder's offer	
3.34	Type of motor protection		Based on bidder's offer	
3.35	Total time from initiation of opening operation in fully open position	sec	≤15	
3.36	Breaking and closing of:			
3.36.1	Magnetizing current of power transformers	Yes / No	Yes	
3.36.2	Mutual inductive/capacitive current of parallel circuit in double circuit line	Yes / No	Yes	
3.36.3	Charging current of unloaded lines and/or cables	Yes / No	Yes	
3.37	Minimum guaranteed no. of operations for grounding switches before maintenance	N	Based on bidder's offer	
3.38	Maximum required force for hand operation with supplied handle		Based on bidder's offer	
3.39	Thickness of steel control cabinet	mm	Min (2)	
3.40	Degree of protection (IP) of mechanism housing		IP55	
3.41	Cubicle space heaters (thermostat Controlled)	Yes / No	Yes	
3.42	Cabinet heater			
3.42.1	Power	W	Based on bidder's offer	
3.42.2	Nominal Voltage	V	240 AC	
3.43	Whether local/ remote/ disconnect selector switch is provided? (Yes / No)	Yes / No	Yes	
3.44	Whether open/neutral /close control switch is provided? (Yes / No)	Yes / No	Yes	
3.45	Whether under voltage relay is provided for motor supply?	Yes / No	Yes	
3.46	Whether all of the heaters are equipped with a M.C.B ?	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
3.47	Rated power of operation coil	W	Based on bidder's offer	
3.48	Total load of heaters	W	Based on bidder's offer	
	<u>Insulators</u>			
3.49	Manufacturer		Based on bidder's offer	
3.50	Place of manufacturing		Based on bidder's offer	
3.51	Type (porcelain /composite)		porcelain	
3.52	Colour		Based on bidder's offer	
3.53	Creepage distance	mm	7595	
3.54	Protected creepage distance	mm	Based on bidder's offer	
3.55	Permissible cantilever working load	N	C8	
3.56	Operating handle or lever mounting height above ground	m	1.2	
3.57	Permissible tensional strength	N.m	Based on bidder's offer	
3.58	Minimum clearance	mm		
3.58.1	Between poles when earth switch is closed		Acc to IEC	
3.58.2	Between poles when earth switch is open		Acc to IEC	
3.58.3	Between phase and ground		Acc to IEC	
3.58.4	Between one pole terminals at open condition		Acc to IEC	
	<u>Interlocks</u>			
3.59	Type of interlocking		Electrical and Mechanical	
3.60	Locking arrangement in on/off position	Yes / No	Yes	
3.61	Automatic isolation of control supplies when lock off	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
	<u>Miscellaneous</u>			
3.62	Type of main contacts		Based on bidder’s offer	
3.63	For grounding switch		Based on bidder’s offer	
3.64	Material of main contacts			
3.64.1	For grounding switch		Based on bidder’s offer	
3.65	Material of blades			
3.65.1	For grounding switch		Based on bidder’s offer	
3.66	Whether main contacts are silver plated			
3.66.1	For grounding switches		Yes	
3.67	Quantity and type of free auxiliary contacts			
3.67.1	For grounding switches		10NO+10NC	
3.68	Permissible force on HV terminals			
3.68.1	Static in any direction	N	Based on bidder’s offer	
3.68.2	Dynamic in any direction	N	Based on bidder’s offer	
3.69	Weight of maximum package ready for shipment	kg	Based on bidder’s offer	
3.70	Weight of complete earth switch	kg	Based on bidder’s offer	
3.71	Cubicle Light (Compact LED)	Yes / No	Yes	
4.	220KV CURRENT TRANSFOMERS			
	General			
4.1	Manufacturer		Based on bidder’s offer	
4.2	Place of manufacturing		Based on bidder’s offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.3	Type designation		Post	
4.4	Number of phases		3 phase	
4.5	Type of neutral grounding		Effective	
4.6	Applicable standard		IEC 61869-1/-2	
4.7	Class (indoor / outdoor)		Outdoor	
4.8	Type (Oil-immersed / dry)		Oil-immersed Oil impregnated paper	
4.9	Construction (tank / inverted)		Tank	
4.10	Rated voltage	kV rms	220	
4.11	Rated current at max. site temperature :	A		
4.11.1	For line feeders		2500	
4.11.2	For transformer feeders		2500	
4.11.3	For Diameters		2500	
4.12	Rated frequency	Hz	50	
4.13	Max. and min. ambient temperatures used for design	°C	Acc. to section 1	
4.14	Rated short time withstand current	kA rms	40/1sec	
4.15	Rated short time dynamic current	kA peak	2.5*40	
4.16	Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No)	(Yes / No)	Yes	
4.17	Altitude above sea level	m	Acc. to section 1	
4.18	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
4.18.1	Date of issue		Latest	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.18.2	Validity			
4.18.3	Certificate attached to the offer	Yes/No	Yes	
4.19	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
4.19.1	Certificate to be attached to the offer	Yes/No	Yes	
4.19.2	Report to be attached to the offer	Yes/No	Yes	
	Insulation	-	-	
4.20	Maximum continuous line to line operating voltage	kV rms	245	
4.21	Basic Insulation level (at site condition)	kV peak	1050	
4.22	Switching impulse withstand level (at site condition)	kV peak	-	
4.23	One minute power frequency withstand voltage (at site condition)	kV rms		
4.23.1	Dry		460	
4.23.2	Wet		Acc to IEC	
4.24	One minute power frequency withstand voltage for secondary winding	kV rms	Acc to IEC	
4.25	Highest value of partial discharge when tested acc. to IEC	pc	5	
4.26	Voltage at secondary winding terminals with normal primary load current , and secondary open circuit	kV	Based on bidder's offer	
4.27	Time permitted with open circuit secondary	sec	Based on bidder's offer	
4.28	Dielectric dissipation factor		Based on bidder's offer	
	Ratings and Accuracies	-	-	
4.29	Rated primary current	A	2500	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.30	Rated extended primary current		120%	
4.31	Rated secondary current	A	1	
4.32	Change of CT ratio shall be possible at the secondary circuit only	Yes/No	Yes	
4.33	specification of CTs on: Line feeders, Transformer feeders,Bus couple, Tie coupler, Auxiliary transformer, Power transformer neutral, Core balance			
4.33.1	Number of cores		Acc. to PS LD	
4.33.2	Ratio (TR – turns ratio)	A	Acc. to PS LD	
4.33.3	Class		Acc. to PS LD	
4.33.4	Knee point voltage (Ek)	V	Based on bidder’s offer	
4.33.5	Exciting current (IE) at Ek	mA	Based on bidder’s offer	
4.33.6	Rated output (burden to be 25-100% rated burden)	VA	50	
	External Insulation	-	-	
4.34	Material		Based on bidder’s offer	
4.35	Manufacturer		Based on bidder’s offer	
4.36	Place of manufacturing		Based on bidder’s offer	
4.37	Type designation		Based on bidder’s offer	
4.38	Minimum creepage distance	mm	7595	
4.39	Color		Brown	
4.40	Protected creepage distance (90 shadow)	mm	Based on bidder’s offer	
4.41	Shortest flash-over distance	mm	Based on bidder’s offer	
4.42	Whether washable in service ? (Yes / No)	(Yes / No)	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
	Miscellaneous	-	-	
4.43	Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107	μv	2500	
4.44	Whether oil level indicator/oil sampling valve/oil filling valve are provided ? (Yes / No)		Yes	
4.45	Means for compensation of oil expansion		Based on bidder's offer	
4.46	Temperature rise at rated continuous thermal current	°C	Based on bidder's offer	
4.47	Rated continuous thermal current (% of rated primary current)		Rated extended primary current	
4.48	Electrostatic capacity of complete current transformer. PF		Based on bidder's offer	
4.49	Loss angle at rated voltage		Based on bidder's offer	
4.50	Permissible force at HV terminals			
4.50.1	Static at any direction	N	3000	
4.50.2	Dynamic at any direction	N	5000	
4.51	Type , grade and manufacturer of oil		Based on bidder's offer	
4.52	Weight of oil	kg	Based on bidder's offer	
4.53	Primary conductor material		Based on bidder's offer	
4.54	Secondary conductor material		Based on bidder's offer	
4.55	Overall height	mm	Based on bidder's offer	
4.56	Overall width	mm	Based on bidder's offer	
4.57	Overall length	mm	Based on bidder's offer	
4.58	Total weight of complete current transformer	Kg	Based on bidder's offer	
4.59	Max. package weight ready for shipment	Kg	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
4.60	ting up of CT are provided? (Yes / No)		Yes	
4.61	Permitted inclination refer to vertical axis during transport or storage	Degree	Based on bidder’s offer	
4.62	Degree protection of Terminal box		IP55	
5.	220KV CAPACITIVE VOLTAGE TRANSFORMERS			
	General			
5.1	Manufacturer		Based on bidder’s offer	
5.2	Place of manufacturing		Based on bidder’s offer	
5.3	Type of CVT		Single-phase/self cooled	
5.4	Applicable standard		IEC 61869-1/-5	
5.5	Rated voltage	kV rms	245	
5.6	Rated frequency	Hz	50	
5.7	Max. and min. ambient temperatures used for design	°C	Acc. to Section1	
5.8	Class (indoor/ outdoor)		Outdoor	
5.9	Type (Oil-immersed / dry)		Oil-immensed/ Oil-impregnated paper	
5.8	Maximum permissible partial discharge level at Um	pC	10	
5.9	Maximum permissible partial discharge level at 1.2Um /Ö3	pC	5	
5.10	Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No)	(Yes / No)	Yes	
5.11	Altitude above sea level	m	Acc. to Section1	
5.12	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
5.12.1	Date of issue		Latest	
5.12.2	Validity		Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.12.3	Certificate attached to the offer	Yes/No	Yes	
	Insulation ratings			
5.13	Basic insulation level (at site condition)	kV peak	1050	
5.14	Switching impulse withstand voltage (at site condition)	kV peak	-	
5.15	One minute power frequency withstand voltage (at site condition)	kV rms	460	
5.16	Power frequency withstand voltage between secondaries and secondary to earth	kV rms	Based on bidder’s offer	
5.17	Rated voltage factor			
5.17.1	Continuous		1.2	
5.17.2	30 seconds		1.5	
5.18	Minimum HV terminal withstand			
5.18.1	Static terminal load	N	1000	
5.18.2	Dynamic terminal load	N	2000	
5.19	Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR	μV	Based on bidder’s offer	
	Burdens and accuracies			
	• <u>3-Winding CVT</u>		3	
5.20	Number of secondary windings		3	
5.21	Accuracy class for		Acc. to SLD	
5.21.1	Winding 1		Acc. to PSLD	
5.21.2	Winding 2		Acc. to PSLD	
5.21.3	Winding 3		Acc. to PSLD	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.22	Rated primary voltage	KVrms	220/√3	
5.23	Rated secondary voltage	KVrms	0.110/√3	
5.24	Rated burden for		Acc. to SLD	
5.24.1	Winding 1	VA	50	
5.24.2	Winding 2	VA	50	
5.24.3	Winding 3	VA	50	
5.25	Continuous thermal burden of			
5.25.1	Winding 1 alone	VA	Based on bidder's offer	
5.25.2	Winding 2 alone	VA	Based on bidder's offer	
	<ul style="list-style-type: none">• <u>2-Winding CVT</u>			
5.26	Number of secondary windings		2	
5.27	Accuracy class for			
5.27.1	Winding 1		Acc. to PSLD	
5.27.2	Winding 2	KVrms	Acc. to PSLD	
5.28	Rated primary voltage	KVrms	220/√3	
5.29	Rated secondary voltage	KVrms	0.110/√3	
5.30	Rated burden for		Acc. to PSLD	
5.30.1	Winding 1	VA	Acc. to PSLD	
5.30.2	Winding 2	VA	Acc. to PSLD	
5.31	Continuous thermal burden of			
5.31.1	Winding 1 alone	VA	Effective	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.31.2	Winding 2 alone	VA	phase to ground	
5.32	Type of system grounding		Effective	
5.33	Type of connection		phase to ground	
5.34	Connections		Based on bidder's offer	
5.34.1	Primary		Stud type	
5.34.2	Secondary		Standard terminal block (screw and bolt)	
5.35	Type of protection device in secondary side		MCB with auxiliary contact	
5.36	Total continuous thermal burden of secondary windings	VA	Based on bidder's offer	
5.36.1	Primary		Stud type	
5.36.2	Secondary		Standard terminal block (screw and bolt)	
	Other Characteristics			
5.37	Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature	K	60K Wind. 50K Oil	
5.38	Permissible secondary short circuit time with rated primary voltage	sec	1	
5.39	Short circuit impedance	Ohm	Max(0.25)	
5.40	Method of suppressing for ferro-resonance		RLC Dumping	
5.41	Available ranges of high voltage capacitor	pF	Based on bidder's offer	
5.42	Coupling capacitor *	pF	Max (10000)	
5.43	Loss angle at rated voltage		35*10-4	
5.44	Frequency range for PLC use	KHz	Based on bidder's offer	
5.45	Equipment series resistance for 35-450 KHz	Ohm	Max(40)	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.46	Natural frequency	MHz	Based on bidder's offer	
5.47	Intermediate stage voltage	kV	Based on bidder's offer	
5.48	Attenuation of intermediate voltage transformer within 35-450 KHz	dB	Based on bidder's offer	
5.49	Max. insertion loss when used for PLC	dB	Based on bidder's offer	
5.50	Whether intermediate tap is brought out? (Yes / No)		YES	
* Min. coupling capacitance of CVT could be changed by manufacture				
	Insulator columns			
5.51	Manufacturer		Based on bidder's offer	
5.52	Place of manufacturing		Based on bidder's offer	
5.53	Type designation		Based on bidder's offer	
5.54	Material		Based on bidder's offer	
5.55	Min. creepage distance	mm	7595	
5.56	Protected creepage distance	mm	Based on bidder's offer	
5.57	Color		Brown	
	Miscellaneous			
5.58	Type and manufacturer of oil for capacitor section		Based on bidder's offer	
5.59	Type and manufacturer of oil for intermediate section		Based on bidder's offer	
5.60	Whether oil level indicator is provided? (Yes / No)	(Yes / No)	Yes	
5.61	Class and grade of insulation material used in capacitors		Based on bidder's offer	
5.62	Permitted inclination during transport/ storage	Degree	Based on bidder's offer	
5.63	Material of windings		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
5.64	Whether CVT is designed to mount line trap on top? (Yes / No)		NO	
5.65	Permissible force at HV terminals			
5.65.1	Static at any direction	N	Based on bidder's offer	
5.65.2	Dynamic at any direction	N	Based on bidder's offer	
5.66	Total weight	kg	Based on bidder's offer	
5.67	Total oil weight	kg	Based on bidder's offer	
5.68	Overall height	mm	Based on bidder's offer	
5.69	Overall width	mm	Based on bidder's offer	
5.70	Max. package dimensions ready for shipment	m ³	Based on bidder's offer	
5.71	Washable in service? (Yes / No)		Yes	
6.	220KV Conductors			
	<u>General</u>			
6.1	Rated current	A		
6.1.1	Line feeders		2500	
6.1.2	Trans feeders		2500	
6.1.3	Busbars		3150	
6.1.4	Rated frequency	Hz	50	
6.2	Rated voltage	kV	245	
6.2.1	Basic insulation level of equipment at site condition	kV peak	1050	
6.2.2	Rated one minute power frequency withstand voltage at site condition	kV rms	460	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.2.3	Rated short circuit withstand current and its duration	kA/sec	40/3	
6.3	Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No)	(Yes / No)	Yes	
6.4	Maximum permissible temperature of conductors at rated current and Max. ambient temperature	°C	80	
6.5	Minimum assumed tension for each stranded conductor at E.D.S condition	% of UTS	3	
6.6	Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase)	% of UTS	20	
6.7	Minimum tension of incoming and outgoing shield wires	% of UTS	10	
6.8	Maximum permissible surface gradient	kV/cm	16	
6.9	Maximum permissible angle for incoming and outgoing overhead lines		±30	
6.10	Ambient condition			
6.10.1	Minimum ambient temperature		Acc. to section 1	
6.10.2	Maximum ambient temperature		Acc. to section 1	
6.10.3	Solar radiation		Acc. to section 1	
6.10.4	Seismic acceleration		Acc. to section 1	
6.10.5	Wind speed		Acc. to section 1	
6.10.6	Ice thickness		Acc. to section 1	
6.11	Solar radiation absorption coefficient (Y)		Acc. to section 1	
6.12	Emissivity coefficient in respect to black body (Ke)		0.5	
6.13	Altitude above sea level	m	Acc. to section 1	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
	<u>Stranded Conductors</u>			
6.14	Manufacturer		Based on bidder’s offer	
6.15	Place of manufacturing		Based on bidder’s offer	
6.16	Material and alloy type		AAAC/AAC	
6.17	Nominal cross section	mm²	Based on bidder’s offer	
6.18	Number of strands		Based on bidder’s offer	
6.19	Overall diameter of conductor	mm	Based on bidder’s offer	
6.20	Ultimate strength of conductor	kN	Based on bidder’s offer	
6.21	Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature	A	Based on bidder’s offer	
	Note: The stranded conductor size adequacy shall be determined by calculation.			
	<u>Tubular Conductors</u>			
6.22	Manufacturer		Based on bidder’s offer	
6.23	Place of manufacturing		Based on bidder’s offer	
6.24	Material and alloy type		Aluminum alloy	
6.25	Outside diameter	mm	Based on bidder’s offer	
6.26	Thickness	mm	Based on bidder’s offer	
6.27	Weight	kg/m	Based on bidder’s offer	
6.28	Max. deflection after installation	mm	Based on bidder’s offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.29	Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C	A	Based on bidder's offer	
6.30	Moment of inertia	cm	Based on bidder's offer	
6.31	Minimum yield strength	kg/cm²	Based on bidder's offer	
	Note: The tubular conductor size adequacy shall be determined by calculation.			
	<u>Shield wires</u>			
6.32	Manufacturer		Based on bidder's offer	
6.33	Place of manufacturing		Based on bidder's offer	
6.34	Material		Al clad steel	
6.35	Cross section	mm²	58.56	
6.36	Diameter	mm	9.78	
6.37	Number of strands		Based on bidder's offer	
6.38	Resistance (at 20 °C)	ohm/km	1.463	
6.39	Ultimate strength	kN	70.76	
6.40	Modulus of elasticity	kg/mm2	16000	
6.41	Coefficient of linier expansion	1/°C	13* 10 ^{^(−6)}	
6.42	Aluminium coating thickness	µm	Based on bidder's offer	
	<u>Connectors and Hardware</u>			
6.43	Manufacturer		Based on bidder's offer	
6.44	Place of manufacturing		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
6.45	Material of connectors		Based on bidder's offer	
6.46	Material of bolts and nuts		Based on bidder's offer	
6.47	Material of washers		Based on bidder's offer	
6.48	Applicable standard for connectors		Based on bidder's offer	
6.49	Type of contact paste		Based on bidder's offer	
	<u>Minimum Clearances</u> (Not applicable for equipment subject to impulse voltage tests)			
6.50	Clearance between live parts and ground (Basic value)	mm	2530	
6.51	Clearance between different phases in bays	mm	4500	
6.52	Minimum Spacing between phases of rigid buses	mm	4500	
6.53	Minimum height of energized parts above ground	mm	5000	
6.54	Height of energized parts above access roads	mm	10000	
6.55	Minimum Distance between over-span phases	mm	5500	
6.56	Shield wire clearance over bus conductors	mm	5000	
7.	220KV Insulators			
	<u>General</u>			
7.1	Rated current	A	Based on bidder's offer	
7.1.1	Line feeders		Acc. to SLD	
7.1.2	Trans feeders		Acc. to SLD	
7.1.3	Busbars		Acc. to SLD	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.1.4	Rated frequency	Hz	50	
7.2	Rated voltage	kV	245	
7.2.1	Basic insulation level of equipment at site condition	kV peak	1050	
7.2.2	Rated one minute power frequency withstand voltage at site condition	kV rms	460	
7.2.3	Rated short circuit withstand current and its duration	kA/sec	40/3	
7.3	Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No)	(Yes / No)	Yes	
7.4	Maximum permissible temperature of conductors at rated current and Max. ambient temperature	°C	80	
7.5	Maximum permissible surface gradient	kV/cm	16	
7.6	Maximum permissible angle for incoming and outgoing overhead lines		±30	
7.7	Ambient condition			
7.7.1	Minimum ambient temperature		Acc. to section 1	
7.7.2	Maximum ambient temperature		Acc. to section 1	
7.7.3	Solar radiation		Acc. to section 1	
7.7.4	Seismic acceleration		Acc. to section 1	
7.7.5	Wind speed		Acc. to section 1	
7.7.6	Ice thickness		Acc. to section 1	
7.7	Solar radiation absorption coefficient (Y)		Acc. to section 1	
7.8	Emissivity coefficient in respect to black body (Ke)		0.5	
7.9	Altitude above sea level	m	Acc. to section 1	
7.10	Manufacturer quality system in accordance with ISO 9000	Yes / No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.10.1	Date of issue		Latest	
7.10.2	Validity		Yes	
7.10.3	Certificate attached to the offer	Yes / No	Yes	
7.11	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes / No	Yes	
7.11.1	Certificate to be attached to the offer		Yes	
	<u>String Insulators</u>			
7.12	Manufacturer		Based on bidder's offer	
7.13	Place of manufacturing		Based on bidder's offer	
7.14	Type designation		ball & socket	
7.15	Applicable standard		Based on bidder's offer	
7.16	Insulator material		Glazed porcelain	
7.17	Color		Based on bidder's offer	
7.18	Wet power frequency withstand voltage of each unit	kV	47	
7.19	Lightning impulse withstand voltage of each unit	kV	125	
7.20	Electromechanical failing load of each unit	kN	160	
7.21	Puncture voltage of each unit	kV	130	
7.22	Minimum creepage distance of each unit	mm	370	
7.23	Total creepage distance of string	mm	7595	
7.24	Nominal spacing	mm	170	
7.25	Protected (90) creepage distance	mm	Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.26	Size of ball and socket	mm	Based on bidder's offer	
7.27	IEC coupling ball		Based on bidder's offer	
7.28	Material of fittings		Based on bidder's offer	
7.29	Minimum quantity of disks per string		22	
7.30	Power frequency withstand voltage of complete String	kV rms		
7.30.1	Dry		460	
7.30.2	Wet		Acc to IEC	
7.31	Basic Insulation level of complete string	KV peak		
7.31.1	Positive		1050	
7.31.2	Negative		Acc to IEC	
7.32	Max. R.I.V. at 1MHz as per CISPR no.1	μ V	Based on bidder's offer	
7.33	Overall length of string with accessories	mm	Based on bidder's offer	
7.34	Ultimate tensile strength of string	kN	Based on bidder's offer	
7.35	Total weight of string	kg	Based on bidder's offer	
7.36	Whether arcing ring at ground side Provided? (Yes / No)	(Yes / No)	Yes	
7.37	Whether corona ring at live side Provided? (Yes / No)	(Yes / No)	Yes	
7.38	Arcing distance	mm	Based on bidder's offer	
7.39	Whether washable in service? (Yes / No)	(Yes / No)	Yes	
	Note: The string insulator and each insulator size adequacy shall be determined by calculation.			
	<u>String Insulator Accessories</u>			
7.40	Manufacturer		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.41	Place of manufacturing		Based on bidder's offer	
7.42	Material		Based on bidder's offer	
7.43	Applicable standard		Based on bidder's offer	
7.44	Rated ultimate tensile strength	kN	Based on bidder's offer	
	<u>Post Insulators</u>			
7.45	Manufacturer		Based on bidder's offer	
7.46	Place of manufacturing		Based on bidder's offer	
7.47	Type designation		Post type	
7.48	Applicable standard		Based on bidder's offer	
7.49	One minute power frequency withstand Voltage (at IEC condition)	kV rms		
7.49.1	Dry		460	
7.49.2	Wet		Acc to IEC	
7.48	Basic Insulation level (at IEC condition)	kV peak	1050	
7.49	Basic Insulation level (at site condition)	kV peak	Based on bidder's offer	
7.50	Switching impulse withstand voltage	kV peak	1050	
7.51	Color		Based on bidder's offer	
7.52	Insulator material		Ceramic	
7.53	Top metal fitting material		Based on bidder's offer	
7.54	Bottom metal fitting material		Based on bidder's offer	
7.55	Bonding material		Based on bidder's offer	
7.56	Minimum creepage distance	mm	7595	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.57	Protected (90) creepage distance	mm	Based on bidder's offer	
7.58	Maximum cantilever working load (complete post insulator)	kN	Based on bidder's offer	
7.59	Minimum cantilever breaking load, upright (complete post insulator)	kN	Based on bidder's offer	
7.60	Minimum torsion strength	kNm	Based on bidder's offer	
7.61	Minimum compression strength	kN	Based on bidder's offer	
7.62	Total height	mm	Based on bidder's offer	
7.63	Arcing distance	mm	Based on bidder's offer	
7.64	Fixing bolts			
7.64.1	Quantity per post insulator		Based on bidder's offer	
7.64.2	Diameter		Based on bidder's offer	
7.65	Bolt circle diameter (Top / Bottom)	mm	Based on bidder's offer	
7.66	Total weight	kg	Based on bidder's offer	
7.67	Maximum R.I.V. at 100 KHz	μv	500	
7.68	Whether washable in service? (Yes / No)		Yes	
7.69	Maximum weight of one package ready for Shipment	kg	Based on bidder's offer	
7.70	Whether corona ring at live side Provided? (Yes / No)		Yes	
7.71	Number of units in complete post insulator		Based on bidder's offer	
7.72	Length of each unit	mm	Based on bidder's offer	
	Note: The post insulator size adequacy shall be determined by calculation.			
	<u>Connectors and Hardware</u>			
7.73	Manufacturer		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
7.74	Place of manufacturing		Based on bidder’s offer	
7.75	Material of connectors		Based on bidder’s offer	
7.76	Material of bolts and nuts		Based on bidder’s offer	
7.77	Material of washers		Based on bidder’s offer	
7.78	Applicable standard for connectors		Based on bidder’s offer	
7.79	Type of contact paste		Based on bidder’s offer	
	<u>Minimum Clearances</u> (Not applicable for equipment subject to impulse voltage tests)			
7.80	Height of base of post insulator from ground	mm	2500	
7.81	Clearance between live parts and ground (Basic value)	mm	2530	
7.82	Minimum height of energized parts above ground	mm	5000	
7.83	Height of energized parts above access roads	mm	10000	
8.	220KV SURGE ARRESTERS			
	General			
8.1	Manufacturer of surge arrester:			
8.1.1	Name		Based on bidder’s offer	
8.1.2	Country		Based on bidder’s offer	
8.2	Manufacturer of surge counter:			
8.2.1	Name		Based on bidder’s offer	
8.2.2	Country		Based on bidder’s offer	
8.3	Type designation for surge arresters		Based on bidder’s offer	
8.4	Type designation for surge counter (equipped with leakage current measuring device)		Based on bidder’s offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.5	Applicable standard		IEC 60099-4	
8.6	Rated frequency	Hz	50	
8.7	Nominal line to line voltage rating	kV	245	
8.8	Type		Metal Oxide	
8.9	Class of surge arrester		Very Heavy	
8.10	Maximum and Minimum ambient temperature for design	°C	Acc. to section 1	
8.11	Altitude above sea level	m	Acc. to section 1	
8.12	Design seismic acceleration	g	Acc. to section 1	
8.13	Ice thickness	mm	Acc. to section 1	
8.14	Wind velocity	m/s	Acc. to section 1	
8.15	Maximum overvoltage factor on the system due to any switching duty	pu	2.3	
8.16	Whether withstanding in load combinations of earthquake , wind , short circuit, as mentioned In Technical Specification?	(Yes / No)	Yes	
	Surge Arresters			
8.17	Rated voltage	kV rms	198	
8.18	Continuous operating voltage	kV rms	158	
8.19	Long duration discharge class as per IEC 99-1	Class	4	
8.20	Number of phases		3	
8.21	Type of system earthing		Effective	
8.22	Nominal discharge current with 8/20 us wave	kA peak	20	
823	Arrester designation		SH	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.24	Type of housing in the case of utilizing porcelain and its classification acc to Std. 60672		Brown glazed Aluminum porcelain class C130	
8.25	Type of housing in the case of utilizing composite polymer and its resistance classification acc to IEC 60587		Silicon rubber (LSR,HCR or RTV type) class 3.4	
8.26	Earth fault factor		1.4	
8.27	Place of installation		Line/Transformer/GI S Feeders	
8.28	Pressure relief class			
8.28.1	High current 0.2 sec	kA	50	
8.28.2	Low current 1 sec		600±200	
8.29	Thermal energy rating (Wth)	(kJ / kV) of	> 10	
8.30	Repitative charge transfer rating (Qrs)	C	> 2.4	
8.31	Reference voltage	kV rms	Based on bidder's offer	
8.32	Reference current	mA	Based on bidder's offer	
8.33	TOV capability for			
8.33.1	1 sec	kV	Acc. to IEC 60099-4	
8.33.2	10 sec	kV	Acc. to IEC 60099-4	
8.34	Continuous current under ambient temperature	mA	Based on bidder's offer	
8.35	Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks			
8.35.1	Switching surges-1kA/2kA	kV peak	Acc. to IEC 60099-4	
8.35.2	5 KA	kV peak	Acc. to IEC 60099-4	
8.35.3	10 KA	kV peak	Acc. to IEC 60099-4	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.35.4	20 KA	kV peak	Acc. to IEC 60099-4	
8.36	Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks			
8.36.1	500 A	kV peak	Acc. to IEC 60099-4	
8.36.2	1 KA	kV peak	Acc. to IEC 60099-4	
8.36.3	2 KA	kV peak	Acc. to IEC 60099-4	
8.37	Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak	kV peak	Based on bidder's offer	
8.38	High current 4/10 microsecond impulse withstand level	kA peak	Acc. to IEC 60099-4	
8.39	Low current 2000 microsecond withstand level	kA peak	Acc. to IEC 60099-4	
8.40	Number of arrester units		Based on bidder's offer	
8.41	Rated voltage of each arrester unit	kV rms	Based on bidder's offer	
8.42	Number of parallel non-linear MO resistance block		1	
8.43	Power frequency voltage versus time characteristics included?	(Yes/No)	Based on bidder's offer	
8.44	Maximum internal partial discharge	pC	Acc. to IEC 60099	
8.45	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
8.45.1	Date of issue		Latest	
8.45.2	Validity		Yes	
8.45.3	Certificate attached to the offer	Yes/No	Yes	
8.46	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
8.46.1	Certificate to be attached to the offer	Yes/No	Yes	
8.46.2	Report to be attached to the offer	Yes/No	Yes	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
	Miscellaneous			
8.47	Insulator			
8.47.1	Manufacturer		Based on bidder's offer	
8.47.2	Country		Based on bidder's offer	
8.47.3	Type		Based on bidder's offer	
8.47.4	Material		Based on bidder's offer	
8.48	Creepage distance of insulator	mm	7595	
8.49	Basic insulation level of insulator at site condition	kV peak	1.3*LIPL	
8.50	One minute power frequency withstand voltage of insulator at site condition	kV rms	1.06*SIWL/ $\sqrt{2}$	
8.51	Switching Impulse withstand voltage of insulator at site condition	kV peak	1.25*SIWL	
8.52	Filling medium		Based on bidder's offer	
8.53	Method used for sealing test		Based on bidder's offer	
8.54	Whether washable in service (Yes/ No)	(Yes/ No)	Yes	
8.55	Permissible force at HV terminals			
8.55.1	Static Horizontal	N	Based on bidder's offer	
8.55.2	Static Vertical	N	Based on bidder's offer	
8.55.3	Dynamic Horizontal	N	Based on bidder's offer	
8.55.4	Dynamic vertical	N	Based on bidder's offer	
8.56	Whether isolating pads for surge arresters with surge counter provided? (Yes/No)	(Yes/ No)	Yes, separated	
8.57	Non Linear MO resistor			
8.57.1	Manufacturer		Based on bidder's offer	

c) 220 kV OPEN TERMINAL SWITCHGEAR		UNIT	DATA	
			Required	Offered
8.57.2	Country		Based on bidder's offer	
8.57.3	Type		Based on bidder's offer	
8.58	Dimension of each non-linear MO resistance block			
8.58.1	Diameter	mm	Based on bidder's offer	
8.58.2	Height	mm	Based on bidder's offer	
8.59	Total weight of single unit	kg	Based on bidder's offer	
8.60	Total weight of complete surge arrester	kg	Based on bidder's offer	
8.61	Total height of surge arrester	mm	Based on bidder's offer	
8.62	Total width of surge arrester	mm	Based on bidder's offer	
8.63	Whether grading ring for high voltage terminal required?	(Yes/ No)	Yes	
8.64	Maximum Package weight ready for shipment	kg	Based on bidder's offer	

d) 400/220KV TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
1	<u>Substation name</u>		KIMUKA SUBSTATION	
2	<u>Manufacture name & country</u>		Should be Proposed By Tenderer	
3	<u>Type designation</u>		Should be Proposed By Tenderer	
4	<u>Type of transformers</u>		Auto Transformer	
4.1	Auto or separate windings		Auto	
4.2	Shell or core		Core	
4.3	Indoor or outdoor		Outdoor	
4.4	Three phases or single phases units		Three phase	
4.5	Standards		IEC 60076, 60137, 60214, 60529 NEMA TR1	
5	<u>Type of cooling acc. to IEC</u>			
5.1	First stage		ONAN	
5.2	Second stage		ONAF1	
5.3	Third stage		ONAF2	
6	<u>Rated frequency</u>	Hz	50	
7	<u>Rated voltage</u>			
7.1	HV	kVrms	400	
7.2	LV	kVrms	220	
7.3	TV	kVrms	11	
8	<u>Continuous power rating at principle tap</u>			

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
8.1	Type		ONAN/ONAF1/ONAF2	
8.2	Nominal power rating at site conditions	MVA	200	
8.3	At first stage of cooling:			
8.3.1	HV winding	MVA	120	
8.3.2	LV winding	MVA	120	
8.3.3	TV winding	MVA	24	
8.4	At second stage of cooling:			
8.4.1	HV winding	MVA	160	
8.4.2	LV winding	MVA	160	
8.4.3	TV winding	MVA	32	
8.5	At third stage of cooling:			
8.5.1	HV winding	MVA	200	
8.5.2	LV winding	MVA	200	
8.5.3	TV winding	MVA	70	
9	<u>Maximum temperature rise at rated power outputs corrected for altitude & ambient temperature of site</u>			
9.1	Top oil	°C	56	
9.2	Winding	°C	61	
9.3	Hottest spot	°C	74	
10	<u>Off load tap changer</u>		N.A	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
10.1	Type		-----	
10.2	Manufacture		-----	
10.3	Rated current	Arms	-----	
10.4	Total range	%	-----	
10.5	Total number of steps		-----	
10.6	Variation per step	%	-----	
10.7	Position to tapings (winding)		-----	
11	<u>On load tap changer</u>			
11.1	Type		On-load	
11.1.1	Resistor/reactor		Resistor	
11.1.2	In tank/ out of tank		In Tank	
11.1.3	Vacuum or oil		Vacuum	
11.2	Manufacturer		MR Germany	
11.3	Country of manufacturer		Should be Proposed By Tenderer	
11.4	Standards		IEC 60214	
11.5	Number of phases		3	
11.6	Arrangement of tapping (linear, coarse/fine, reversing)		Should be Proposed By Manufacturer	
11.7	Rated current	Arms	Min (347)	
11.8	Rated step voltage	Vrms	Should be Proposed By Manufacturer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
11.9	Rated switching capacity	kVA	Should be Proposed By Manufacturer	
11.10	Rated short circuit withstand current	kArms	Should be Proposed By Manufacturer	
11.11	Rated short circuit duration	sec	Should be Proposed By Manufacturer	
11.12	Total range	%	±10	
11.13	Total number of steps		17	
11.14	Variation per step	V	5000	
11.15	Principle Tap Position		9	
11.16	Insulation level		Should be Proposed By Manufacturer	
11.16.1	Voltage class	kVrms	Should be Proposed By Manufacturer	
11.16.2	Highest voltage for equipment	kVrms	Should be Proposed By Manufacturer	
11.16.3	BIL to ground	kVpeak	Should be Proposed By Manufacturer	
11.16.4	BIL between diverter switch contacts	kVpeak	Should be Proposed By Manufacturer	
11.16.5	BIL across regulating winding	kVpeak	Should be Proposed By Manufacturer	
11.17	OLTC protection system		Should be Proposed By Manufacturer	
11.17.1	Is oil flow relay required? If so, type and manufacturer		Required	
11.17.2	Is pressure relief device required? If so, type and manufacturer		Required	
11.17.3	Over pressure relay type and manufacturer		Should be Proposed By Manufacturer	
11.17.4	Other protection device type & manufacturer		Should be Proposed By Manufacturer	
11.18	Rated voltage of drive system	V	415/240	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
11.19	Rated voltage of control circuit	V	110		
11.20	All features, controls, alarms and interlocks as called for provide	Yes/No	Yes		
11.21	Whether remote control cubicle included in scope of work	Yes/No	Yes		
11.22	Whether AVR required?	Yes/No	Yes		
11.23	Type of AVR		Should be Proposed By Manufacturer		
11.24	Full description of remote OLTC control included	Yes/No	Yes		
11.25	Parallel operation control required for number of transformers		4		
11.26	Method of parallel control		Acc. to Specifications		
11.26.1	Master /follower		Yes		
11.26.2	Min circulating current		Yes		
11.26.3	Reverse reactance method		Yes		
11.27	Is line drop compensation required?	Yes/No	Yes		
11.28	Tap position output type		BCD/mA/Ohm/Contact		
12	<u>Vector group</u>		YNa0d11		
13	<u>Impedance</u>				
	On the base of rated power of main windings	MVA	200		
13.1	Positive sequence impedance at 75◦ C, on principal tapping and on:				
13.1.1	Between HV & LV winding	%	14		

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
13.1.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.1.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.2	Positive sequence impedance at 75°C, on max. raise voltage and on:			
13.2.1	Between HV & LV windings	%	Should be Filled By Manufacturer	
13.2.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.2.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.3	Positive sequence impedance at 75°C, on max. lower voltage and on:			
13.3.1	Between HV & LV windings	%	Should be Filled By Manufacturer	
13.3.2	Between HV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.3.3	Between LV & TV winding (if applicable)	%	Should be Filled By Manufacturer	
13.4	Zero sequence impedance at 75°C:			
13.4.1	Between HV & LV windings (LV open)	Ohm/ph.	Should be Filled By Manufacturer	
13.4.2	Between HV & LV windings (LV short)	Ohm/ph.	Should be Filled By Manufacturer	
13.4.3	Between LV & HV windings (HV open)	Ohm/ph.	Should be Filled By Manufacturer	
13.4.4	Between LV & HV windings (HV short)	Ohm/ph.	Should be Filled By Manufacturer	
13.5	Resistance of windings at 75°C on principal tapping:			
13.5.1	HV	Ohm/ph.	Should be Filled By Manufacturer	
13.5.2	LV	Ohm/ph.	Should be Filled By Manufacturer	
13.6	Estimated winding capacitance's with:			

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
13.6.1	Series capacitance of HV phase winding	PF	Should be Proposed By Tenderer	
13.6.2	Series capacitance of LV phase winding	PF	Should be Proposed By Tenderer	
13.6.3	Shunt capacitance to earth of each HV phase winding with LV unearthed	PF	Should be Proposed By Tenderer	
13.6.4	Shunt capacitance to earth of each LV phase winding with HV unearthed	PF	Should be Proposed By Tenderer	
13.6.5	Capacitance of HV-LV phase winding with LV unearthed	PF	Should be Proposed By Tenderer	
14	Rated short circuit strength of windings (symmetrical values)		Should be Filled By Manufacturer	
14.1	HV system Indicate 1 and 3 phase	kA/kA	40	
14.2	LV system Indicate 1 and 3 phase	kA/kA	40	
14.3	TV system Indicate 1 and 3 phase	kA/kA	31.5	
14.4	Short circuit duration	sec	2	
14.5	Short circuit calculation will be submitted after award of contract	Yes/No	Yes	
15	Insulation levels			
15.1	Lightning impulse withstand voltages:			
15.1.1	HV winding/bushing	kV _{pe} / kV _{pe} / kV _{ak}	1425	
15.1.2	LV winding/bushing	kV _{pe} / kV _{pe} / kV _{ak}	1050	
15.1.3	TV winding/bushing (if applicable)	kV _{pe} / kV _{pe} / kV _{ak}	≥75	
15.1.4	Neutral end winding/bushing	kV _{pe} / kV _{pe} / kV _{ak}	170	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)	UNI T	Data	
		REQUIRED DATA	OFFERED DATA
	kVpe ak		
15.2	Switching impulse withstand voltages:		
15.2.1	HV winding/bushing kVpe ak / kVpe ak	1050	
15.2.2	LV winding/bushing kVpe ak / kVpe ak	850	
15.2.3	TV winding/bushing (if applicable) kVpe ak / kVpe ak	N.A	
15.2.4	Neutral end winding/bushing kVpe ak / kVpe ak	N.A	
15.3	One minute power frequency withstand voltages:		
15.3.1	HV winding/bushing kVrm s / kVrm s	630	
15.3.2	LV winding/bushing kVrm s / kVrm s	416	
15.3.3	TV winding/bushing kVrm s / kVrm s	≥28	
15.3.4	Neutral end winding/bushing kVrm s / kVrm s	70	
15.4	Partial discharge measurement:		
15.4.1	Standard	IEC 60270	
15.4.2	Test method	IVPD	
15.4.3	Long duration induced voltage kVrm s	Acc. to IEC 60076-3	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data							
			REQUIRED DATA				OFFERED DATA				
15.4.4	Enhancement voltage level		kVrms	Acc. to IEC 60076-3							
15.4.5	Maximum allowable partial discharge		pC	Acc. to IEC 60076-3							
16	<u>Bushing data</u>			HV	LV	TV	N	HV	LV	TV	N
16.1	Manufacturer & country			Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer				
16.2	Type (OIP/RIP/RBP/...)			OIP	OIP	OIP	OIP				
16.3	Rated service voltage		kV	400	220	11	24				
16.4	Nominal current rating		A	347	630	2520	2000				
16.5	Rated short circuit current		kA	40	40	31.5	31.5				
16.6	Rated thermal short time current duration		sec	2	2	2	2				
16.7	Power frequency withstand voltage (complete with all fittings)		kV	750	505	55	77				
16.8	Radio influence voltage level measured at 1.1 rated system voltage at 1MHz		micro V	2500							
16.9	Is test tap required?		Yes/No	Yes	Yes	No	No				
16.10	Quantity of oil per bushing		liters	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data				
16.11	Type of internal insulation (oil impregnated/resin type)			Oil Impregnated	Oil Impregnated	Acc. to Manufacturer Data	Acc. to Manufacturer Data				

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data						
				REQUIRED DATA				OFFERED DATA		
16.12	Equipped with magnetic oil indicator (in case of oil type)	Yes/No	Yes	Yes	No	No				
16.13	Creepage distance (31mm/kV)	mm	13020	7595	372	>900				
16.14	Protected creepage distance	mm	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data				
16.15	Loss angle (insulation power factor) at working Voltage		Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data				
16.16	Electrostatic capacity of complete bushing	PF	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data				
16.17	Cantilever load class (Acc to IEC 60137)		Level II	Level II	Level II	Level II				
16.18	Max. mechanical forces		Acc. to Buswork Calc.	Acc. to Buswork Calc.	Acc. to Buswork Calc.	Acc. to Buswork Calc.				
	Static, horizontal	N	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer				
	Static, vertical	N	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer				
	Dynamic, horizontal	N	Should be Proposed By	Should be Proposed By	Should be Proposed By	Should be Proposed By				

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-)	UNIT	Data							
				REQUIRED DATA				OFFERED DATA			
			Tenderer	Tenderer	Tenderer	Tenderer					
	Dynamic, vertical	N	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer					
16.19	Min. corona inception voltage	kV	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer	Should be Proposed By Tenderer					
16.20	Washable in service	Yes/No	Yes	Yes	Yes	Yes					
16.21	Terminal leads full insulated at factory	Yes/No	Yes	Yes	Yes	Yes					
16.22	Bushing can be removed/ installed	Yes/No	Yes	Yes	Yes	Yes					
16.23	Bushing can be interchanged with spares	Yes/No	Yes	Yes	Yes	Yes					
16.24	Maximum external diameter of ring type current transformer which can be accommodated	mm	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data					
16.25	Minimum external diameter of ring type current transformer which can be accommodated	mm	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data	Acc. to Manufacturer Data					
17	<u>Bushing type current transformer</u>										
17.1	Fully complies with requirement	Yes/No	Yes								
17.2	Number of cores (HV,LV,HV-N,LV-N,TV)		Acc to PS LD								
17.3	Specification		Acc to PS LD								

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
17.4	Ratio accuracy class and burdens will be selected acc to owner request during design review	Yes/No	Yes	
17.5	Test conductor (winding) will be provided	Yes/No	Yes	
18	<u>Losses</u>			
18.1	No load losses at 75 °C, rated frequency and rated voltage on principal tapping	kW	Should be Filled By Tenderer	
18.2	Load losses at rated frequency, 75 °C And rated current on principal tapping:	kW	Should be Filled By Tenderer	
18.2.1	At first stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.2.2	At second stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.2.3	At third stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.3	Load losses at 75° C and max. raise Voltage tapping:			

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
18.3.1	At first stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.3.2	At second stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.3.3	At third stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.4	Load losses at 75° C and max. lower voltage tapping:			
18.4.1	At first stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.4.2	At second stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.4.3	At third stage of cooling			
a	HV/LV	kW	Should be Filled By Tenderer	
b	HV/TV (if applicable)	kW	Should be Filled By Tenderer	
c	LV/TV (if applicable)	kW	Should be Filled By Tenderer	
18.5	Cooling plant losses at ONAF/OFAF1/ONAF2 rating	kW	Should be Filled By Tenderer	
18.6	Evaluation rate of losses as per Section III at Tendering stage			
18.6.1	No load loss	\$/kW	12,000	
18.6.2	Load loss & Aux. loss	\$/kW	7,000	
18.7	Penalty of higher measured losses than the guaranteed values as per Section IX			
18.7.1	No load loss	\$/kW	18,000	
18.7.2	Load loss & Aux. loss	\$/kW	11,000	
18.7.3	Noise Level	\$/dB	5,000	
19	<u>Efficiency at winding temperature of 75° C & PF=1</u>			
19.1	At ONAN rating, full load, ¾ full load, ½ full load	%	Should be Filled By Tenderer	
19.2	At ONAF rating, full load, ¾ full load, ½ full load (ONAF1)	%	Should be Filled By Tenderer	
19.3	At OFAF rating, full load, ¾ full load, ½ full load (ONAF2)	%	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS- AIS)	AUTO (AIS- AIS)	UNI T	Data	
			REQUIRED DATA	OFFERED DATA
20	<u>Cooling system data</u>			
20.1	ONAF system		Should be Filled By Tenderer	
20.1.1	Number of coolers or cooler banks		Should be Filled By Tenderer	
20.1.2	Number of radiator units in each bank		Should be Filled By Tenderer	
20.1.3	Manufacturer and type of radiators		painted	
20.1.4	Number of fans		Should be Filled By Tenderer	
20.1.5	Make and type of fans		Should be Filled By Tenderer	
20.1.6	Capacity of each fan	kW	Should be Filled By Tenderer	
20.1.7	Rated operating voltage	Vrms	Should be Filled By Tenderer	
20.1.8	Three phase or single phase		Should be Filled By Tenderer	
20.1.9	Starting current of each	Arms	Should be Filled By Tenderer	
20.1.10	Efficiency of each fan	%	Should be Filled By Tenderer	
20.2	OFAF system		Should be Filled By Tenderer	
20.2.1	Number of pumps		Should be Filled By Tenderer	
20.2.2	Manufacturer and type of pumps		Should be Filled By Tenderer	
20.2.3	Capacity of each pumps	HP	Should be Filled By Tenderer	
20.2.4	Rated operating voltage of pumps	Vrms	Should be Filled By Tenderer	
20.2.5	Three phase or single phase		Should be Filled By Tenderer	
20.2.6	Starting current of each	Arms	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
20.2.7	Efficiency of each pump	%	Should be Filled By Tenderer	
21	<u>Capability of transformer to remain in operation from hot condition without Injurious heating at rated full load in case of failure of:</u>		Should be Filled By Tenderer	
21.1	50% of air forced cooling	Minute	Should be Proposed By Tenderer	
21.2	100% of air forced cooling	Minute	Should be Proposed By Tenderer	
21.3	All of air and oil forced cooling	Minute	Should be Proposed By Tenderer	
21.4	Condition of injurious heating (hot spot temp.)	°C	Should be Proposed By Tenderer	
22	<u>Exciting current</u>			
22.1	At rated voltage when excited from HV side	Arms	Should be Filled By Tenderer	
22.2	At 110% rated voltage when excited from HV side	Arms	Should be Filled By Tenderer	
23	<u>Core and winding data</u>			
23.1	Three limb/ five limb		Should be Filled By Tenderer	
23.2	Type of core stacking		Step Lap	
23.3	Type of steel core lamination		Should be Filled by Tenderer	
23.4	Manufactures of steel core material		Should be Filled By Tenderer	
23.5	Thickness of steel core lamination	mm	<0.3	
23.6	Flux density of core on principal tap			
23.6.1	At rated HV voltage	Wb/m ²	Should be Filled By Tenderer	
23.6.2	At 110% rated HV voltage	Wb/m ²	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
23.7	Main limb/yoke cross section	cm ² /c m ²	Should be Filled By Tenderer	
23.8	Types and arrangement of winding			
23.8.1	HV winding		Should be Filled By Tenderer	
23.8.2	LV winding		Should be Filled By Tenderer	
23.8.3	TV winding		Should be Filled By Tenderer	
23.9	Winding arrangement		Should be Filled By Tenderer	
23.10	Current density at rated power and voltage			
23.10.1	HV winding	A/m m ²	Should be Filled By Tenderer	
23.10.2	LV winding	A/m m ²	Should be Filled By Tenderer	
23.10.3	TV winding	A/m m ²	Should be Filled By Tenderer	
23.10.4	Tap winding	A/m m ²	Should be Filled By Tenderer	
23.11	Insulation of core			
23.11.1	Lamination		Should be Filled By Tenderer	
23.11.2	Core bolts		Should be Filled By Tenderer	
23.11.3	Strapping		Should be Filled By Tenderer	
23.12	Type of Insulation of winding (uniform/graded)			
23.12.1	HV		Graded	
23.12.2	LV		Graded	
23.12.3	TV		Uniform	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
23.13	Insulation material				
23.13.1	Turn insulation HV/LV			Should be Filled By Tenderer	
23.13.2	Between windings HV/LV			Should be Filled By Tenderer	
23.13.3	Between core and LV side			Should be Filled By Tenderer	
23.13.4	Between laminations			Should be Filled By Tenderer	
23.13.5	Core bolts			Should be Filled By Tenderer	
23.13.6	Core bolts washers			Should be Filled By Tenderer	
23.13.7	Side plates			Should be Filled By Tenderer	
23.13.8	Core lamination			Should be Filled By Tenderer	
23.13.9	Tapping			Should be Filled By Tenderer	
23.13.10	Tapping connections			Should be Filled By Tenderer	
24	<u>Calculated thermal time constant</u>	-			-
24.1	Natural cooling	sec		Should be Filled By Tenderer	
24.2	Forced cooling	sec		Should be Filled By Tenderer	
25	<u>Tank</u>	-			-
25.1	Tank design conventional/bell shaped			Conventional	
25.2	Thickness of transformer plates:				
25.2.1	Cover of tank	mm		Should be Filled By Tenderer	
25.2.2	Sides	mm		Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
25.2.3	Bottom	mm	Should be Filled By Tenderer	
25.2.4	Conservator	mm	Should be Filled By Tenderer	
25.2.5	Radiator plates	mm	Should be Filled By Tenderer	
26	<u>Vacuum withstand capability</u>	-	Should be Filled By Tenderer	-
26.1	Tank	mm Hg	Should be Filled By Tenderer	
26.2	Radiators	mm Hg	Should be Filled By Tenderer	
26.3	Conservator	mm Hg	Should be Filled By Tenderer	
26.4	Positive pressure withstand capability for complete Transformer	mm Hg	Should be Filled By Tenderer	
27	<u>Oil</u>			
27.1	Manufacture		Shell, nynas, michang	
27.2	Type designation		Diala S4 ZX-I	
27.3	Oil preservation system		Air-bag	
27.4	Country of manufacture		Should be Filled By Tenderer	
27.5	Naphthenic or Paraphenic based oil		Naphthenic	
27.6	Type – inhibited/ trace inhibited/ non-inhibited		non-inhibited	
27.7	Details of inhibitor		By manufacturer	
27.8	Details of passivators		By manufacturer	
27.9	Viscosity at 40 °C (Acc. to ISO 3104)	mm ² / s	Max. 12	
27.10	Viscosity at –30 °C (Acc. to ISO 3104)	mm ² / s	Max. 1800	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
27.11	Pour point (Acc. To ISO 3016)	°C	Max. -40	
27.12	Water content (Acc. To IEC 60814)	mg/kg	Max. 40 for delivery in drums (IBC)	
27.13	Breakdown voltage (Acc. To IEC 60156)			
27.13.1	As delivered	kV	Min. 30	
27.13.2	After laboratory treatment	kV	Min. 70	
27.14	Density at 20 °C (Acc. To ISO3675 or ISO12185)	g/ml	Max. 0.895	
27.15	DDF at 90 °C (Acc. To IEC 60247 / IEC 61620)		Max. 0.005	
27.16	Appearance		Clear, free from sediment and suspended matter	
27.17	Acidity (Acc. To IEC 62021-1 / IEC 62021-2)	mg KOH /g	Max. 0.01	
27.18	Interfacial tension (Acc. To EN 14210/ASTM D971)	mN/m	Min. 40	
27.19	Total Sulphur content (Acc. To IP 373 / ISO 14596)	%	Max. 0.05	
27.20	Corrosive Sulphur (Acc. To DIN 51353)		Not corrosive	
27.21	Copper Corrosion (Acc. To IEC 62535)		Not corrosive	
27.22	Potentially corrosive Sulphur (Acc. To IEC 62535)		Not corrosive	
27.23	DBDS (Acc. To IEC 62697-1)	mg/kg	Not detectable (<5)	
27.24	Inhibitors of IEC 60666 (Acc. To IEC 60666)	%	(U) uninhibited oil (Max. 0.01)	
27.25	Metal passivator additives of IEC 60666	mg/kg	Max. 5	
27.26	2-Furfural and related compounds content (Acc. To IEC 61198)	mg/kg	Max. 0.05 (for each individual compound)	
27.27	Oxidation stability (Acc. To IEC 61125:1992 (Method C))			

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
27.27.1	Test duration (for uninhibited oil)	h	164	
27.27.2	Total acidity (Acc. To 1.9.4 of IEC 61125:1992)	mg KOH /g	Max. 1.2	
27.27.3	Sludge (Acc. To 1.9.1 of IEC 61125:1992)	%	Max. 0.8	
27.27.4	DDF at 90 °C (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247)		Max. 0.5	
27.28	Flash point (Acc. To ISO 2719)	°C	Min. 135	
27.29	PCA content (Acc. To IP 346)	%	Max. 3	
27.30	PCB content (Acc. To IEC 61619)	mg/kg	Not detectable (Max. 2)	
27.31	Quantity of oil			
27.31.1	Main tank	Liters	By manufacturer	
27.31.2	Conservator	Liters	By manufacturer	
27.31.3	Radiator	Liters	By manufacturer	
27.32	Total oil required for commissioning	Liters	By manufacturer	
27.33	Total oil provided (including 5% extra)	Liters	By manufacturer	
27.34	Way of shipping		By drums	
27.35	Total number of drums provided		By manufacturer	
28	<u>Maximum sound pressure level (NEMA TR1 – 5dB(A))</u>	dB(A)	74	-
29	<u>Max. RIV at 1 MHz for complete transformer acc. to NEMA 107</u>	Micr o V	500	-
30	<u>Applicable standard for overload capacity of transformer with cooling system in operation</u>	-	IEC 60076-3	-

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
31	<u>Vibration at rated frequency, voltage and 75°C</u>	Micron	<=100	-
32	<u>Physical data</u>	-	Should be Filled By Tenderer	-
32.1	Overall height, including bushings	mm	Should be Filled By Tenderer	
32.2	Overall width, including mounted accessories	mm	Should be Filled By Tenderer	
32.3	Overall length, including mounted accessories	mm	Should be Filled By Tenderer	
32.4	Height over cover for lifting core and coils	mm	Should be Filled By Tenderer	
32.5	Dimensions of transformer arranged for transport		Should be Filled By Tenderer	
32.6	Length	m	Should be Filled By Tenderer	
32.7	Height	m	Should be Filled By Tenderer	
32.8	Width	m	Should be Filled By Tenderer	
32.9	Weight of oil	kg	Should be Filled By Tenderer	
32.10	Weight of on load tap changer	kg	Should be Filled By Tenderer	
32.11	Total weight of core and coils	kg	Should be Filled By Tenderer	
32.12	Total weight of tank/cooler and fittings	kg	Should be Filled By Tenderer	
32.13	Total weight of windings	kg	Should be Filled By Tenderer	
32.14	Total weight of core (steel lamination)	kg	Should be Filled By Tenderer	
32.15	Total weight steel (tank, fittings, conservator, etc)	kg	Should be Filled By Tenderer	
32.16	Total weight of complete transformer	kg	Should be Filled By Tenderer	
32.17	Max. shipping weight (heaviest item)	kg	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
33	<u>Provisions for tank mounting lightning arresters</u>		-	-	-
33.1	HV		Yes/No	No	
33.2	LV		Yes/No	No	
33.3	TV		Yes/No	Yes (inside of Cable Box)	
33.3.1	Type			MOA	
33.3.2	Type designation			Should be Filled By Tenderer	
33.3.3	Standard			IEC 60099-4	
33.3.4	Rated/system voltage		kV	Should be Filled By Tenderer	
33.3.5	Maximum overvoltage factor on the system due to any switching duty		pu	Should be Filled By Tenderer	
33.3.6	Rated system frequency		Hz	50	
33.3.7	Condition of system neutral			Solid	
33.3.8	Nominal Discharge current		KA crest	20	
33.3.9	Energy capability as per IEC 60099-4		kJ/kV	Should be Filled By Tenderer	
33.3.10	Rated Voltage – MOA		kV	Should be Filled By Tenderer	
33.3.11	Long duration discharge class as per IEC 99-1		Class	4	
33.3.12	Maximum Continuous Operating Voltage (COV)		kV	Should be Filled By Tenderer	
33.3.13	TOV capability for				
	• 1sec		kV	Should be Filled By Tenderer	
	• 10sec		kV	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
33.3.14	Maximum residual voltage with current wave			
	<ul style="list-style-type: none">Switching Surges – 1kA/2kA	kV	To IEC 60099-4	
	<ul style="list-style-type: none">8/20 μs – 5kA	kV	To IEC 60099-4	
	<ul style="list-style-type: none">8/20 μs – 20kA	kV	To IEC 60099-4	
33.3.15	Discharge current withstand strength			
	<ul style="list-style-type: none">High current 4/10 μs	KAp	To IEC 60099-4	
	<ul style="list-style-type: none">Low current 2000 μs	KAp	To IEC 60099-4	
34	<u>Anti-vibrations pads</u>	Yes/No	Yes	-
35	<u>Radiators mounted separate</u>	Yes/No	No	-
36	<u>Wheels</u>	Yes/No	Acc. to Project Requirements	-
36.1	Plain/ Flanged		Plain	
36.2	Unidirectional/ bi-directional		bi-directional (If Needed)	
36.3	Gauge	mm	Should be Filled By Tenderer	
37	<u>All accessories supplied as specified</u>	Yes/No	Yes	-
38	<u>All drawings and documents enclosed</u>	Yes/No	Yes	-
39	<u>Schedule of deviations filled</u>	Yes/No	Yes	-
40	<u>Fire protection scheme</u>	Yes/No	Acc. to Project Requirements	-
41	<u>All additional equipment specified provided</u>	Yes/No	Yes	-
42	<u>Accessories make and type</u>	-		-

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
42.1	Buchholz relay with sampling device				
42.1.1	For conservator main compartment			Yes	
42.1.2	For conservator OLTC			Yes	
42.2	Pressure relief Relay			Yes	
42.3	Oil level indicator:				
42.3.1	For conservator main compartment			Yes	
42.3.2	For conservator OLTC			Yes	
42.4	Temperature indicators:				
42.4.1	Oil			Yes	
42.4.2	HV winding			Yes	
42.4.3	LV winding			Yes	
42.4.4	TV winding			Yes	
42.5	Conservator type:				
42.5.1	Normal/air bag (diaphragm)			Air bag	
42.5.2	Air detector relay (for air bag)		Yes/No	Yes	
42.6	breather			Maintenance free type	
42.7	Cables			By Contractor	
42.8	Control cabinets			By Contractor	
42.9	Fire extinguishing system:			Acc. to Project Requirements	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
42.9.1	Drainage and mixing			Should be Filled By Tenderer	
42.9.2	Water sprinkler system			Should be Filled By Tenderer	
42.9.3	Whether full information are attached	Yes/ No		Should be confirmed by Tenderer	
42.10	Whether all catalogues of accessories are enclosed	Yes/ No		Should be confirmed by Tenderer	
43	<u>Fault currents and mechanical forces and stresses.</u>	-		Should be Filled by Tenderer	-
43.1	Max. fault current in windings on which mechanical stresses are based.				
43.1.1	HV winding				
a	Symmetrical component current	Arms		Should be Filled By Tenderer	
b	Asymmetrical crest current	Amp Peak		Should be Filled By Tenderer	
43.1.2	LV winding				
a	Symmetrical component current	Arms		Should be Filled By Tenderer	
b	Asymmetrical crest current	Amp Peak		Should be Filled By Tenderer	
43.1.3	Tapped winding				
a	Symmetrical component current	Arms		Should be Filled By Tenderer	
b	Asymmetrical crest current	Amp Peak		Should be Filled By Tenderer	
43.2	Max. fault current on which mechanical stresses are based for OLTC (main+arcing contacts):				
43.2.1	Symmetrical short circuit current	kArms		Should be Filled By Tenderer	
43.2.2	Dynamic short circuit current value			Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS- AIS)	AUTO (AIS- AIS)	UNI T	Data	
			REQUIRED DATA	OFFERED DATA
43.2.2	Asymmetrical crest current	Amp crest	Should be Filled By Tenderer	
43.3	Max. fault current on which mechanical stresses are based for leads to OLTC are:			
43.3.1	Symmetrical short circuit current	Arms	Should be Filled By Tenderer	
43.3.2	Asymmetrical crest current	Amp crest	Should be Filled By Tenderer	
43.4	Max. fault current on which mechanical Stresses are based for various bushings of:			
43.4.1	HV side	kArm s	Should be Filled By Tenderer	
43.4.2	LV side	kArm s	Should be Filled By Tenderer	
43.4.3	Neutral HV/LV	kArm s	Should be Filled By Tenderer	
43.5	Current density in windings on principal tapping under the most onerous fault condition			
43.5.1	HV winding	A/m m ²	Should be Filled By Tenderer	
43.5.2	LV winding	A/m m ²	Should be Filled By Tenderer	
43.5.3	Tapped windings	A/m m ²	Should be Filled By Tenderer	
43.5.4	Tapping lead connections	A/m m ²	Should be Filled By Tenderer	
43.5.5	Neutral	A/m m ²	Should be Filled By Tenderer	
43.5.6	HV bushings	A/m m ²	Should be Filled By Tenderer	
43.5.7	LV bushings	A/m m ²	Should be Filled By Tenderer	
43.5.8	Neutral bushings	A/m m ²	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
43.6	Hoop stress in winding conductors:			
43.6.1	HV winding	N/m ²	Should be Filled By Tenderer	
43.6.2	LV winding	N/m ²	Should be Filled By Tenderer	
43.6.3	Tapping	N/m ²	Should be Filled By Tenderer	
43.7	Total axial compressive force in windings:			
43.7.1	HV winding	N	Should be Filled By Tenderer	
43.7.2	LV winding	N	Should be Filled By Tenderer	
43.7.3	Tapped winding	N	Should be Filled By Tenderer	
43.7.4	Tertiary winding	N	Should be Filled By Tenderer	
43.8	Max. stress to flexion of conductor between two adjacent spacers:			
43.8.1	HV winding	N/m ²	Should be Filled By Tenderer	
43.8.2	LV winding	N/m ²	Should be Filled By Tenderer	
43.8.3	Tapping	N/m ²	Should be Filled By Tenderer	
43.9	Total axial and thrust in windings:			
43.9.1	HV winding	N	Should be Filled By Tenderer	
43.9.2	LV winding	N	Should be Filled By Tenderer	
43.9.3	Tapping	N	Should be Filled By Tenderer	
43.10	Max. stresses in end insulation and supports:			
43.10.1	HV winding	N/m ²	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS AUTO (AIS- AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
43.10.2	LV winding	N/m ²	Should be Filled By Tenderer	
43.10.3	Tapped winding	N/m ²	Should be Filled By Tenderer	
43.11	Relative axial displacement at the windings assumed in items 43.9, 43.10 Above			
43.12	Cross sectional area of conductor for each windings:	%	Should be Filled By Tenderer	
43.12.1	HV winding	mm ²	Should be Filled By Tenderer	
43.12.2	LV winding	mm ²	Should be Filled By Tenderer	
43.12.3	Tapped winding	mm ²	Should be Filled By Tenderer	
43.13	Cross section area of insulation for:			
43.13.1	HV winding	mm ²	Should be Filled By Tenderer	
43.13.2	LV winding	mm ²	Should be Filled By Tenderer	
43.13.3	Tapped winding	mm ²	Should be Filled By Tenderer	
43.14	Specific heat in watt- seconds per degree Celsius per pound of conductor Material for:			
43.14.1	HV winding	mm ²	Should be Filled By Tenderer	
43.14.2	LV winding	mm ²	Should be Filled By Tenderer	
43.14.3	Tapped winding	mm ²	Should be Filled By Tenderer	
43.15	Position and magnitude of max. axial stress on inter turn insulation in:			
43.15.1	HV winding	N/m ²	Should be Filled By Tenderer	
43.15.2	LV winding	N/m ²	Should be Filled By Tenderer	
43.15.3	Tapped winding	N/m ²	Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-AIS)	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
44	<u>On-line gas monitoring</u>	-			-
44.1	Manufacturer			Should be Filled By Tenderer	
44.2	Country of manufacturer			Should be Filled By Tenderer	
44.3	Model/Type			Should be Filled By Tenderer	
44.4	Detectable key gases			Should be Filled By Tenderer	
44.5	Moisture detection	Yes/No		Yes	
44.6	Lower detection limit (LDL)	ppm		Should be confirmed by Tenderer	
44.7	Accuracy of sensor	%		Should be confirmed by Tenderer	
44.8	Response time	Minute		Should be confirmed by Tenderer	
44.9	Operating range				
44.9.1	Operating temperature	°C		Should be Filled By Tenderer	
44.9.2	Operating oil temperature	°C		Should be Filled By Tenderer	
44.9.3	Operating oil pressure	PSI		Should be Filled By Tenderer	
44.9.4	Operating humidity	% RH		Should be Filled By Tenderer	
44.9.5	Storage temperature	°C		Should be Filled By Tenderer	
44.9.6	Storage humidity	% RH		Should be Filled By Tenderer	
44.9.7	Altitude	m		Acc. to section 1	
44.10	Input power requirement				
44.10.1	Voltage	V AC		Should be Filled By Tenderer	

d) 400/220KV TRANSFORMERS (AIS-AIS)		UNIT	Data	
			REQUIRED DATA	OFFERED DATA
44.10.2	Frequency	Hz	Should be Filled By Tenderer	
44.10.3	Current or power	A or kW	Should be Filled By Tenderer	
44.11	Communication option			
44.11.1	Display		Should be Filled By Tenderer	
44.11.2	Communication protocols		Should be Filled By Tenderer	
44.11.3	Communication ports and analog I/O		Should be Filled By Tenderer	
44.11.4	Measurement alarms		Should be Filled By Tenderer	
44.11.5	Alarm contacts		Should be Filled By Tenderer	
44.11.6	Data storage	Year	Should be Filled By Tenderer	
44.12	Software		Should be Filled By Tenderer	
44.13	Dimensions		Should be Filled By Tenderer	
44.14	Weight	kg	Should be Filled By Tenderer	
44.15	Whether all catalogues and description of the system attached	Yes/No	Should be Filled By Tenderer	
45	<u>Minimum Clearances (IEC 60076-3)</u>	-	Should be confirmed by Tenderer	-
45.1	Line to earth			
45.1.1	HV side	mm	3100	
45.1.2	LV side	mm	1900	
45.1.3	TV side	mm	200	
45.2	Phase to phase			

d) 400/220KV TRANSFORMERS (AIS-AIS)		AUTO (AIS-	UNIT	Data	
				REQUIRED DATA	OFFERED DATA
45.2.1	HV side		mm	4200	
45.2.2	LV side		mm	2600	
45.2.3	TV side		mm	200	
45	<u>System Grounding</u>	-		-	-
45.1	HV system			Effective	
45.2	LV system			Effective	
45.3	TV system			Grounding TR	
45	<u>Winding and oil temp. (Dial type or temp. monitoring)</u>	-		Dial type	-
46	<u>Size of copper ground conductor</u>	-		240	-
47	<u>Type of terminals</u>	-			-
47.1	HV			Air bushing	
47.2	LV			Air bushing	
47.3	TV			Cable box	
47.4	Neutral			Air bushing	
48	<u>Pre-stressed non-return valve (PNRV)</u>	Yes/No		Yes	-
49	<u>Buchholz relay test pump</u>	Yes/No		Yes	-
50	<u>Color of exterior/finishing paint</u>			Will be Finalized During Detail Design	-
51	<u>Manufacturer quality assurance</u>				
51.1	According to ISO 9000, 9001, 9002, 9003 and 9004	Validity		Yes	

d) 400/220KV TRANSFORMERS (AIS-AIS)	AUTO (AIS-AIS)	UNIT	Data	
			REQUIRED DATA	OFFERED DATA
51.2	Certificate attached to the offer	Yes/No	Yes	
52	<u>Type test certificate to be issued by:</u>			
52.1	Independent laboratory or independently witnessed type test certificate	Yes/No	Yes	
52.2	Certificate attached to the offer	Yes/No	Yes	
54	<u>Special Tests to be performed:</u> <u>As Type test = T</u> <u>As Routine test = R</u>			
54.1	Chopped Wave Lightning Impulse Test (*)Type or routine test as appropriate to transformer HV Um		Yes (*)	
54.2	Measurement of zero-sequence impedance		Yes (T)	
54.3	Determination of sound levels		Yes (T)	
54.4	Measurement of harmonics of no-load current		Yes (T)	
54.5	Frequency response analysis (FRA)		Yes (R)	
54.6	Measurement of the power by the fan motors and oil pumps		Yes (T)	
54.7	Check of external coating		Yes, R)	
54.8	Determination of capacitance, windings to earth and between windings		Yes, R)	
54.9	Measurement of insulation resistance to earth and loss angle of insulation system capacitances		Yes, R)	
54.10	Short circuit withstand test/calculations		Yes (Calculation)	
55	<u>Wheel locking capability on Transformer rails</u>	Yes/No	Yes	

e) 11/0.415kV EARTHING/ AUXILIARY TRANSFORMER (CAF-CAF)		UNIT	DATA	
ITEM	DESCRIPTION		REQUIRED	OFFERED
1	System performance data			
1.1	Nominal power rating at site conditions	MVA	200	
1.2	Nominal service voltage	kVrms	400/220/11	
1.3	Max. system voltage	kVrms	420	
1.4	System earthing		Solid	
1.5	Rated frequency	Hz	50	
1.6	3-Phase short circuit			
1.6.1	Rated value	kArms	40	
1.6.2	Dynamic value	kApeak	100	
1.7	Max radio interference level measured at 1.1 rated system voltage at 1 MHz	microV	By Manufacturer	
1.8	Station service aux. AC supply			
1.8.1	Rated voltage	V	415/240	
1.8.2	Voltage variation	%	±10%	
1.8.3	Phase		3 (4 wires)	
1.8.4	Frequency	Hz	50	
1.8.5	Neutral earthing		Solid	
1.9	Station service aux. DC supply			
1.9.1	Rated voltage	V	110	
2	EAT specifications			
2.1	Number of transformers		2	
2.2	Manufacturer, type designation and country		Should be Filled By Tenderer	
2.3	Type			
2.3.1	Indoor/Outdoor		Outdoor	
2.3.2	Stationary/Mobile		Stationary	
2.4	Rated capacity of secondary winding at site conditions	kVA	500	

2.5	Type of cooling		ONAN	
2.6	Vector group		ZNyn11	
2.7	Impedance voltage between HV and LV windings at 75 °C	%	5	
2.8	Rated voltage of windings	kVrms	11	
2.9	Highest system voltages	kVrms	12	
2.10	Rated frequency	Hz	50	
2.11	Insulation levels			
2.11.1	Windings (HV/LV)			
2.11.1.1	Rated voltage	kVrms	11/0.415	
2.11.1.2	Highest voltage for equipment	kVrms	12/1	
2.11.1.3	Rated one min. power frequency withstand voltage	kVrms	28/3	
2.11.1.4	Rated lightning impulse withstand voltage	kVpeak	95/N.A	
2.11.2	Bushings (HV/LV)			
2.11.2.1	Rated voltage	kVrms	20/1	
2.11.2.2	Highest voltage for equipment	kVrms	24/1	
2.11.2.3	Rated one min. power frequency withstand voltage	kVrms	55/10	
2.11.2.4	Rated lightning impulse withstand voltage	kVpeak	125/20	
2.12	Tap changer			
2.12.1	Whether manual off circuit tap changer is required	Yes/No	Yes	
2.12.2	Type (Onload - Off load)		Off load	
2.12.3	Manufacturer & country		Should be Filled By Tenderer	
2.12.4	Total range(number of steps)		±2*2.5%	
2.12.5	Location		HV-N	
2.12.6	Rated current	A	Min. 33	
2.13	Losses			
2.13.1	No load losses at 75 °C, rated frequency and rated voltage on principal tapping	kW	Max. 1	
2.13.2	Load losses at rated frequency, 75 °C And rated current on principal tapping	kW	Max. 4.5	
2.13.3	Evaluation rate of no load loss at Tendering stage	\$/kW	12000	

2.13.4	Evaluation rate of load loss & cooling loss at Tendering stage	\$/kW	7000	
2.14	Zero sequence impedance at HV side at 75°C	Ohm/ph	18.1	
2.15	Rated interconnected star winding current (short time)			
2.15.1	Phase	A	350	
2.15.2	Neutral	A	1050	
2.15.3	Duration	sec	30	
2.16	Rated continuous neutral current (at principle tap & max. ambient temp.)	A	By manufacturer	
2.17	Exciting current			
2.17.1	At rated voltage	A	By manufacturer	
2.17.2	At 110% rated voltage	A	By manufacturer	
2.18	Temperature rise (corrected for altitude, ambient condition and IEC 60076-2)			
2.18.1	Top oil	°C	57	
2.18.2	Winding	°C	62	
2.18.3	Hot Spot	°C	75	
2.19	Max. sound level (acc. to IEC 60076-10)	dB	50	
2.20	Vacuum withstand capacity of total transformer	mmHg	Acc. To Technical Specification	
2.21	Core and winding data			
2.21.1	Manufacturer of steel core material		Should be Filled By Tenderer	
2.21.2	Type of steel core lamination		By manufacturer	
2.21.3	Flux density of core			
2.21.3.1	At rated voltage	Wb/m ²	1.727	
2.21.3.2	As above at 110% rated voltage	Wb/m ²	1.9	
2.21.4	Thickness of steel core lamination	mm	≤0.3	
2.21.5	Main limb/yoke cross section	cm ²	By manufacturer	
2.21.6	Current density at rated power and voltage			
2.21.6.1	HV winding	A/mm ²	By manufacturer	
2.21.6.2	LV winding	A/mm ²	By manufacturer	
2.21.7	Current density at rated short circuit current			

2.21.7.1	HV winding	A/mm2	By manufacturer	
2.21.7.2	LV winding	A/mm2	By manufacturer	
2.22	Thickness of transformer plates			
2.22.1	Tank	mm	By manufacturer	
2.22.2	Sides	mm	By manufacturer	
2.22.3	Bottom	mm	By manufacturer	
2.22.4	Radiator plates	mm	By manufacturer	
2.23	Bushings (HV/LV)			
2.23.1	Manufacturer & country		Should be Filled By Tenderer	
2.23.2	External creepage distance	mm	min (372)	
2.23.3	Protected creepage distance	mm	By manufacturer	
2.23.4	Rated normal	A	32/835	
2.23.5	Short circuit current (HV)	kA	25	
2.23.6	Test tap required	Yes/No	No	
2.23.7	Rated normal/short circuit current for neutral	(A/kA)	Should be Filled By Tenderer	
2.23.4	Bushing type current transformers (Required)	Yes/No	Yes	
2.23.4.1	No of cores (HV,HVN,LV,LVN)		According to SLD	
2.23.4.2	Specifications		According to SLD	
2.24	Type of terminals			
2.24.1	HV		Cable Box	
2.24.2	LV		Cable Box	
2.24.3	HV-N		Cable Box	
2.24.4	LV-N		Cable Box	
2.24.5	Filling medium for cable box		Air	
2.25	Overall Dimensions (H*W*L)	mm*mm*mm	Should be Filled By Tenderer	
2.26	Weights			
2.26.1	Core and coils	kg	By manufacturer	
2.26.2	Tank and fittings	kg	By manufacturer	
2.26.3	Weight of oil	kg	By manufacturer	

2.26.4	Total Weight of complete transformer	kg	By manufacturer	
2.27	Regulation at full load and 75°C winding temperature			
2.27.1	a) Unity Power Factor		By manufacturer	
2.27.2	b) 0.8 PF lag		By manufacturer	
2.28	Efficiency (at P.F.=1)			
2.28.1	At full load	%	By manufacturer	
2.28.2	At 3/4 full load	%	By manufacturer	
2.28.3	At 1/2 full load	%	By manufacturer	
2.28.3	Max. and the load at which it occurs	%	By manufacturer	
2.29	Oil			
2.29.1	Manufacture		Should be Filled By Tenderer	
2.29.2	Country of manufacture		Should be Filled By Tenderer	
2.29.3	Naphthenic or Paraphenic based oil		Naphthenic	
2.29.4	Type – inhibited/ trace inhibited/ non-inhibited		non-inhibited	
2.29.5	Details of inhibitor		Should be Filled By Tenderer	
2.29.6	Details of passivators		Should be Filled By Tenderer	
2.29.7	Viscosity at 40 °C (Acc. to ISO 3104)	mm ² /s	Max. 12	
2.29.8	Viscosity at –30 °C (Acc. to ISO 3104)	mm ² /s	Max. 1800	
2.29.9	Pour point (Acc. To ISO 3016)	°C	Max. -40	
2.29.10	Water content (Acc. To IEC 60814)	mg/kg	Max. 40	
2.29.11	Breakdown voltage (Acc. To IEC 60156)			
2.29.11.1	As delivered	kV	Min. 30	
2.29.11.2	After laboratory treatment	kV	Min. 70	
2.29.12	Density at 20 °C (Acc. To ISO3675 or ISO12185)	g/ml	Max. 0.895	
2.29.13	DDF at 90 °C (Acc. To IEC 60247 / IEC 61620)		Max. 0.005	
2.29.14	Appearance		Clear, free from sediment and suspended matter	
2.29.15	Acidity (Acc. To IEC 62021-1 / IEC 62021-2)	mg KOH/g	Max. 0.01	
2.29.16	Interfacial tension (Acc. To EN 14210/ASTM D971)	mN/m	Min. 40	

2.29.17	Total Sulphur content (Acc. To IP 373 / ISO 14596)	%	Max. 0.05	
2.29.18	Corrosive Sulphur (Acc. To DIN 51353)		Not corrosive	
2.29.19	Copper Corrosion (Acc. To IEC 62535)		Not corrosive	
2.29.20	Potentially corrosive Sulphur (Acc. To IEC 62535)		Not corrosive	
2.29.21	DBDS (Acc. To IEC 62697-1)	mg/kg	Not detectable (<5)	
2.29.22	Inhibitors of IEC 60666 (Acc. To IEC 60666)	%	(U) uninhibited oil (Max. 0.01)	
2.29.23	Metal passivator additives of IEC 60666	mg/kg	Max. 5	
2.29.24	2-Furfural and related compounds content (Acc. To IEC 61198)	mg/kg	Max. 0.05 (for each individual compound)	
2.29.25	Oxidation stability (Acc. To IEC 61125:1992 (Method C))			
2.29.25. 1	Test duration (for uninhibited oil)	h	164	
2.29.25. 2	Total acidity (Acc. To 1.9.4 of IEC 61125:1992)	mg KOH/g	Max. 1.2	
2.29.25. 3	Sludge (Acc. To 1.9.1 of IEC 61125:1992)	%	Max. 0.8	
2.29.25. 4	DDF at 90 °C (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247)		Max. 0.5	
2.29.26	Flash point (Acc. To ISO 2719)	°C	Min. 135	
2.29.27	PCA content (Acc. To IP 346)	%	Max. 3	
2.29.28	PCB content (Acc. To IEC 61619)	mg/kg	Not detectable (Max. 2)	
2.29.29	Quantity of oil			
2.29.29. 1	Main tank	Liters	Should be Filled By Tenderer	
2.29.29. 2	Conservator	Liters	Should be Filled By Tenderer	
2.29.29. 3	Radiator	Liters	Should be Filled By Tenderer	
2.29.31	Total oil required for commissioning	Liters	Should be Filled By Tenderer	
2.29.32	Total oil provided (including 5% extra)	Liters	Should be Filled By Tenderer	
2.29.33	Way of shipping		By drums	
2.29.34	Total number of drums provided		Should be Filled By Tenderer	
2.30	Accessories make, type and country		Should be filled By Tenderer	
2.30.1	Buchholz relay		Yes	
2.30.2	Pressure relief device		Yes	

2.30.3	Silicagel breather		Yes	
2.30.4	Control Cabinet		Yes	
2.30.5	Cables		Yes	
2.30.6	Oil level gauge		Yes	
2.30.7	Winding temperature indicator		Yes	
2.30.8	Oil temperature indicator		Yes	
2.31	Whether wheels are required	Yes/No	No	
2.32	Whether switch-fuse unit is required	Yes/No	No	
2.33	Type of conservator (Air bag/ Conventional)		Conventional	
2.34	Max. vibration (at rated condition) P-P	Micron	50	

f) NEUTRAL EARTHING RESISTOR (NER)		UNIT	DATA	
			REQUIRED	OFFERED
1	Related Standard		IEEE Std 32	
2	Design environmental site condition		Acc. to Section a) site condition	
3	Installation (Indoor/Outdoor)		Outdoor	
4	Type of cooling		Air	
5	Rated frequency	Hz	50	
6	Service voltages	kV	$11/\sqrt{3}$	
7	Rated voltages	kV	Should be Filled By Tenderer	
8	One minute Power frequency withstand voltage	kV	38	
9	Impulse withstand voltage	kV	95	
10	Rated Current		500A- 10 Sec	
11	Degree of protection		IP55	
12	Provisions for accommodating current transformers	Yes/No	Yes	
13	Current transformers type		Internal	
14	Current transformers rating		Acc. to SLD	

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
1	GENERAL			
1.1	Name of manufacturer		Should be Filled By Tenderer	
1.2	Place of manufacturing		Should be Filled By Tenderer	
1.3	Manufacturers Quality Certification		ISO 9001	
	– Certified by (Company Name)		Should be Filled By Tenderer	
	– Certification valid till (year)		Should be Filled By Tenderer	
1.4	Circuit rating required	kVA	500	
1.5	General description of cable		Should be Filled By Tenderer	
	– number of cores		1 or 3	
	– system voltage	kV	11	
	– conductor size	mm ²	2*95	
	– conductor type		Cu	
	– Insulation type		XLPE	
	– metal sheath type		Al	
	– over sheath type		MDPE	
1.6	Year of first commercial operation of cable type		Should be Filled By Tenderer	
2	INSULATION CO-ORDINATION			
2.1	Highest system voltage (U _m) (insulation class)	kV	12	
2.2	Nominal voltage between conductors (U)	kV	11	
2.3	Rated frequency	Hz	50	
2.4	Nominal voltage between conductor and sheath (U _o)	kV	6.35	
2.5	Rated impulse withstand voltage (U _p) (at altitude <1000m)	kV	95	
2.6	Rated short duration power frequency withstand voltage (at altitude <1000m)	kV	28	
3	RATINGS			
3.1	Maximum continuous current carrying capacity at installed site condition for auxiliary transformer feeders	A	Should be Filled By Tenderer	
3.2	Maximum continuous direct-buried current rating, assuming,			
	– Soil thermal resistivity of 2.0K.m/W		2.0K.m/W	
	– Flat spaced configuration, phase spacing of 250mm		Should be Filled By Tenderer	
	– Special bonding of metal sheaths		Should be Filled By Tenderer	

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	For,		Should be Filled By Tenderer	
	– Guaranteed Current Rating (Single Circuit in Trench)	A	Should be Filled By Tenderer	
	– Guaranteed Current Rating (Double Circuit in one Trench, distance between middle phases, s = 1500 mm)	A	Should be Filled By Tenderer	
	– Ground temperature at burial depth	°C	Should be Filled By Tenderer	
	– Calculation Method		IEC 60287	
3.3	Maximum continuous in-air current rating, assuming,			
	– Air temperature (in shade) of 35 °C		Should be Filled By Tenderer	
	– Special bonding of metal sheaths		Should be Filled By Tenderer	
	– Flat spaced configuration, group/phase spacing of 150mm		Should be Filled By Tenderer	
	– Thermally independent of other cable circuits		Should be Filled By Tenderer	
	For,		Should be Filled By Tenderer	
	– Guaranteed Current Rating (single circuit)	A	Should be Filled By Tenderer	
	– Calculation Method		IEC 60287	
3.4	Maximum permissible core temperature for continuous operation	°C	90	
3.5	Short circuit capacity for 1 sec			
	– Short circuit current	kA	As per IEC60502	
	– Permissible maximum sheath temperature	°C	200	
	– Permissible maximum conductor temperature	°C	250	
3.6	Short circuit level			
	– Symmetrical current	kA rms/sec	25/1	
	– Maximum dynamic current	kA peak	Should be Filled By Tenderer	
3.7	Short circuit withstand current/time of armour	kA rms/sec	25/1	
3.8	Permissible emergency overload			
3.8.1	Applied on 100% continuous load			
	– Emergency current rating	A	Should be Filled By Tenderer	

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	– Maximum emergency temperature	°C	Should be Filled By Tenderer	
	– Allowable duration/operation	hours	Should be Filled By Tenderer	
	– Allowable total duration/annum	hours	Should be Filled By Tenderer	
	– Maximum average duration/annum on total life of cable	hours	Should be Filled By Tenderer	
3.8.2	Applied on 50% continuous load			
	– Emergency current rating	A	Should be Filled By Tenderer	
	– Maximum emergency temperature	°C	Should be Filled By Tenderer	
	– Allowable duration/operation	hours	Should be Filled By Tenderer	
	– Allowable total duration/annum	hours	Should be Filled By Tenderer	
	– Maximum average duration/annum on total life of cable	hours	Should be Filled By Tenderer	
3.8.3	Applied on 20% continuous load			
	– Emergence current rating	A	Should be Filled By Tenderer	
	– Maximum emergency temperature	°C	Should be Filled By Tenderer	
	– Allowable duration/operation	hours	Should be Filled By Tenderer	
	– Allowable total duration/annum	hours	Should be Filled By Tenderer	
	– Maximum average duration/annum on total life of cable	hours	Should be Filled By Tenderer	
4	CONSTRUCTION FEATURES			
4.1	Conductor			
	– Material		Cu	
	– Nominal cross-section	mm ²	Should be Filled By Tenderer	
	– Shape of conductor		circular	
	– Overall diameter	mm	Should be Filled By Tenderer	
	– Waterblocking method		Tape/yarn	
	– Semiconducting binder tape		yes	
4.2	Conductor screen			

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	– Type of material		Fully bonded semicon. XLPE	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Nominal overall diameter	mm	Should be Filled By Tenderer	
	– Compound Identification Reference		yes	
4.3	Insulation			
	– Material		XLPE	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Nominal overall diameter	mm	Should be Filled By Tenderer	
	– Maximum continuous operating temperature	°C	90	
	– Compound Identification Reference	Yes/No	Yes	
	– Maximum stress at nominal voltage		Should be Filled By Tenderer	
	– At conductor screen	kV/mm	Should be Filled By Tenderer	
	– At insulation screen	kV/mm	Should be Filled By Tenderer	
	– Maximum stress at impulse voltage		Should be Filled By Tenderer	
	– At conductor screen	kV/mm	Should be Filled By Tenderer	
	– At insulation screen	kV/mm	Should be Filled By Tenderer	
4.4	Insulation screen			
	– Type of material		Fully bonded semicon. XLPE	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Nominal overall diameter	mm	Should be Filled By Tenderer	
	– Compound Identification Reference	Yes/No	Yes	
	– Indelible ink marking on screen	Yes/No	Yes	
4.5	XLPE Manufacturing Methods			

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	– Extrusion line type e.g. CCV, MDCV, VCV		Should be Filled By Tenderer	
	– Single pass, triple extrusion	Yes/No	Yes	
	– Curing method		Dry	
	– Cooling method		Dry	
	– Degassing Period	days	Should be Filled By Tenderer	
4.6	Bedding for moisture absorption			
	– Type and material		Should be Filled By Tenderer	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Nominal overall diameter over bedding	mm	Should be Filled By Tenderer	
4.7	Metallic screen			
	– Type and material		Copper wire	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Wire diameter	No.	Should be Filled By Tenderer	
	– Nominal diameter over the screen	mm	Should be Filled By Tenderer	
	– Cross sectional area of screen	mm ²	Should be Filled By Tenderer	
	– Short time current density (1 sec)	kA/mm ²	Should be Filled By Tenderer	
4.8	Bedding/Binder tape			
	– Type and material		Should be Filled By Tenderer	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Nominal overall diameter over bedding	mm	Should be Filled By Tenderer	
4.9	Metallic sheath			
	– Type and material		Aluminum	

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Nominal diameter over the sheath	mm	Should be Filled By Tenderer	
	– Cross sectional area of sheath	mm ²	Should be Filled By Tenderer	
	– Short time current density (1 sec.)	kA/mm ²	Should be Filled By Tenderer	
4.10	Protective anti-corrosion external sheath covering			
	– Bitumen undercoat layer		Yes	
	– Type and material		MDPE	
	– Color		Black	
	– Nominal thickness	mm	Should be Filled By Tenderer	
	– Minimum thickness	mm	Should be Filled By Tenderer	
	– Termite resistant	Yes/No	Yes	
	– Type of anti-termite protection		Should be Filled By Tenderer	
	– Thermal resistivity	K.m/W	Max 2.0	
4.11	Type of conductive outer layer		Graphite/or semicon. polymer	
4.12	Nominal overall cable diameter	mm	Should be Filled By Tenderer	
4.13	Weight of completed cable			
	– Copper	kg/m	Should be Filled By Tenderer	
	– Insulation	kg/m	Should be Filled By Tenderer	
	– Aluminium	kg/m	Should be Filled By Tenderer	
	– Gross Weight	kg/m	Should be Filled By Tenderer	
5	LOSSES			
5.1	Maximum dielectric loss per metre / phase when operating at nominal voltage and frequency and at maximum conductor temperature	W/m	Should be Filled By Tenderer	
5.2	Maximum sheath loss per metre / phase when operating at nominal voltage and frequency and at full load condition with	W/m	Should be Filled By Tenderer	

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
	sheath bonded and earthed as recommended (sectionalizing cross bonding)			
5.3	Maximum conductor loss per metre / phase when operating at nominal voltage and frequency and at full load condition.	W/m	Should be Filled By Tenderer	
5.4	Total loss of cable per metre / phase of three phase circuit	W/m	Should be Filled By Tenderer	
6	ELECTRICAL VALUES			
6.1	Maximum d.c. resistance of conductor at 20°C	$\mu\Omega/m$	Should be Filled By Tenderer	
6.2	Maximum a.c. resistance of conductor at operating temperature	$\mu\Omega/m$	Should be Filled By Tenderer	
6.3	Equivalent reactance of three phase circuit at 50 Hz	$\mu\Omega/m$	Should be Filled By Tenderer	
6.4	Electrostatic capacitance per conductor of cable at nominal voltage and operating temperature	pF/m	Should be Filled By Tenderer	
6.5	Maximum charging current per conductor at nominal voltage	mA/m	Should be Filled By Tenderer	
6.6	Charging capacity of three phase system (at U_0)	VAR/m	Should be Filled By Tenderer	
6.7	Maximum dielectric loss factor of cable at normal voltage and frequency at a conductor temperature of:			
	– 20°C		Should be Filled By Tenderer	
	– 90°C		Should be Filled By Tenderer	
6.8	Positive & Negative sequence impedance	Ω/m	Should be Filled By Tenderer	
6.9	Zero sequence impedance (as installed conditions)			
	– Resistance	Ω/m	Should be Filled By Tenderer	
	– Reactance	Ω/m	Should be Filled By Tenderer	
	– Capacitance	pF/m	Should be Filled By Tenderer	
6.10	Surge impedance	Ω	Should be Filled By Tenderer	
7	BONDING & EARTHING			
7.1	Number of connections to earth		Should be Filled By Tenderer	
7.2	Interconnected sheaths at joint positions	Yes/No	Yes	
8	TYPE TEST CERTIFICATE			

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)		UNIT	DATA	
			Required	Offered
8.1	Type test certificate (to be issued by independent laboratory or independently witnessed type test certificate available), to be attached to the offer	Yes/No	Yes	
9	OTHER INSTALLATION DATA			
9.1	Minimum cable bending radius when laid:			
	– Direct burial	mm	Should be Filled By Tenderer	
	– In air	mm	Should be Filled By Tenderer	
	– In ducts	mm	Should be Filled By Tenderer	
	– At terminations (with former)	mm	Should be Filled By Tenderer	
9.2	Maximal permissible pulling force of total cable	kN	Should be Filled By Tenderer	
9.3	Maximal side wall bearing pressure to the cable at bending points	kN/m	Should be Filled By Tenderer	
9.4	Delivery length per drum			
	– Normal	m	Should be Filled By Tenderer	
	– Maximum	m	Should be Filled By Tenderer	
9.5	Maximal weight of full drum with maximum delivery length of cable	kg	Should be Filled By Tenderer	
9.6	Drum dimensions:			
	– Flange diameter	m	Should be Filled By Tenderer	
	– Core diameter	m	Should be Filled By Tenderer	
	– Width	m	Should be Filled By Tenderer	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.	11KV SURGE ARRESTERS			
	General			
1.1	Manufacturer of surge arrester:			
1.1.1	Name		Should be Filled By Tenderer	
1.1.2	Country		Should be Filled By Tenderer	
1.2	Manufacturer of surge counter:			
1.2.1	Name		Should be Filled By Tenderer	
1.2.2	Country		Should be Filled By Tenderer	
1.3	Type designation for surge arresters		Should be Filled By Tenderer	
1.4	Type designation for surge counter (equipped with leakage current measuring device)		Should be Filled By Tenderer	
1.5	Applicable standard		IEC 60099-4	
1.6	Rated frequency	Hz	50	
1.7	Nominal line to line voltage rating	kV	12	
1.8	Type		MOA	
1.9	Class of surge arrester		Very Heavy	
1.10	Maximum and Minimum ambient temperature for design	°C	Acc. to section a	
1.11	Altitude above sea level	m	Acc. to section a	
1.12	Design seismic acceleration	g	Acc. to section a	
1.13	Ice thickness	mm	Acc. to section a	
1.14	Wind velocity	m/s	Acc. to section a	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.15	Maximum overvoltage factor on the system due to any switching duty	pu	2.3	
1.16	Whether withstanding in load combinations of earthquake , wind , short circuit, as mentioned In Technical Specification?	(Yes / No)	Yes	
	Surge Arresters			
1.17	Rated voltage	kV rms	9	
1.18	Continuous operating voltage	kV rms	7.2	
1.19	Long duration discharge class as per IEC 99-1	Class	2	
1.20	Number of phases		3	
1.21	Type of system earthing		Effective	
1.22	Nominal discharge current with 8/20 us wave	kA peak	10	
1.23	Arrester designation		SL	
1.24	Type of housing in the case of utilizing porcelain and its classification acc to Std. 60672		Brown glazed Aluminum porcelain class C130	
1.25	Type of housing in the case of utilizing composite polymer and its resistance classification acc to IEC 60587		Silicon rubber (LSR,HCR or RTV type) class 3.4	
1.26	Earth fault factor		1.4	
1.27	Place of installation		Transformer Tertiary Cable Box	
1.28	Pressure relief class			
1.28.1	High current 0.2 sec	kA	25	
1.28.2	Low current 1 sec		600±200	
1.29	Thermal energy rating (Wth)	(kJ / kV) of	> 4	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.30	Repetitive charge transfer rating (Qrs)	C	> 1	
1.31	Reference voltage	kV rms	Should be Filled By Tenderer	
1.32	Reference current	mA	Should be Filled By Tenderer	
1.33	TOV capability for			
1.33.1	1 sec	kV	Acc. to IEC 60099-4	
1.33.2	10 sec	kV	Acc. to IEC 60099-4	
1.34	Continuous current under ambient temperature	mA	Should be Filled By Tenderer	
1.35	Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks			
1.35.1	Switching surges-1kA/2kA	kV peak	Acc. to IEC 60099-4	
1.35.2	5 KA	kV peak	Acc. to IEC 60099-4	
1.35.3	10 KA	kV peak	Acc. to IEC 60099-4	
1.35.4	20 KA	kV peak	Acc. to IEC 60099-4	
1.36	Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks			
1.36.1	500 A	kV peak	Acc. to IEC 60099-4	
1.36.2	1 KA	kV peak	Acc. to IEC 60099-4	
1.36.3	2 KA	kV peak	Acc. to IEC 60099-4	
1.37	Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak	kV peak	Should be Filled By Tenderer	
1.38	High current 4/10 microsecond impulse withstand level	kA peak	Acc. to IEC 60099-4	
1.39	Low current 2000 microsecond withstand level	kA peak	Acc. to IEC 60099-4	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.40	Number of arrester units		Should be Filled By Tenderer	
1.41	Rated voltage of each arrester unit	kV rms	Should be Filled By Tenderer	
1.42	Number of parallel non linear MO resistance block		1	
1.43	Power frequency voltage versus time characteristics included?	(Yes/No)	Yes	
1.44	Maximum internal partial discharge	pC	Acc. to IEC 60099	
1.45	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
1.45.1	Date of issue		Latest	
1.45.2	Validity		Should be Filled By Tenderer	
1.45.3	Certificate attached to the offer	Yes/No	Yes	
1.46	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
1.46.1	Certificate to be attached to the offer	Yes/No	Yes	
1.46.2	Report to be attached to the offer	Yes/No	Yes	
	Miscellaneous			
1.47	Insulator			
1.47.1	Manufacturer		Should be Filled By Tenderer	
1.47.2	Country		Should be Filled By Tenderer	
1.47.3	Type		disc	
1.47.4	Material		Porcelain	
1.48	Creepage distance of insulator	mm	372	
1.49	Basic insulation level of insulator at site condition	kV peak	1.3*LIPL	
1.50	One minute power frequency withstand voltage of insulator at site condition	kV rms	1.06*SIWL/ $\sqrt{2}$	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.51	Switching Impulse withstand voltage of insulator at site condition	kV peak	1.25*SIWL	
1.52	Filling medium		Should be Filled By Tenderer	
1.53	Method used for sealing test		Should be Filled By Tenderer	
1.54	Whether washable in service (Yes/ No)	(Yes/ No)	Yes	
1.55	Permissible force at HV terminals			
1.55.1	Static Horizontal	N	Should be Filled By Tenderer	
1.55.2	Static Vertical	N	Should be Filled By Tenderer	
1.55.3	Dynamic Horizontal	N	Should be Filled By Tenderer	
1.55.4	Dynamic vertical	N	Should be Filled By Tenderer	
1.56	Whether isolating pads for surge arresters with surge counter provided? (Yes/No)	(Yes/ No)	Yes, separated	
1.57	Non Linear MO resistor			
1.57.1	Manufacturer		Should be Filled By Tenderer	
1.57.2	Country		Should be Filled By Tenderer	
1.57.3	Type		Should be Filled By Tenderer	
1.58	Dimension of each non-linear MO resistance block			
1.58.1	Diameter	mm	Should be Filled By Tenderer	
1.58.2	Height	mm	Should be Filled By Tenderer	
1.59	Total weight of single unit	kg	Should be Filled By Tenderer	
1.60	Total weight of complete surge arrester	kg	Should be Filled By Tenderer	
1.61	Total height of surge arrester	mm	Should be Filled By Tenderer	
1.62	Total width of surge arrester	mm	Should be Filled By Tenderer	

h) 11kV SURGE ARRESTER		UNIT	DATA	
			REQUIRED	OFFERED
1.63	Whether grading ring for high voltage terminal required?	(Yes/ No)	Yes	
1.64	Maximum Package weight ready for shipment	kg	Should be Filled By Tenderer	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
1	EARTHING SYSTEM			
1.1	General			
1.1.1	Manufacturers		Should be Filled By Tenderer	
1.1.2.	Standard Applied The following standards shall apply to the earthing installations and to the accessories:			
	– Guide for safety in A.C. substation grounding		IEEE80 & 81	
	– Earthing system in A.C. installation for rated voltages above 1000 V		VDE 0141	
1.1.3	Design ground fault current	kA rms	40	
1.1.4	Time duration of ground fault	sec	3	
1.1.5	Fault clearing time	sec	0.6	
1.1.6	Maximum Resistance of Earthing/Grounding System	Ohm	1 1 1	
1.1.7	Step length	m	Should be Filled By Tenderer	
1.1.8	Body resistance	Ohm	Should be Filled By Tenderer	
1.1.9	Maximum touch voltage	V	Should be Filled By Tenderer	
1.1.10	Maximum step voltage	V	Should be Filled By Tenderer	
1.1.11	Tolerable touch voltage	V	Should be Filled By Tenderer	
1.1.12	Tolerable step voltage	V	Should be Filled By Tenderer	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
1.1.13	Maximum ground potential rise	kV	5	
1.1.14	Maximum allowable temperature for riser	°C	250	
1.1.15	Maximum allowable temperature for mesh grid	°C	450	
1.1.16.	Physical Properties of Copper			
	The most important physical properties of copper used for the earthing conductors:			
	– Density	kg/dm ³	8.89	
	– Electrical resistivity at 20°C	Ωmm ² /m	0.0176	
	– Melting point	°C	1083	
	– Current density at which the conductor temperature rises from 50°C to 300°C in a time of 1 s if all heat is retained in conductor	A/mm ²	190	
1.1.17.	Physical Properties of Lead-Sheathed Copper			
	The most important physical properties of lead-sheathed copper used for the earth electrodes:			
	– Thickness of lead sheath	mm	2.0	
	– Electrical resistivity of copper at 20°C	Ωmm ² /m	0.0176	
	– Copper melting point	°C	1083	
	– Lead melting point	°C	327	
	– Current density at which the conductor temperature rises from 40°C to 150°C in a time of 1 s if all heat is retained in conductor	A/mm ²	140	
1.2	Ground Grid and Risers			
1.2.1	Ground grid conductor			
	– Type		Should be Filled By Tenderer	
	– Material		Stranded soft drawn annealed copper	
	– Minimum cross-section area to be confirmed by acceptance calculation	mm ²	min 150 /after acceptance of calculation	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
	– Number of wires	No.	Should be Filled By Tenderer	
	– Diameter of each wire	mm	Should be Filled By Tenderer	
	– Conductor diameter	mm	Should be Filled By Tenderer	
	– Density	kg/m	Should be Filled By Tenderer	
1.2.2	Riser conductor			
	– Type		Should be Filled By Tenderer	
	– Material		Stranded soft drawn annealed copper	
	– Minimum cross-section area to be confirmed by acceptance calculation	mm ²	after acceptance of calculation	
	– Number of wires	No.	Should be Filled By Tenderer	
	– Diameter of each wire	mm	Should be Filled By Tenderer	
	– Conductor diameter	mm	Should be Filled By Tenderer	
	– Density	kg/m	Should be Filled By Tenderer	
1.2.3	Connections			
	Mode of Connection in the Earthing Systems:			
	– Between earthing conductors and earth electrodes		Brazed	
	– Crossing of earth electrodes		Compression	
	– Type of connection of risers to steel structures		bolt and two hole cable lug	
1.2.4	Manufacturer of ground grid and risers conductor			

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
1.2.5	Ground resistivity	ohm.m	will be declared later	
1.2.6	Surface gravel resistivity	ohm.m	3000	
1.2.7	Minimum surface gravel height	cm	15	
1.2.8	Minimum depth of ground grid burial	cm	50	
1.3	Grounding Accessories			
1.3.1.	Earth Electrodes			
1.3.1.1.	Lead-sheathed stranded copper conductors			
	The following lead-sheathed stranded copper conductor will be used as earth electrodes:			
	– Thickness of lead sheath	mm	Should be Filled By Tenderer	
	– Copper cross-section area	mm ²	Should be Filled By Tenderer	
	– Number of wires	pcs	Should be Filled By Tenderer	
	– Diameter of each wire	mm	Should be Filled By Tenderer	
	– Conductor diameter	mm	Should be Filled By Tenderer	
	– Density	kg/m	Should be Filled By Tenderer	
1.3.1.2.	Earth rod			
	– Manufacturer		Should be Filled By Tenderer	
	– Length	m	Min (3)	
	– Diameter	mm	Min (16)	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
	– Material (copper, stainless steel)		Should be Filled By Tenderer	
1.3.1.3.	Stainless steel electrodes			
	The following steel flat bars will be used as earth electrodes:			
	– Cross-section area	mm ²	Should be Filled By Tenderer	
	– Dimensions	mm x mm	Should be Filled By Tenderer	
	– Density	kg/m	Should be Filled By Tenderer	
1.3.2	Equipment mat			
	Material		Should be Filled By Tenderer	
	Size		Should be Filled By Tenderer	
1.3.3	Manufacturer of moulds		Should be Filled By Tenderer	
3.4	Type and size of cable connectors and cable lugs		Should be Filled By Tenderer	
1.4	Miscellaneous			
1.4.1	Minimum estimated length of ground grid (without risers)	m	Should be Filled By Tenderer	
1.4.2	Minimum estimated quantity of rods inside substation		Should be Filled By Tenderer	
1.4.3	Minimum estimated quantity of rods located at primeters of substation		Should be Filled By Tenderer	
1.4.4	Is required one set of portable temporary earthing equipment?	Yes/No	Yes	
1.4.5	Temporary grounding device			
	Type		Should be Filled By Tenderer	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
	Material		Should be Filled By Tenderer	
	Short time current (3 sec)	kA peak	Should be Filled By Tenderer	
	Length of insulated stick		Should be Filled By Tenderer	
	Type of insulated stick		Should be Filled By Tenderer	
2.	LIGHTNING PROTECTION			
2.1.	Manufacturers		Should be Filled By Tenderer	
2.2.	Standard Applied:			
	– Protection of structures against lightning		IEC 62305	
2.3.	Cross-section area	mm ²	Should be Filled By Tenderer	
2.4.	Thickness of lead-sheath	mm	Should be Filled By Tenderer	
2.5.	Supports			
	Conductor supports of the lightning protection system			
	– Type		Should be Filled By Tenderer	
2.6.	Earth rod			
	– Manufacturer		Should be Filled By Tenderer	
	– Length	m	Should be Filled By Tenderer	
	– Diameter	mm	Should be Filled By Tenderer	
	– Material (copper, stainless steel)		Should be Filled By Tenderer	

i) EARTHING AND LIGHTNING PROTECTION		UNIT	DATA	
			Required	Offered
3.	Type test certificate (to be issued by independent laboratory or independently witnessed type test certificate available), to be attached to the offer	Yes/No	Yes	

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
1.	GENERAL			
1.1	Manufacturer		Should be Filled By Tenderer	
1.2	Type		Should be Filled By Tenderer	
2.	FIELD MODULE			
2.1	Sampling rate	ms	Should be Filled By Tenderer	
2.2	Data resolution	ms	1	
2.3	Auxiliary voltage range (Vn = 110Vdc)	Vdc	88→150	
2.4	Protection degree of panel/box	IP	55	
2.5	Range of operating temperature	°C	Should be Filled By Tenderer	
2.6	Communication			
2.6.1	Local interface for PC/Laptop connection			
	- Communication ports (Front/rear etc.)		Should be Filled By Tenderer	
	- Physical links (RS232/Ethernet etc.)		Should be Filled By Tenderer	
2.6.2	Remote Control and Monitoring			
	- Communication ports (Front/rear etc.)		Rear	
	- Physical links (RS485/Fibre optic etc.)		Fibre optic	
	- Protocol		IEC 61850	
2.6.3	Centralized HMI PC for analysis, evaluation and diagnostic			

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
	- Communication ports (Front/rear etc.)		Should be Filled By Tenderer	
	- Physical links (RS485/Fibre optic etc.)		Fibre Optic	
	- Protocol		Should be Filled By Tenderer	
3.	CENTRALIZED HMI PC FOR ANALYSIS, EVALUATION AND DIAGNOSTIC			
3.1	Manufacturer		Should be Filled By Tenderer	
3.2	Model		Should be Filled By Tenderer	
3.3	Processor			
	– Type		Should be Filled By Tenderer	
	– Word length	Bits	Should be Filled By Tenderer	
	– Clock speed (minimum)	GHz	3	
3.4	Memory size	GB	6	
	– Supplied (minimum)	Mb	Should be Filled By Tenderer	
	– Supportable/expandable	Gb	Should be Filled By Tenderer	
3.5	Hard disk size	GB		
	– Supplied (minimum)	Gb	Should be Filled By Tenderer	
	– Supportable/expandable	Gb	Should be Filled By Tenderer	
3.6	Optical Storage	Yes/No	Yes	
3.7	Pointer Device		Should be Filled By Tenderer	

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
3.8	Operating system		Should be Filled By Tenderer	
3.9	Operator interface screen	inch	24	
3.10	Operating temperature range	°C	Should be Filled By Tenderer	
3.11	Maximum relative humidity	%	Should be Filled By Tenderer	
3.12	Nominal voltage	Vac	Should be Filled By Tenderer	
3.13	Operating frequency	Hz	Should be Filled By Tenderer	
3.14	Power requirement	W	Should be Filled By Tenderer	
4.	MINIMUM QUANTITIES TO BE MEASURED			
	- Oil temperature	Yes/No	Yes	
	- Hot-spot-temperature	Yes/No	Yes	
	- Moisture-in-oil content	Yes/No	Yes	
	- Gas-in-oil content and gas consistency	Yes/No	Yes	
	- Gas quantity and rate in Buchholz relay	Yes/No	Yes	
	- Oil pressure	Yes/No	Yes	
	- Oil level	Yes/No	Yes	
	- Winding temperature	Yes/No	Yes	
	- Humidity of air in conservator	Yes/No	Yes	
	- Actual losses	Yes/No	Yes	
	- Overload capacity	Yes/No	Yes	

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
	- Emergency overloading time	Yes/No	Yes	
	- Partial discharge	Yes/No	Yes	
	- Ambient air temperature	Yes/No	Yes	
	- Ambient air humidity	Yes/No	Yes	
	- Ambient air pressure	Yes/No	Yes	
	- Load currents of bushings	Yes/No	Yes	
	- Overcurrents of bushings	Yes/No	Yes	
	- Operating voltages of bushings	Yes/No	Yes	
	- Overvoltages of bushings	Yes/No	Yes	
	- Bushing capacitance and capacitive displacement currents	Yes/No	Yes	
	- Tap changer position and number of switching operations	Yes/No	Yes	
	- Sum of switched load current tap changer	Yes/No	Yes	
	- Power consumption of motor-drive	Yes/No	Yes	
	- Contact wear	Yes/No	Yes	
	- Operating conditions and operating time of fans	Yes/No	Yes	
	- Cooling efficiency and power	Yes/No	Yes	
	- Intake and outlet cooling equipment temperatures	Yes/No	Yes	
5.	TYPE TESTS			
5.1	Atmospheric Environment			
	– Operation -25°C and 55°C for 96hrs, IEC 60068-2-1	Yes/No	Yes	
	– Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2	Yes/No	Yes	

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
5.2	Relative Humidity			
	– Operation at 93%	Yes/No	Yes	
	– Tested to IEC 60068-2-3 with severity class 56 days	Yes/No	Yes	
5.3	Enclosure			
	– IEC 60529		IP50	
5.4	Mechanical Environment			
	– Vibration IEC 60255-21-1	Yes/No	Yes	
	– Shock and bump IEC 60255-21-2	Yes/No	Yes	
	– Seismic IEC 60255-21-3	Yes/No	Yes	
5.5	Insulation			
	– Rated insulation			
	1000V high impedance protection CT inputs	Yes/No	Yes	
	250V for other circuits	Yes/No	Yes	
	1000V open contact withstand	Yes/No	Yes	
	– Dielectric Tests IEC 60255-5 – Series C of table 1	Yes/No	Yes	
	– Impulse voltage IEC 60255-5 test voltage 5kV	Yes/No	Yes	
5.6	Electromagnetic compatibility			
	– 1MHz Burst disturbance test, IEC 60255-22-1 severity class III	Yes/No	Yes	
	– Electrostatic Discharge IEC 60255-22-2 severity class III	Yes/No	Yes	
	– Radiated Electromagnetic Field Disturbance IEC 60255-22-3 severity class III	Yes/No	Yes	
	– Electromagnetic Emissions IEC 60255-25	Yes/No	Yes	

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM		UNIT	DATA	
			Required	Offered
	– Fast Transient Disturbance IEC 60255-22-4 severity level IV	Yes/No	Yes	
5.7	Type test certificate provided	Yes/No	Yes	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
1	General			
1.1	Applicable standard		Acc. to Protection, control and metering system Technical Specification	
1.2	Nominal system frequency	Hz	50	
1.3	Nominal current transformers secondary current	A	1	
1.4	Rated voltage transformers secondary voltage	V	110	
1.5	Auxiliary DC	V	110	
1.6	Variation of Aux. DC	%	-15 , +10	
1.7	Auxiliary AC	V	415 / 240	
1.8	Type of system grounding		400kV/220kV: Solid	
			11 kV Solid	
1.9	Accuracy class of CTs for protection and metering equipment		Acc. to Bid Drawing & relay requirement	
1.10	Accuracy class of CVTs for protection and metering		Acc. to Bid Drawing	
1.11	Control and metering system			
1.11.1	All sub-division of control and metering system such as operating system, interlocking, synchronizing, alarm annunciation, automatic and manual voltage control, metering and indication instruments, event and fault recorder, PMU (as required) and relays setting and configuration integrated control system		Acc. to Protection, control and metering system Technical Specification	
1.12	Protection system			

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
1.12.1	All sub-division of protection system such as protection design criteria, protection relays requirement, common circuit breaker protection, transmission line protection, sub-transmission line protection, power transformer protection, short transmission line protection, short sub-transmission line protection, bus section protection, reactor protection, load shedding and busbar protection		Acc. to Protection, control and metering system Technical Specification	
1.13	Packing, transportation and storage		Acc. to Protection, control and metering system Technical Specification	
1.14	Supervision over installation and erection procedure		Acc. to Protection, control and metering system Technical Specification	
1.15	Inspection and test		Acc. to Protection, control and metering system Technical Specification	
2	Panel			
2.1	Manufacturer :			
2.1.1	Name		Should be Filled By Tenderer	
2.1.2	Country		Should be Filled By Tenderer	
2.2	Type of panels construction		Acc. to Protection, control and metering system Technical Specification	
2.2	Degree of protection of panels:			
	Indoor		IP51	
	Outdoor		IP55	
2.3	Color of Panel:			
	Indoor		RAL7035	
	Outdoor		RAL7032	

k) PROTECTION, CONTROL AND METERING			UNIT	DATA	
				REQUIRED	OFFERED
2.4	Thickness of Panel color		Micron	between 80 and 120	
2.5	Minimum thickness of steel panels		mm	2	
2.6	Overall dimensions :				
	protection & Relay panels		mm*mm*mm	800*800*2200	
	Control panels		mm*mm*mm	800*800*2200	
	AVR panel		mm*mm*mm	800*800*2200	
2.7	Size of wires :				
	CT & CVT circuits		mm2	4/2.5	
	control circuit		mm2	2.5	
2.8	Voltage rating of wirings		V	Should be Filled By Tenderer	
2.9	Terminal blocks :				
	Manufacturer / Name / Country			Should be Filled By Tenderer	
	Type designation			Should be Filled By Tenderer	
	Spare		%	20	
2.10	Earthquake protection coefficient				
2.11	Lighting, door switch, heater, thermostat		yes/no	yes	
2.12	DC supervision for relay and control panel		yes/no	yes	
2.13	Type of mounting			Should be Filled By Tenderer	
2.14	Other requirement			Acc. to Protection, control and metering system Technical Specification	
*	<u>Over Head Line Protection</u>				
1	<u>Distance Protection (Main I Protection)</u>			400/220kV	400/220kV

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
1.1	Manufacturer :			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
1.2	Applicable standard		Should be Filled By Tenderer	
1.3	Type	Static/ Microprocessor based	Microprocessor based	
1.4	Rated current		Should be Filled By Tenderer	
1.5	Rated voltage		110V DC	
1.6	Rated auxiliary DC		110V DC	
1.7	Method of starting		Should be Filled By Tenderer	
1.8	Number of zones :		Minimum 5 zone ph-ph & ph-E	
	Forward reach		Should be Filled By Tenderer	
	Reverse reach		Should be Filled By Tenderer	
1.9	Mounting arrangement		Flush mounted	
1.10	Maximum zone 1 operating time		Should be Filled By Tenderer	
1.11	Time setting range for :			
	Zone 2		Should be Filled By Tenderer	
	Zone 3		Should be Filled By Tenderer	
1.12	power swing blocking provided	yes/no	yes	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
1.13	Dielectric test voltage		Should be Filled By Tenderer	
1.14	Type of relay characteristics		Should be Filled By Tenderer	
1.15	Type of characteristics for phase-ground and three phase faults		Should be Filled By Tenderer	
1.16	Number of measuring units		Should be Filled By Tenderer	
1.17	Type of impedance measuring characteristic for phase to ground faults /setting range / step			
	Zone 1		Should be Filled By Tenderer	
	Zone 2		Should be Filled By Tenderer	
	Zone 3		Should be Filled By Tenderer	
1.18	Type of impedance measuring characteristic for phase to phase faults /setting range / step			
	Zone 1		Should be Filled By Tenderer	
	Zone 2		Should be Filled By Tenderer	
	Zone 3		Should be Filled By Tenderer	
1.19	Method of ensuring correct discrimination for three phase close up faults		Should be Filled By Tenderer	
1.20	Fault locator feature built in	yes/no	yes	
1.21	Built in directional overcurrent/ earth fault relay	yes/no	yes	
1.22	Built in disturbance Recorder	yes/no	yes	
1.23	Built in DTT	yes/no	yes	
1.24	Built in SOTF	yes/no	yes	
1.25	Mutual compensation provided	yes/no	yes	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
1.26	internal Fuse failure blocking provided	yes/no	yes	
1.27	Filtering against CVT transients provided	yes/no	yes	
1.28	Current carrying /making/breaking capacity for trip contacts	A	Should be Filled By Tenderer	
1.29	Weak-end in feed trip feature provided	yes/no	yes	
1.30	Current reversal logic (for double lines) provided	yes/no	yes	
2	<u>Directional EF Relay (Included Main I Distance)</u>		400/220kV	400/220kV
2.1	Manufacturer :			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
2.2	Applicable standard		Should be Filled By Tenderer	
2.3	Rated zero sequence current	A	Should be Filled By Tenderer	
2.4	Rated zero sequence polarizing voltage	V	Should be Filled By Tenderer	
2.5	Whether the following characteristics provided :		Should be Filled By Tenderer	
2.6	Normal inverse /Very inverse / Extremely inverse		Should be Filled By Tenderer	
2.7	Whether instantaneous unit provided	yes/no	yes	
2.8	Mounting arrangement		Flush mounted	
2.9	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	
2.10	Current setting range in instantaneous/ definite characteristic / step	A	Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
2.11	Time setting range / step	Sec	Should be Filled By Tenderer	
2.12	Relay characteristic angle	deg	Should be Filled By Tenderer	
2.13	Drop-off / pick-up ratio		Should be Filled By Tenderer	
2.14	Hand reset operation indicator	yes/no	yes	
2.15	Power consumption	VA	Should be Filled By Tenderer	
2.16	Inrush current blocking	yes/no	yes	
2.17	Transient over reach	yes/no	yes	
2.18	Current reversal logic (for parallel lines) provided	yes/no	yes	
2.19	Echo feature for tele-protection provided	yes/no	yes	
3	<u>Current Differential Protection (Main II Protection)</u>		400/220kV	400/220kV
3.1	Manufacturer :			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
3.2	Fault setting with maximum number of current transformers connected primary amperes for :			
	Phase/earth fault	A	Should be Filled By Tenderer	
	Phase/phase fault	A	Should be Filled By Tenderer	
3.3	Basic sensitivity setting range	%	Should be Filled By Tenderer	
3.4	Rated current	A	Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
3.5	Current setting range	A	Should be Filled By Tenderer	
3.6	Current transformer supervision alarm setting with maximum number of current transformer		Should be Filled By Tenderer	
3.7	Connected (primary amperes)	A	Should be Filled By Tenderer	
3.8	Pick up ration (slop) setting range	%	Should be Filled By Tenderer	
3.9	Pick-up time :			
	At “3” times fault setting	Ms	Should be Filled By Tenderer	
	At “ 10” times fault setting	Ms	Should be Filled By Tenderer	
3.10	Maximum through fault current at which protection is stable	A	Should be Filled By Tenderer	
3.11	Current transformer requirement :			
	Knee point voltage	V	Should be Filled By Tenderer	
	Winding resistance	Ohm	Should be Filled By Tenderer	
	Maximum exciting current at knee point voltage	MA	Should be Filled By Tenderer	
3.12	Max operating time	Ms	Should be Filled By Tenderer	
3.13	Number of contacts available		Should be Filled By Tenderer	
3.14	Relay burden	VA	Should be Filled By Tenderer	
3.15	Setting of series connected reinforcing contactor	A	Should be Filled By Tenderer	
3.16	Resistance of series connected	Ohm	Should be Filled By Tenderer	
3.17	Values of series resistance and wattage		Should be Filled By Tenderer	
3.18	Isolator Aux switches requirement :			
	Number of contacts normally open		Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
	Number of contacts normally closed		Should be Filled By Tenderer	
	Timing sequence between aux switches and main contacts		Should be Filled By Tenderer	
3.19	Maximum total lead burden	VA	Should be Filled By Tenderer	
3.20	Recommended cable lead burden	Mm	Should be Filled By Tenderer	
3.21	CT circuit supervision time setting range	S	Should be Filled By Tenderer	
3.22	IEC 61850 communication protocol support	yes/no	yes	
4	<u>Directional Earth Fault Relay (Include Main II protection)</u>		400/220kV	400/220kV
4.1	Manufacturer :			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
4.2	Applicable standard		Should be Filled By Tenderer	
4.3	Rated zero sequence current	A	Should be Filled By Tenderer	
4.4	Rated zero sequence polarizing voltage	V	Should be Filled By Tenderer	
4.5	Rated auxiliary DC voltage	V	Should be Filled By Tenderer	
4.6	Whether the following characteristics provided :			
	Normal inverse		Should be Filled By Tenderer	
	Very inverse		Should be Filled By Tenderer	
	Extremely inverse		Should be Filled By Tenderer	
4.7	Mounting arrangement		Flush mounted	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
4.8	Whether instantaneous unit provided	yes/no	yes			
4.9	Current setting range	A	Should be Filled By Tenderer			
4.10	Drop-off / pick-up ratio		Should be Filled By Tenderer			
4.11	Hand reset operation indicator provided	yes/no	yes			
4.12	Power consumption	VA	Should be Filled By Tenderer			
4.13	IEC 61850 communication protocol support	yes/no	yes			
5	<u>Under & Over Voltage Relay</u>		Under Voltage	Over Voltage	Under Voltage	Over Voltage
5.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.3	Rated voltage	V	110v DC	110v DC		
5.4	Rated auxiliary DC voltage	V	110v DC	110v DC		
5.5	Resetting ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.6	Time delay setting range / step	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.7	Time characteristic		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.8	voltage Setting range / step	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.9	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.10	Mounting arrangement		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.11	Hand reset operation indicator	yes/no	yes	yes		
5.12	Manual blocking possibility	yes/no	yes	yes		
6	<u>Autorecloser with Check synchro relay</u>		400/220kV		400/220kV	
6.1	Manufacturer :					
	Name		Should be Filled By Tenderer			
	Country		Should be Filled By Tenderer			
	Type designation		Should be Filled By Tenderer			
6.2	Applied standard		Should be Filled By Tenderer			
6.3	number of auto recloser shots		Should be Filled By Tenderer			
6.4	Relay type	Static/ Microprocessor based	microprocessor			
6.5	whether operation indicator provided	yes/no	Should be Filled By Tenderer			
6.6	provision for blocking and switching in the relay from :	Hz	Should be Filled By Tenderer			
6.7	control / relay panel	yes/no	yes			
6.8	remote control	yes/no	yes			
6.9	range of dead time adjustment / step	sec	Should be Filled By Tenderer			
6.10	range of reclaim time adjustment / step	sec	Should be Filled By Tenderer			

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
6.11	closing pulse time	sec	Should be Filled By Tenderer	
6.12	Method of blocking auto recloser		Should be Filled By Tenderer	
6.13	when circuit breaker is open		Should be Filled By Tenderer	
6.14	when closing into a fault		Should be Filled By Tenderer	
6.15	Single and 3 pole reclosing	yes/no	Yes	
6.16	whether operation counter provided	yes/no	Yes	
6.17	whether following features provided for safe closing			
6.18	synchronizing check in live bus / live line	yes/no	yes	
6.19	live line / dead bus	yes/no	yes	
6.20	live bus / dead line	yes/no	yes	
6.21	dead bus / dead line	yes/no	yes	
6.22	Time details (rag etc):			
	Number of timer		Should be Filled By Tenderer	
	Auxiliary voltage	V	110v DC	
	Timing range	sec	Should be Filled By Tenderer	
6.23	Number of phases		Should be Filled By Tenderer	
6.24	Range of voltage difference in percent of Un		Should be Filled By Tenderer	
6.25	Range of phase angle difference		Should be Filled By Tenderer	
6.26	Range of frequency difference		Should be Filled By Tenderer	
6.27	Limiting Short time thermal withstand value		Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
6.28	Values of Auxiliary DC and its permissible variation	V	Should be Filled By Tenderer	
6.29	DC consumption	W	Should be Filled By Tenderer	
6.30	Contact data:			
	Number		Should be Filled By Tenderer	
	Continuous rating at 110VDC	A	Should be Filled By Tenderer	
6.31	Mounting position	flush/ Surface/ etc.	Flush Mounted	
6.32	Accessories (if essential to relay performance) provided	yes/no	yes	
6.33	Hand reset operation indicator with inscription provided	yes/no	yes	
6.34	Burden	VA	Should be Filled By Tenderer	
6.35	Manual close inhibit timer		Should be Filled By Tenderer	
7	<u>Breaker Failure Protection (with Short zone)</u>		400/220kV	400/220kV
7.1	Manufacturer :			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
7.2	Applied standard		Should be Filled By Tenderer	
7.3	Rated Value of Current		Should be Filled By Tenderer	
7.4	Setting range & accuracy class of characteristic quantity		Should be Filled By Tenderer	
7.5	Drop out current as % of pick up current		Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
7.6	Pick up time	ms	Should be Filled By Tenderer	
7.7	Resetting time	ms	Should be Filled By Tenderer	
7.8	Frequency	Hz	50Hz	
7.9	Burden		Should be Filled By Tenderer	
7.10	Time details (rag etc.):			
	Number of timer		Should be Filled By Tenderer	
	Auxiliary voltage	V	110v DC	
	Timing range	sec	Should be Filled By Tenderer	
7.11	Number of phases		Should be Filled By Tenderer	
7.12	Limiting Short time thermal withstand value		Should be Filled By Tenderer	
7.13	Values of Auxiliary DC and its permissible variation	V	Should be Filled By Tenderer	
7.14	DC consumption	W	Should be Filled By Tenderer	
7.15	Contact data:			
	Number		Should be Filled By Tenderer	
	Continuous rating at 110VDC	A	Should be Filled By Tenderer	
7.16	Mounting position	flush/Sur face/etc	Flush Mounted	
7.17	Accessories (if essential to relay performance) provided	yes/no	yes	
7.18	Hand reset operation indicator with inscription provided	yes/no	yes	
7.19	Burden	VA	Should be Filled By Tenderer	
7.20	Dielectric test voltage	KV/sec	Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
7.21	IEC 61850 communication protocol support	yes/no	yes	
8	<u>STUB Protection</u>		400/220kV	400/220kV
8.1	Manufacturer			
	Name		Should be Filled By Tenderer	
	Country		Should be Filled By Tenderer	
	Type designation		Should be Filled By Tenderer	
8.2	Applicable standard		Should be Filled By Tenderer	
8.3	Rated current		Should be Filled By Tenderer	
8.4	Current setting range		Should be Filled By Tenderer	
8.5	Mounting arrangement		Should be Filled By Tenderer	
8.6	Number of phases			
8.7	Rated aux DC voltage		110v DC	
8.8	Hand reset operation indicator			
8.9	Time setting range		Should be Filled By Tenderer	
8.10	Burden		Should be Filled By Tenderer	
8.11	IEC 61850 communication protocol support		yes	
*	<u>Power Transformer Protection</u>	400/220 kV		
1	<u>Biased Differential Protection Relay</u>		400/220 kV	400/220 kV
1.1	Manufacturer :			
	Name		Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING			UNIT	DATA			
				REQUIRED		OFFERED	
	Country			Should be Filled By Tenderer			
	Type designation			Should be Filled By Tenderer			
1.2	Applicable standard			Should be Filled By Tenderer			
1.3	Relay type		Static/ Microprocessor based	microprocessor			
1.4	Rated current		A	Should be Filled By Tenderer			
1.5	Rated auxiliary DC voltage		V	110V DC			
1.6	Bias setting range		(%)	Should be Filled By Tenderer			
1.7	Mounting arrangement			Should be Filled By Tenderer			
1.8	Hand reset operation indicator provided		yes/no	Should be Filled By Tenderer			
1.9	Method of preventing tripping during magnetizing inrush current			Should be Filled By Tenderer			
1.10	Maximum through fault current for which the relay is stable		A	Should be Filled By Tenderer			
1.11	Rated value of the auxiliary DC voltage		V	110v DC			
1.12	Fifth harmonic restrain feature		yes/no	yes			
2	<u>Restricted Earth Fault Relay</u>			400kV SIDE	220kV SIDE	400kV SIDE	220kV SIDE
2.1	Manufacturer :						
	Name			Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country			Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation			Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
2.2	Relay type	Static/ Microprocessor based	microprocessor or	microprocessor		
2.3	Hand reset operation indicator provided	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.4	Rated auxiliary DC voltage	V	110v DC	110v DC		
2.5	Mounting arrangement		Flush Mounted	Flush Mounted		
2.6	Current setting range	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.7	Voltage setting range	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.8	Time setting range	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.9	Resetting ratio	(%)	Should be Filled By Tenderer	Should be Filled By Tenderer		
3	<u>Over Current Protection Relay</u>		400kV SIDE	220kV SIDE	400kV SIDE	220kV SIDE
3.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.4	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
3.5	Current setting range in instantaneous/definite characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.6	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.7	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.8	Mounting arrangement		Flush mounted	Flush mounted		
3.9	Number of phases					
3.10	Rated auxiliary DC voltage	V	110v DC	110v DC		
3.11	Hand reset operation indicator	yes/no	yes	yes		
3.12	Current setting range of instantaneous unit	A	yes	yes		
3.13	Second harmonic blocking feature	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.14	Minimum pick-up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.15	Relay design (microprocessor-based, numerical)	Yes/No	Yes	Yes		
4	<u>Neutral point Earth Fault Relay</u>		400kV SIDE	220kV SIDE	400kV SIDE	220kV SIDE
4.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
4.4	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.5	Current setting range in instantaneous/ definite charactristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.6	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.7	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.8	Mounting arrangement		Flush mounted	Flush mounted		
4.9	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.10	Rated auxiliary DC voltage	V	110v DC	110v DC		
4.11	Hand reset operation indicator	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.12	Current setting range of instantaneous unit	A	yes	yes		
4.13	Second harmonic blocking feature	yes/no	yes	yes		
4.14	Minimum pick-up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
5	<u>Aux/Earthing Trans OC & EF Protection Relay</u>		OC	EF	OC	EF
5.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.4	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.5	Current setting range in instantaneous/definite characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.6	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.7	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.8	Mounting arrangement		Flush mounted	Flush mounted		
5.9	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.10	Rated auxiliary DC voltage	V	110v DC	110v DC		
5.11	Hand reset operation indicator	yes/no	yes	yes		
5.12	Current setting range of instantaneous unit	A	yes	yes		
5.13	Second harmonic blocking feature	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.14	Minimum pick-up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
6	<u>Directional Over Current Relay</u>		400kV SIDE	220kV SIDE	400kV SIDE	220kV SIDE
6.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
6.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.4	Rated polarizing voltage	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.5	Whether the following characteristics provided :		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.6	Normal inverse /Very inverse / Extremely inverse		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.7	Whether instantaneous unit provided	yes/no	Yes	Yes		
6.8	Mounting arrangement		Flush mounted	Flush mounted		
6.9	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.10	Current setting range in instantaneous/ definite characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.11	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.12	Relay characteristic angle	deg	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.13	Drop-off / pick-up ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.14	Hand reset operation indicator	yes/no	yes	yes		
6.15	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.16	Inrush current blocking	yes/no	yes	yes		
6.17	Transient over reach	yes/no	yes	yes		
6.18	Current reversal logic (for parallel lines) provided	yes/no	yes	yes		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
6.19	Echo feature for tele-protection provided	yes/no	yes	yes		
7	<u>Directional Earth Fault Relay</u>		400kV SIDE	220kV SIDE	400kV SIDE	220kV SIDE
7.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.3	Rated zero sequence current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.4	Rated zero sequence polarizing voltage	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.5	Whether the following characteristics provided :		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.6	Normal inverse /Very inverse / Extremely inverse		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.7	Whether instantaneous unit provided	yes/no	yes	yes		
7.8	Mounting arrangement		Flush mounted	Flush mounted		
7.9	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.10	Current setting range in instantaneous/ definite characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.11	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
7.12	Relay characteristic angle	deg	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.13	Drop-off / pick-up ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.14	Hand reset operation indicator	yes/no	yes	yes		
7.15	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.16	Inrush current blocking	yes/no	yes	yes		
7.17	Transient over reach	yes/no	yes	yes		
7.18	Current reversal logic (for parallel lines) provided	yes/no	yes	yes		
7.19	Echo feature for tele-protection provided	yes/no	yes	yes		
8	<u>Under & Over Relay</u>		Under Voltage	Over Voltage	Under Voltage	Over Voltage
8.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.3	Rated voltage	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.4	Rated auxiliary DC voltage	V	110v DC	110v DC		
8.5	Resetting ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.6	Time delay setting range / step	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
8.7	Time characteristic		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.8	voltage Setting range / step	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.9	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.10	Mounting arrangement		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.11	Hand reset operation indicator	yes/no	yes	yes		
8.12	Manual blocking possibility	yes/no	yes	yes		
9	<u>Over Flux Relay</u>					
9.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.3	Rated voltage	V	110v DC	110v DC		
9.4	Rated auxiliary DC voltage	V	110v DC	110v DC		
9.5	Resetting ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.6	Time delay setting range / step	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.7	Time characteristic		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
9.8	voltage Setting range / step	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.9	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.10	Mounting arrangement		Flush mounted	Flush mounted		
9.11	Hand reset operation indicator	yes/no	yes	yes		
9.12	Manual blocking possibility	yes/no	yes	yes		
10	<u>High Set and Low Set Over Current Relay</u>		HS	LS	HS	LS
10.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.3	Rated current		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.4	Current setting range		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.5	Mounting arrangement		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.6	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.7	Rated auxiliary DC voltage	V	110v DC	110v DC		
10.8	Hand reset operation indicator	yes/no	yes	yes		
10.9	Current setting range of instantaneous unit	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
10.10	Second harmonic blocking feature	yes/no	yes	yes		
10.11	IEC 61850 communication protocol support	yes/no	yes	yes		
11	<u>Thermal over load Protection Relay</u>					
11.1	Manufacturer :		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
11.4	Rated auxiliary DC voltage	V	110v DC	110v DC		
11.5	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
11.6	Mounting arrangement		Flush mounted	Flush mounted		
11.7	Hand reset operation indicator	yes/no	yes	yes		
11.8	Current setting range of inverse unit / step		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.9	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.10	fifth harmonic blocking feature	yes/no	yes	yes		
11.11	Current setting range / step of instantaneous unit		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.12	type of characteristic		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
12	<u>Aux/Earthing Transformer Sensitive Earth Fault Protection Relay</u>					
12.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.3	Rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.4	Current setting range in inverse characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.5	Current setting range in instantaneous/definite characteristic / step	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.6	Time setting range / step	Sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.7	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.8	Mounting arrangement		Flush mounted	Flush mounted		
12.9	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.10	Rated auxiliary DC voltage	V	110v DC	110v DC		
12.11	Hand reset operation indicator	yes/no	yes	yes		
12.12	Current setting range of instantaneous unit	A				
12.13	Second harmonic blocking feature	yes/no	yes	yes		
12.14	Minimum pick-up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
13	<u>Breaker Failure Protection (with Short zone)</u>		400kV Side	220kV Side	400kV Side	220kV Side
13.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.2	Applied standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.3	Rated Value of Current		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.4	Setting range & accuracy class of characteristic quantity		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.5	Drop out current as % of pick up current		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.6	Pick up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.7	Resetting time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.8	Frequency	Hz	50	50		
13.9	Burden		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.10	Time details (rag etc):					
	Number of timer		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Auxiliary voltage	V	110v DC	110v DC		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Timing range	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.11	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.12	Limiting Short time thermal withstand value		Should be Filled By Tenderer	Should be Filled By Tenderer		
13.13	Values of Auxiliary DC and its permissible variation	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.14	DC consumption	W	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.15	Contact data:					
	Number		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Continuous rating at 110VDC	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.16	Mounting position	flush/Surface/etc	Flush Mounted	Flush Mounted		
13.17	Accessories (if essential to relay performance) provided	yes/no	yes	yes		
13.18	Hand reset operation indicator with inscription provided	yes/no	yes	yes		
13.19	Burden	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.20	Dielectric test voltage	KV/sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
13.21	IEC 61850 communication protocol support	yes/no	yes	yes		
14	<u>AVR Relay</u>		400/220 kV		400/220 kV	
14.1	Manufacturer :					
	Name		Should be Filled By Tenderer			
	Country		Should be Filled By Tenderer			

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
	Type designation		Should be Filled By Tenderer	
14.2	Applicable standard		Should be Filled By Tenderer	
14.3	Relay rated current	A	Should be Filled By Tenderer	
14.4	Relay rated voltage	V	Should be Filled By Tenderer	
14.5	Rated auxiliary DC voltage	Vdc	110V DC	
14.6	Current circuit power consumption	VA	Should be Filled By Tenderer	
14.7	Voltage circuit power consumption	VA	Should be Filled By Tenderer	
14.8	Rated frequency range	Hz	50	
14.9	Regulating voltage setting range / step	V	Should be Filled By Tenderer	
14.10	Dead band voltages setting / step	V	Should be Filled By Tenderer	
14.11	Initial time delay setting / step :			
	Inverse		Should be Filled By Tenderer	
	Definite		Should be Filled By Tenderer	
14.12	Inter tap delay		Should be Filled By Tenderer	
14.13	Under voltage setting /step	V	Should be Filled By Tenderer	
14.14	Over voltage setting / step	V	Should be Filled By Tenderer	
14.15	Load over current setting / step	A	Should be Filled By Tenderer	
14.16	Circulating current setting /step		Should be Filled By Tenderer	
14.17	Line drop compensation setting / step :			
	Reactive setting		Should be Filled By Tenderer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Reactive setting		Should be Filled By Tenderer			
14.18	Out-put contacts :					
	Number		Should be Filled By Tenderer			
	Type	NO/NC	Should be Filled By Tenderer			
	Rated breaking capacity	VA	Should be Filled By Tenderer			
	Rated continuous current	A	Should be Filled By Tenderer			
14.19	Mounting arrangement		Should be Filled By Tenderer			
14.20	Hand reset operation indicator	yes/no	yes			
14.21	IEC 61850 communication protocol support	yes/no	yes			
14.22	Transformer Monitoring in accordance to IEC 60354 and IEC 60076	yes/no	yes			
*	<u>Busbar Protection</u>					
1	<u>Differential Protection Relay</u>		400kV	220kV	400kV	220kV
1.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.2	Type reference		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.3	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.4	Relay type, static or elec. Mech. or other system of measuring basis (High imp, restrain current , directional comparison, etc)		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.5	Relay rated current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.6	Relay burden	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.7	Frequency	Hz	50	50		
1.8	Current setting range :		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.9	Phase / earth fault	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.10	Phase / Phase fault	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.11	Time between fault commencement and initiation of trip:		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.12	At 3 times fault setting	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.13	At 10 times fault setting	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.14	Max through fault current for which relay is stable	KA	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.15	CT supervision relay	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.16	Current Transformer requirement :					
	Formula for knee point voltage		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Max of magnetization current		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.17	CT Supervision relay details:					
	Type and manufacturer		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Alarm pick up current		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Alarm pick up time		Should be Filled By Tenderer	Should be Filled By Tenderer		
	short circuit CT lead provided	yes/no	yes	yes		
	Blocking trip after a preset time provided	yes/no	yes	yes		
1.18	Relay allowable saturation factor		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.19	Hand reset operation indicator provided	yes/no	yes	yes		
1.20	Mounting position (flush , surface , etc)		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.21	Rated values of auxiliary energizing quantity & its permissible variation	VDC	110v DC	110v DC		
1.22	Short time rating	KA/sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.23	Fault setting with maximum number of CTs connected		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.24	Isolating auxiliary switches provided	yes/no	yes	yes		
1.25	Accessories (Essential to really performance) provided	yes/no	yes	yes		
1.26	No of tripping relays		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.27	Interference test (Mhz)	KV	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.28	Surge test (12/50 micro second)	KV	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.29	Self monitoring of its important circuit possible	yes/no	Yes	Yes		
1.30	Automatic testing is possible	yes/no	Yes	Yes		
1.31	IEC 61850 communication protocol support	yes/no	yes	yes		
2	U/O Voltage Relay for Distribution Busbars		Under Voltage	Over Voltage	Under Voltage	Over Voltage

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
2.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.3	Rated voltage	V	110V DC	110V DC		
2.4	Rated auxiliary DC voltage	V	110V DC	110V DC		
2.5	Resetting ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.6	Time delay setting range / step	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.7	Time characteristic		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.8	voltage Setting range / step	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.9	Power consumption	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.10	Mounting arrangement		Flush mounted	Flush mounted		
2.11	Hand reset operation indicator	yes/no	yes	yes		
2.12	Manual blocking possibility	yes/no	yes	yes		
3	<u>High Speed Auxiliary Relay (self-reset)</u>					
3.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING			UNIT	DATA			
				REQUIRED		OFFERED	
	Country			Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation			Should be Filled By Tenderer	Should be Filled By Tenderer		
3.2	Rated voltage		VDC	110v DC	110v DC		
3.3	Targets		yes/no	yes	yes		
3.4	Number of contacts			Should be Filled By Tenderer	Should be Filled By Tenderer		
3.5	Pick up time:						
	Make Contact (NO)		ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Break contact (NC)		ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.6	Pickup/ drop off ratio			Should be Filled By Tenderer	Should be Filled By Tenderer		
3.7	Permitted ambient temperature - indoor		°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.8	Permitted ambient temperature - outdoor		°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.9	Contacts detail:						
	rated voltage (ac/dc)		V	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Maximum system voltages			Should be Filled By Tenderer	Should be Filled By Tenderer		
3.10	Current carrying capacity:						
	short time		A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	continuously		A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Making and conducting capacity		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Breaking Capacity		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.11	Type of Mounting		Rail mounted	Rail mounted		
*	<u>General Relays</u>					
1	<u>Self Reset Trip Relay</u>		Heavy Duty	High Speed	Heavy Duty	High Speed
1.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.2	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.3	Pick-up time	msec	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.4	Voltage in percent of rated voltage for :					
	Pick-up		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Reset		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.5	Continuous current carrying capacity of already		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.6	closed contacts	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.7	Current breaking capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.8	Current making capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.9	Mounting arrangement		flush mounted	flush mounted		
2	<u>Fuse Failure relay</u>					
2.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.3	Operating time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.4	Rated voltage	V	110v DC	110v DC		
2.5	Mounting		flush mounted	flush mounted		
2.6	Monitoring fuse fail of 1, 2 or 3 phase	yes/no	yes	yes		
2.7	Hand reset operation indicator	yes/no	yes	yes		
2.8	setting range		Should be Filled By Tenderer	Should be Filled By Tenderer		
3	<u>Close Relay</u>					
3.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.2	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.3	Pick-up time	msec	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.4	Voltage in percent of rated voltage for :					
	Pick-up		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Reset		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.5	Closed contacts continuous current capacity	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.6	Current breaking capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.7	Current making capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
3.8	Mounting arrangement		flush mounted	flush mounted		
4	<u>Lockout Relay</u>					
4.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.2	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.3	Pick-up time	msec	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
4.4	Voltage in percent of rated voltage for :					
	Pick-up		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Reset		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.5	Continuous current carrying capacity of already		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.6	closed contacts	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.7	Current breaking capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.8	Current making capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.9	Hand reset operation indicator	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
4.10	Mounting arrangement		flush mounted	flush mounted		
5	<u>TCS & CCS relay</u>		TCS	CCS	TCS	CCS
5.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.2	Rated auxiliary DC voltage	V	110v DC	110v DC		
5.3	Supervision of CB open and close position	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.4	Hand reset operation indicator provided	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.5	Mounting arrangement		flush mounted	flush mounted		
5.6	Circuit breaker trip coil current	mA	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.7	Pick-up time	msec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.8	Continuous current carrying for closed contacts	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6	<u>Switching Control Relay</u>					
6.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.3	ambient temprature	c	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.4	controlled switching (opening , closing or both of them)		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.5	operation modes	single mode / double mode	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.6	adaptation control function	yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.7	targets for controlled switching	rapidmode/ secured mode/ both of them	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING			UNIT	DATA			
				REQUIRED		OFFERED	
6.8	adaptation control function		yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.9	type of controlled load		transmissionline/ power transformer/ capacitor /reactor	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.10	analogue inputs:						
	voltage reference input value / range		V	Should be Filled By Tenderer	Should be Filled By Tenderer		
	current measuring input value / range		A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	control voltage input value / range		V	Should be Filled By Tenderer	Should be Filled By Tenderer		
	temperature variation sensor input / range			Should be Filled By Tenderer	Should be Filled By Tenderer		
	pressure variation sensor input / range			Should be Filled By Tenderer	Should be Filled By Tenderer		
6.11	Drop-off / pick-up ratio			Should be Filled By Tenderer	Should be Filled By Tenderer		
6.12	Hand reset operation indicator		yes/no	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.13	Mounting arrangement			Should be Filled By Tenderer	Should be Filled By Tenderer		
6.14	Power Supply		V	110v DC	110v DC		
6.15	Power consumption		VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.16	digital input data:		yes/no	yes	yes		
	Number			Should be Filled By Tenderer	Should be Filled By Tenderer		
	application			Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Continuous rating	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.17	open/ close power output data:	yes/no	yes	yes		
	Number		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Continuous rating	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Breaking capacity	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	operating time	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.18	signal output data	yes/no	yes	yes		
6.19	Number					
	Continuous rating	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Breaking capacity	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
6.20	interface communication		Should be Filled By Tenderer	Should be Filled By Tenderer		
6.21	Accessories (if essential to relay performance) provided	yes/no	yes	yes		
6.22	EMC tests	KV/sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
7	<u>Pole Discordance Relay</u>					
7.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.2	Applied standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.3	Rated Value of Current		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.4	Setting range & accuracy of characteristic quantity		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.5	Drop out current as % of pick up current		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.6	Pick up time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.7	Resetting time	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
7.8	Frequency	Hz	50	50		
7.9	Burden		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.10	Number of timers		Should be Filled By Tenderer	Should be Filled By Tenderer		
7.11	Auxiliary voltage	V	110v DC	110v DC		
8	<u>Auxiliary Relay With Flag</u>					
8.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.2	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.3	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
8.4	Pick-up time	msec	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.5	Voltage in percent of rated voltage for :					
	Pick-up		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Reset		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.6	Continuous current carrying capacity of already		Should be Filled By Tenderer	Should be Filled By Tenderer		
8.7	closed contacts	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.8	Current breaking capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.9	Current making capacity (L/R >10 msec)	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
8.10	Hand reset operation indicator	yes/no	yes	yes		
8.11	Mounting arrangement		flush mounted	flush mounted		
9	<u>Auxiliary relay (self reset)</u>					
9.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.2	Rated voltage	VDC	110v DC	110v DC		
9.3	Targets	yes/no	yes	yes		
9.4	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
9.5	Pick up time :					
	Make Contact (NO)	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Break contact (NC)	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.6	Pickup / drop off ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.7	Permitted ambient temperature - indoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.8	Permitted ambient temperature - outdoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.9	Contacts detail:					
	rated voltage (ac/dc)	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Maximum system voltages		Should be Filled By Tenderer	Should be Filled By Tenderer		
9.10	Current carrying capacity:					
	short time	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	continuously	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Making and conducting capacity	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Breaking Capacity	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
9.11	Type of Mounting		rail mounted	rail mounted		
10	<u>High Speed Auxiliary Relay (self reset)</u>					
10.1	Manufacturer :					

k) PROTECTION, CONTROL AND METERING			UNIT		DATA	
			REQUIRED		OFFERED	
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.2	Rated voltage	VDC	110v DC	110v DC		
10.3	Targets	yes/no	yes	yes		
10.4	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.5	Pick up time:					
	Make Contact (NO)	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Break contact (NC)	ms	Should be Filled By Tenderer	Should be Filled By Tenderer		
10.6	Pickup/ drop off ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.7	Permitted ambient temperature - indoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
10.8	Permitted ambient temperature - outdoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
10.9	Contacts detail:					
	rated voltage (ac/dc)	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Maximum system voltages		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.10	Current carrying capacity:					
	short time	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	continuously	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
	Making and conducting capacity		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Breaking Capacity		Should be Filled By Tenderer	Should be Filled By Tenderer		
10.11	Type of Mounting		rail mounted	rail mounted		
11	<u>Time Delay Relay</u>					
11.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.2	Rated voltage	VDC	110v DC	110v DC		
11.3	Output contact function		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.4	Reset time		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.5	Target provided		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.6	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.7	Consistency in operate time		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.8	Principle of operation		Should be Filled By Tenderer	Should be Filled By Tenderer		
11.9	Permitted ambient temperature - indoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
11.10	Permitted ambient temperature - outdoor	°c	Should be Filled By Tenderer	Should be Filled By Tenderer		
11.11	Type of mounting		rail mounted	rail mounted		
11.12	Setting range		Should be Filled By Tenderer	Should be Filled By Tenderer		
12	<u>Protection Relay Test Block</u>					
12.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.2	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.3	Rated voltage	V	110v DC	110v DC		
12.4	Rated Current	A	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.5	short circuit current capacity	A/s	Should be Filled By Tenderer	Should be Filled By Tenderer		
12.6	Number of contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.7	Type of mounting		flush mounted	flush mounted		
12.8	number of current contacts		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.9	secondary CT contacts are shorted	yes/no	yes	yes		
12.10	storage/ working temperature range		Should be Filled By Tenderer	Should be Filled By Tenderer		
12.11	impulse withstand voltage	kV	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
12.12	test plug type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
*	<u>Control System Equipment</u>					
1	<u>Synchronizing Equipment</u>					
1.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.2	Applicable standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.3	Rated auxiliary DC voltage	V	110v DC	110v DC		
1.4	Rated frequency	Hz	50	50		
1.5	Rated CVT secondary voltage	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.6	Mounting arrangement		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.7	Maximum slip frequency at which CB closes	Hz	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.8	Maximum phase difference at which CB closes		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.9	Accuracy		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.10	Continuous over voltage rating	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
1.11	Short time rating		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
2	<u>Double voltmeter:</u>					
2.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.2	Setting Range / step		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.3	Overall dimensions	mm*mm	Should be Filled By Tenderer	Should be Filled By Tenderer		
2.4	Type of mounting		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.5	Method of mounting		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.6	Total deflection angle		240	240		
2.7	Total scale length		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.8	Burden		Should be Filled By Tenderer	Should be Filled By Tenderer		
2.9	Accuracy		1.5	1.5		
3	<u>Double frequency meter:</u>					
3.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.2	Range		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.3	Overall dimensions		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.4	Type of mounting		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.5	Method of mounting		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.6	Total deflection angle	deg	240	240		
3.7	Total scale length		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.8	Burden		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.9	Accuracy		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.10	Synchroscope:		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.11	Overall dimensions		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.12	Type of mounting		Should be Filled By Tenderer	Should be Filled By Tenderer		
3.13	Method of mounting		Flush mounted	Flush mounted		
4	<u>Synchro-scope meter:</u>					
4.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.2	Type and manufacturer		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.3	Rated voltage / frequency		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.4	Voltage difference setting range		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.5	Phase angle difference setting range		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.6	Frequency difference setting range (slip)					
	Paralleling		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Synchronizing		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.7	Operating time		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.8	Resetting time		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.9	Duration of output signal		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.10	Dead voltage limit		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.11	Live voltage limit		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.12	Over load capacity		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.13	Pick-up to drop-off ratio		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.14	Duration of output signal		Should be Filled By Tenderer	Should be Filled By Tenderer		
4.15	Method of mounting		Flush mounted	Flush mounted		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5	<u>Synchronizing relay</u>					
5.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.2	Applied standard		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.3	number of auto recloser shots		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.4	Relay type (microprocessor)		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.5	whether operation indicator provided	yes/no	yes	yes		
5.6	provision for blocking and switching in the relay from :		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.7	control / relay panel	yes/no	yes	yes		
5.8	remote control	yes/no	yes	yes		
5.9	range of dead time adjustment	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.10	range of reclaim time adjustment	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.11	closing pulse time	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.12	Method of blocking auto recloser		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.13	when circuit breaker is open		Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.14	when closing into a fault		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.15	whether operation counter provided	yes/no	yes	yes		
5.16	whether following features provided for safe closing		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.17	synchronizing check in live bus / live line	yes/no	yes	yes		
5.18	live line / dead bus	yes/no	yes	yes		
5.19	live bus / dead line	yes/no	yes	yes		
5.20	dead bus / dead line	yes/no	yes	yes		
5.21	Time details (rag etc):					
	Number of timer		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Auxiliary voltage	V	110v DC	110v DC		
	Timing range	sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.22	Number of phases		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.23	Limiting Short time thermal withstand value		Should be Filled By Tenderer	Should be Filled By Tenderer		
5.24	Values of Auxiliary DC and its permissible variation	V	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.25	DC consumption	W	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.26	Contact data:					
	Number		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Continuous rating at 110VDC	A	Should be Filled By Tenderer	Should be Filled By Tenderer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.27	Mounting position	flush/Surface/etc	Flush mounted	Flush mounted		
5.28	Accessories (if essential to relay performance) provided	yes/no	yes	yes		
5.29	Hand reset operation indicator with inscription provided	yes/no	yes	yes		
5.30	Burden	VA	Should be Filled By Tenderer	Should be Filled By Tenderer		
5.31	Dielectric test voltage	KV/sec	Should be Filled By Tenderer	Should be Filled By Tenderer		
*	<u>Annunciators</u>					
1	<u>DC Operated</u>					
1.1	Manufacturer :					
	Name		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Country		Should be Filled By Tenderer	Should be Filled By Tenderer		
	Type designation		Should be Filled By Tenderer	Should be Filled By Tenderer		
1.2	Applicable standard		Based on bidder's offer	Based on bidder's offer		
1.3	Rated auxiliary DC supply voltage		110v DC	110v DC		
1.4	Speed of operation msec		Based on bidder's offer	Based on bidder's offer		
1.5	Dimensions of each window mm		Based on bidder's offer	Based on bidder's offer		
1.6	Type of reset	manual / auto	Based on bidder's offer	Based on bidder's offer		
1.7	Urgent and non-urgent alarm discrimination	yes/no	yes	yes		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.8	Type of audible alarm for :					
	Urgent cases		Based on bidder's offer	Based on bidder's offer		
	Non-Urgent cases		Based on bidder's offer	Based on bidder's offer		
1.9	Whether suitable for normally open contacts	yes/no	yes	yes		
1.10	Type (solid state/digital type)	solidstate/digital type	Based on bidder's offer	Based on bidder's offer		
1.11	Total power consumption per alarm point :					
	Normal condition	W	Based on bidder's offer	Based on bidder's offer		
	Flashing condition	W	Based on bidder's offer	Based on bidder's offer		
	Steady condition	W	Based on bidder's offer	Based on bidder's offer		
1.12	Number of windows :		Based on bidder's offer	Based on bidder's offer		
1.13	On each control panel		Based on bidder's offer	Based on bidder's offer		
1.14	Total		Based on bidder's offer	Based on bidder's offer		
1.15	10% spare windows provided	yes/no	yes	yes		
1.16	Suitable for normally open contacts	yes/no	yes	yes		
1.17	Whether lamp test , acknowledge , accept and reset push button is provided for each panel	yes/no	yes	yes		
*	<u>Metering and Measuring equipments</u>					
1	<u>Ammeter (Separate from MC)</u>					

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.1	Manufacturer :		Based on bidder's offer	Based on bidder's offer		
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
1.2	Applicable standard		Based on bidder's offer	Based on bidder's offer		
1.3	Type	digital	Based on bidder's offer	Based on bidder's offer		
1.4	Range	A	Based on bidder's offer	Based on bidder's offer		
1.5	Accuracy class		Based on bidder's offer	Based on bidder's offer		
1.6	Rated frequency	Hz	50	50		
1.7	CT secondary current	A	Based on bidder's offer	Based on bidder's offer		
1.8	Total deflection angle		Based on bidder's offer	Based on bidder's offer		
1.9	Continuous overload rating of current coil in Percent of rated current		Based on bidder's offer	Based on bidder's offer		
1.10	Degree scale	Degree	240	240		
1.11	Dimensions	mm*mm	Based on bidder's offer	Based on bidder's offer		
2	<u>Voltmeters (Separate from MC)</u>					
2.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
2.2	Applicable standard		Based on bidder's offer	Based on bidder's offer		
2.3	Type	Moving coil / digital	Based on bidder's offer	Based on bidder's offer		
2.4	Range	kV	Based on bidder's offer	Based on bidder's offer		
2.5	Accuracy class		Based on bidder's offer	Based on bidder's offer		
2.6	Rated frequency		Based on bidder's offer	Based on bidder's offer		
2.7	PT secondary voltage V		Based on bidder's offer	Based on bidder's offer		
2.8	Total deflection angle Degree		Based on bidder's offer	Based on bidder's offer		
2.9	Continuous over voltage rating of voltage coil in percent of rated voltage		Based on bidder's offer	Based on bidder's offer		
2.10	Degree scale	Degree	240			
2.11	Dimensions	mm*mm	Based on bidder's offer	Based on bidder's offer		
3	<u>PF and Freq. meters (Separate from MC)</u>		PF	Freq	PF	Freq
3.1	Type and manufacturer		Based on bidder's offer	Based on bidder's offer		
3.2	Accuracy class		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
3.3	Permitted ambient temperature C		Based on bidder's offer	Based on bidder's offer		
3.4	Voltage rating		Based on bidder's offer	Based on bidder's offer		
3.5	Current rating		Based on bidder's offer	Based on bidder's offer		
3.6	Total deflection angle		Based on bidder's offer	Based on bidder's offer		
3.7	Continuous overload rating of current circuit A		Based on bidder's offer	Based on bidder's offer		
3.8	Continuous overload rating of voltage circuit V		Based on bidder's offer	Based on bidder's offer		
3.9	Short time overload rating of current circuit(3 sec)A		Based on bidder's offer	Based on bidder's offer		
3.10	Short time overload rating of voltage circuit (3 sec)V		Based on bidder's offer	Based on bidder's offer		
3.11	Lead-lag measuring Yes/No		Based on bidder's offer	Based on bidder's offer		
3.12	Measuring range		Based on bidder's offer	Based on bidder's offer		
3.13	Wide range between 0/8 to 1 on both sides (lead & leg) with transducer	yes / no	Based on bidder's offer	Based on bidder's offer		
3.14	Output voltage / current range of the transducer		Based on bidder's offer	Based on bidder's offer		
3.15	Overall dimensions	mm*mm	Based on bidder's offer	Based on bidder's offer		
3.16	Rated frequency	Hz	50	50		
3.17	Type of mounting		Based on bidder's offer	Based on bidder's offer		
3.18	Insulation test voltage for one minute	KVrms	Based on bidder's offer	Based on bidder's offer		
3.19	Low reflection glass	yes / no	yes	yes		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
3.20	Protection degree		Based on bidder's offer	Based on bidder's offer		
4	<u>MW and MVAR meters (Separate from MC)</u>		Based on bidder's offer	Based on bidder's offer		
4.1	Manufacturer :		Based on bidder's offer	Based on bidder's offer		
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
4.2	Applicable standard		Based on bidder's offer	Based on bidder's offer		
4.3	Accuracy		Based on bidder's offer	Based on bidder's offer		
4.4	Frequency		50	50		
4.5	Current range A		Based on bidder's offer	Based on bidder's offer		
4.6	Voltage range V		Based on bidder's offer	Based on bidder's offer		
4.7	Continuous rating of :		Based on bidder's offer	Based on bidder's offer		
	Current circuit	% In	Based on bidder's offer	Based on bidder's offer		
	Voltage circuit	% Vn	Based on bidder's offer	Based on bidder's offer		
4.8	Dimensions	mm* mm	Based on bidder's offer	Based on bidder's offer		
4.9	Mounting arrangement		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
4.10	Type (static)		Based on bidder's offer	Based on bidder's offer		
5	<u>Measuring center</u>					
5.1	Type		Based on bidder's offer	Based on bidder's offer		
5.2	Manufacturer :		Based on bidder's offer	Based on bidder's offer		
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
5.3	Accuracy :					
	Active and reactive energy		Based on bidder's offer	Based on bidder's offer		
	Voltage		Based on bidder's offer	Based on bidder's offer		
	Current		Based on bidder's offer	Based on bidder's offer		
	Power		Based on bidder's offer	Based on bidder's offer		
	Frequency		Based on bidder's offer	Based on bidder's offer		
5.4	Voltage input :					
	Rated voltage		Based on bidder's offer	Based on bidder's offer		
	Measuring range with separate auxiliary supply		Based on bidder's offer	Based on bidder's offer		
	Measuring range - self Powered		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Burden with auxiliary supply		Based on bidder's offer	Based on bidder's offer		
	Burden - self powered		Based on bidder's offer	Based on bidder's offer		
	Rated frequency		Based on bidder's offer	Based on bidder's offer		
	Frequency range		Based on bidder's offer	Based on bidder's offer		
	Overload capacity		Based on bidder's offer	Based on bidder's offer		
5.5	Current input :					
	Rated current		Based on bidder's offer	Based on bidder's offer		
	Maximum current		Based on bidder's offer	Based on bidder's offer		
	Burden		Based on bidder's offer	Based on bidder's offer		
	Overload capacity		Based on bidder's offer	Based on bidder's offer		
5.6	AC auxiliary supply :					
	Auxiliary voltages		Based on bidder's offer	Based on bidder's offer		
	Optional auxiliary voltages		Based on bidder's offer	Based on bidder's offer		
	Supply voltage range		Based on bidder's offer	Based on bidder's offer		
	Burden		Based on bidder's offer	Based on bidder's offer		
	Overload		Based on bidder's offer	Based on bidder's offer		
5.7	Display :					

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	LCD (No of lines)		Based on bidder's offer	Based on bidder's offer		
	Number of digits		Based on bidder's offer	Based on bidder's offer		
	Height of digits		Based on bidder's offer	Based on bidder's offer		
	Width of digits		Based on bidder's offer	Based on bidder's offer		
5.8	Output relays :					
	Contact rating		Based on bidder's offer	Based on bidder's offer		
	Maximum switching power		Based on bidder's offer	Based on bidder's offer		
	Maximum number of pulses		Based on bidder's offer	Based on bidder's offer		
	Pulse duration		Based on bidder's offer	Based on bidder's offer		
5.9	Design :					
	Degree of protection		Based on bidder's offer	Based on bidder's offer		
	Weight		Based on bidder's offer	Based on bidder's offer		
	Dimensions		Based on bidder's offer	Based on bidder's offer		
	Mounting		Based on bidder's offer	Based on bidder's offer		
5.10	Ambient conditions :					
	Temperature - operation		Based on bidder's offer	Based on bidder's offer		
	Temperature - storage		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Humidity		Based on bidder's offer	Based on bidder's offer		
6	<u>Energy Meters ((Separate from MC)</u>					
6.1	Manufacturer :		Based on bidder's offer	Based on bidder's offer		
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
6.2	Applicable standard		Based on bidder's offer	Based on bidder's offer		
6.3	Accuracy		Based on bidder's offer	Based on bidder's offer		
6.4	Frequency	Hz	50	50		
6.5	Current range suitable for	A	Based on bidder's offer	Based on bidder's offer		
6.6	Voltage range suitable for	V	110	110		
6.7	Reverse running stop provided	yes/no	Based on bidder's offer	Based on bidder's offer		
6.8	Impulse contact provided	yes/no	Based on bidder's offer	Based on bidder's offer		
6.9	Whether test blocks provided	yes/no	Based on bidder's offer	Based on bidder's offer		
6.10	Mounting arrangement		Based on bidder's offer	Based on bidder's offer		
6.11	power consumption :					
	Current circuit	VA	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Voltage circuit	VA	Based on bidder's offer	Based on bidder's offer		
6.12	Continuous rating of :					
	Current circuit	%In	Based on bidder's offer	Based on bidder's offer		
	Voltage circuit	% Vn	Based on bidder's offer	Based on bidder's offer		
6.13	Number of digits on the meter		Based on bidder's offer	Based on bidder's offer		
*	<u>Transducer</u>					
1	<u>MW/MVAR</u>					
1.1	Make and type		Based on bidder's offer	Based on bidder's offer		
1.2	Compliance with IEC 60688		Based on bidder's offer	Based on bidder's offer		
1.3	Auxiliary power voltage range	V	Based on bidder's offer	Based on bidder's offer		
1.4	Combined or separate units		Based on bidder's offer	Based on bidder's offer		
1.5	Service conditions (temperature & RH)		Based on bidder's offer	Based on bidder's offer		
1.6	Connections (eg two voltage & two current)		Based on bidder's offer	Based on bidder's offer		
1.7	Input voltage range	V	Based on bidder's offer	Based on bidder's offer		
1.8	Input current range	A	Based on bidder's offer	Based on bidder's offer		
1.9	Output current	A	Based on bidder's offer	Based on bidder's offer		
1.10	Accuracy class		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.11	Burden	VA	Based on bidder's offer	Based on bidder's offer		
1.12	Overload	%	Based on bidder's offer	Based on bidder's offer		
1.13	Case or rack mounted		Based on bidder's offer	Based on bidder's offer		
2	<u>Voltage</u>					
2.1	Make and type		Based on bidder's offer	Based on bidder's offer		
2.2	Compliance with IEC 69688		Based on bidder's offer	Based on bidder's offer		
2.3	Auxiliary power voltage range	V	Based on bidder's offer	Based on bidder's offer		
2.4	Service conditions (temperature & RH)		Based on bidder's offer	Based on bidder's offer		
2.5	Input current Amps	A	Based on bidder's offer	Based on bidder's offer		
2.6	Output current Amps	A	Based on bidder's offer	Based on bidder's offer		
2.7	Accuracy class	%	Based on bidder's offer	Based on bidder's offer		
2.8	Burden	VA	Based on bidder's offer	Based on bidder's offer		
2.9	Overload	%	Based on bidder's offer	Based on bidder's offer		
2.10	Case or rack mounted		Based on bidder's offer	Based on bidder's offer		
3	<u>Current</u>					
3.1	Make and type		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
3.2	Compliance with IEC 60688		Based on bidder's offer	Based on bidder's offer		
3.3	Auxiliary power voltage range	V	Based on bidder's offer	Based on bidder's offer		
3.4	Service conditions (temperature & RH)		Based on bidder's offer	Based on bidder's offer		
3.5	Input current range	A	Based on bidder's offer	Based on bidder's offer		
3.6	Output current	A	Based on bidder's offer	Based on bidder's offer		
3.7	Accuracy class	%	Based on bidder's offer	Based on bidder's offer		
3.8	Burden	VA	Based on bidder's offer	Based on bidder's offer		
3.9	Overload	%	Based on bidder's offer	Based on bidder's offer		
3.10	Case or rack mounted		Based on bidder's offer	Based on bidder's offer		
4	<u>Frequency</u>					
4.1	Make and type		Based on bidder's offer	Based on bidder's offer		
4.2	Compliance with IEC 60688		Based on bidder's offer	Based on bidder's offer		
4.3	Auxiliary power voltage rang Watts	W	Based on bidder's offer	Based on bidder's offer		
4.4	Service conditions (temperature e& RH)		Based on bidder's offer	Based on bidder's offer		
4.5	Input frequency range (eg nominal = 5%)	Hz	50	50		
4.6	Output current Amps	A	Based on bidder's offer	Based on bidder's offer		
4.7	Accuracy class	%	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
4.8	Burden	VA	Based on bidder's offer	Based on bidder's offer		
4.9	Overload	%	Based on bidder's offer	Based on bidder's offer		
4.10	Case or rack mounted		Based on bidder's offer	Based on bidder's offer		
5	<u>Auxiliary relay (self reset)</u>					
5.1	Manufacturer		Based on bidder's offer	Based on bidder's offer		
5.2	Type		Based on bidder's offer	Based on bidder's offer		
5.3	Rated voltage	Vdc	Based on bidder's offer	Based on bidder's offer		
5.4	Targets	yes/no	yes	yes		
5.5	Number of contacts		Based on bidder's offer	Based on bidder's offer		
5.6	Pick up time :					
	Make Contact (NO)	ms	Based on bidder's offer	Based on bidder's offer		
	Break contact (NC)	ms	Based on bidder's offer	Based on bidder's offer		
5.7	Pickup / drop off ratio		Based on bidder's offer	Based on bidder's offer		
5.8	Permitted ambient temperature - indoor	°c	Based on bidder's offer	Based on bidder's offer		
5.9	Permitted ambient temperature - outdoor	°c	Based on bidder's offer	Based on bidder's offer		
5.10	Type of Mounting		Rail mounted	Rail mounted		
5.11	Utilization category		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.12	Contacts detail:		Based on bidder's offer	Based on bidder's offer		
	rated voltage (ac/dc)	V	110	110		
	Maximum system voltages	V	Based on bidder's offer	Based on bidder's offer		
	Current carrying capacity	A	Based on bidder's offer	Based on bidder's offer		
	short time	A	Based on bidder's offer	Based on bidder's offer		
	continuously	A	Based on bidder's offer	Based on bidder's offer		
	Making and conducting capacity	A	Based on bidder's offer	Based on bidder's offer		
	Breaking Capacity	A	Based on bidder's offer	Based on bidder's offer		
6	<u>Time Delay Relay</u>					
6.1	Manufacturer/Country		Based on bidder's offer	Based on bidder's offer		
6.2	Type		Based on bidder's offer	Based on bidder's offer		
6.3	Rated voltage	Vdc	110	110		
6.4	Output contact function		Based on bidder's offer	Based on bidder's offer		
6.5	Reset time		Based on bidder's offer	Based on bidder's offer		
6.6	Target provided		Based on bidder's offer	Based on bidder's offer		
6.7	Number of contacts		Based on bidder's offer	Based on bidder's offer		
6.8	Consistency in operate time		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
6.9	Principle of operation		Based on bidder's offer	Based on bidder's offer		
6.10	Permitted ambient temperature - indoor	°c	Based on bidder's offer	Based on bidder's offer		
6.11	Permitted ambient temperature - outdoor	°c	Based on bidder's offer	Based on bidder's offer		
6.12	Type of mounting		Rail mounted	Rail mounted		
6.13	Setting range / step		Based on bidder's offer	Based on bidder's offer		
*	<u>Control Panel Accessories</u>					
1	<u>Discrepancy Control Switches :</u>					
1.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
1.2	Type designation for :					
	CB control switch		Based on bidder's offer	Based on bidder's offer		
	DS control switch		Based on bidder's offer	Based on bidder's offer		
1.3	Rating of contacts :					
	Voltage	V	110	110		
	Continuous current carrying	A	Based on bidder's offer	Based on bidder's offer		
	Make current	A	Based on bidder's offer	Based on bidder's offer		
	Break current	A	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
1.4	Dimensions :					
	CB control switch	mm*mm	Based on bidder's offer	Based on bidder's offer		
	DS control switch	mm*mm	Based on bidder's offer	Based on bidder's offer		
2	<u>Position indicators</u>					
2.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
	Type designation		Based on bidder's offer	Based on bidder's offer		
3	<u>Selector Switches</u>					
3.1	Manufacturer / name / country for :					
	Voltmeter switch		Based on bidder's offer	Based on bidder's offer		
	Ammeter switch		Based on bidder's offer	Based on bidder's offer		
	Auto-reclose on / off switch		Based on bidder's offer	Based on bidder's offer		
	Local supervisory switch		Based on bidder's offer	Based on bidder's offer		
3.2	Rating of contacts :					
	Voltage	V	110	110		
	Make current	A	Based on bidder's offer	Based on bidder's offer		
	Break current	A	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
3.3	Sub/SCADA switch for each CB provided	yes/no	yes	yes		
4	<u>Indicating lamps</u>					
4.1	Manufacturer					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
4.2	Type		LED	LED		
4.3	Voltage	V	110	110		
4.4	Consumption	W	Based on bidder's offer	Based on bidder's offer		
4.5	Whether series resistors provided	yes/no	Based on bidder's offer	Based on bidder's offer		
4.6	Permissible voltage variation	%	Based on bidder's offer	Based on bidder's offer		
4.7	Type of mounting		Based on bidder's offer	Based on bidder's offer		
5	<u>Push buttons</u>					
5.1	Manufacturer					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
5.2	Type					
5.3	No of NC contacts		Based on bidder's offer	Based on bidder's offer		
5.4	No of NO contacts		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
5.5	Rating of contacts :		Based on bidder's offer	Based on bidder's offer		
	Voltage	V	110	110		
	Make current	A	Based on bidder's offer	Based on bidder's offer		
	Break current	A	Based on bidder's offer	Based on bidder's offer		
	Carry continuously	A	Based on bidder's offer	Based on bidder's offer		
6	<u>Current Test Block</u>					
6.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
6.2	Type designation		Based on bidder's offer	Based on bidder's offer		
6.3	Rated voltage	V	Based on bidder's offer	Based on bidder's offer		
6.4	Rated Current	A	Based on bidder's offer	Based on bidder's offer		
6.5	short circuit current capacity	A/s	Based on bidder's offer	Based on bidder's offer		
6.6	Number of contacts		Based on bidder's offer	Based on bidder's offer		
6.7	Type of mounting		Based on bidder's offer	Based on bidder's offer		
6.8	number of current contacts		Based on bidder's offer	Based on bidder's offer		
6.9	secondary CT contacts are shorted	yes/no	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
6.10	storage/ working temperature range		Based on bidder's offer	Based on bidder's offer		
6.11	impulse withstand voltage	kV	Based on bidder's offer	Based on bidder's offer		
6.12	test plug type designation		Based on bidder's offer	Based on bidder's offer		
7	<u>Voltage Test Block</u>					
7.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
7.2	Type designation		Based on bidder's offer	Based on bidder's offer		
7.3	Rated voltage	V	110	110		
7.4	Rated Current	A	Based on bidder's offer	Based on bidder's offer		
7.5	short circuit current capacity	A/s	Based on bidder's offer	Based on bidder's offer		
7.6	Number of contacts		Based on bidder's offer	Based on bidder's offer		
7.7	Type of mounting		Based on bidder's offer	Based on bidder's offer		
7.8	number of current contacts		Based on bidder's offer	Based on bidder's offer		
7.9	secondary CT contacts are shorted	yes/no	Based on bidder's offer	Based on bidder's offer		
7.10	storage/ working temperature range		Based on bidder's offer	Based on bidder's offer		
7.11	impulse withstand voltage	kV	Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
7.12	test plug type designation		Based on bidder's offer	Based on bidder's offer		
8	<u>Digital Event Recorder</u>					
8.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
8.2	Type		Based on bidder's offer	Based on bidder's offer		
8.3	No of input channels offered		20	20		
8.4	Rated value of input voltage and tolerance		Based on bidder's offer	Based on bidder's offer		
8.5	Self testing facility					
	Manual and automatic initiation		Based on bidder's offer	Based on bidder's offer		
	Time between two tests adjustable		Based on bidder's offer	Based on bidder's offer		
	Information about defective parts indicated		Based on bidder's offer	Based on bidder's offer		
	No of free voltage contacts provided		Based on bidder's offer	Based on bidder's offer		
8.6	Sampling rate		Based on bidder's offer	Based on bidder's offer		
8.7	Filtering time		Based on bidder's offer	Based on bidder's offer		
8.8	Capacity of buffer memory		Based on bidder's offer	Based on bidder's offer		
8.9	Battery life provided for memories Time Lock :					

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Date/time information		Based on bidder's offer	Based on bidder's offer		
	Accuracy		Based on bidder's offer	Based on bidder's offer		
	Synchronize able		Based on bidder's offer	Based on bidder's offer		
	Battery life		Based on bidder's offer	Based on bidder's offer		
	Master clock for synchronization		Based on bidder's offer	Based on bidder's offer		
8.10	Display provided :					
	Printer		Based on bidder's offer	Based on bidder's offer		
	Type of paper		Based on bidder's offer	Based on bidder's offer		
	Printer faulty alarm/indication provided		Based on bidder's offer	Based on bidder's offer		
	Alarm/indication for paper end approach		Based on bidder's offer	Based on bidder's offer		
8.11	Possibility for manual recording of :					
	All inputs		Based on bidder's offer	Based on bidder's offer		
	All inputs which are at 0 status		Based on bidder's offer	Based on bidder's offer		
	All inputs which are at 1 status		Based on bidder's offer	Based on bidder's offer		
	Every selected input		Based on bidder's offer	Based on bidder's offer		
8.12	Power supply :					
	Read voltage and tolerance		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Consumption		Based on bidder's offer	Based on bidder's offer		
	Supervision for failure provided		Based on bidder's offer	Based on bidder's offer		
8.13	Ambient condition :					
	Min-Max Temperature in operation		Based on bidder's offer	Based on bidder's offer		
	Min-Max Temperature in storage		Based on bidder's offer	Based on bidder's offer		
	Relative humidity max					
8.14	Type of mounting		Based on bidder's offer	Based on bidder's offer		
8.15	Ambient condition					
	Min-Max Temperature in operation		Based on bidder's offer	Based on bidder's offer		
	Min-Max Temperature in storage		Based on bidder's offer	Based on bidder's offer		
	Relative humidity max	%	Based on bidder's offer	Based on bidder's offer		
8.16	Type of mounting		Based on bidder's offer	Based on bidder's offer		
8.17	Synchronizing with other E/R		Based on bidder's offer	Based on bidder's offer		
8.18	Specification of panel According to item A in Guarantee Table(panels)		Based on bidder's offer	Based on bidder's offer		
9	<u>Digital Fault Recorder</u>					
9.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
	Country		Based on bidder's offer	Based on bidder's offer		
9.2	Type		Based on bidder's offer	Based on bidder's offer		
9.3	Manufacturer/Country		Based on bidder's offer	Based on bidder's offer		
9.4	Number of card		Based on bidder's offer	Based on bidder's offer		
9.5	Number of AC Channels		20	20		
9.6	Number of DC Channels		Based on bidder's offer	Based on bidder's offer		
9.7	Date and time range		Based on bidder's offer	Based on bidder's offer		
9.8	Rated value of the current for Analog channel		Based on bidder's offer	Based on bidder's offer		
9.9	Rated value of the voltage for Analog channel Permissible		Based on bidder's offer	Based on bidder's offer		
9.10	over voltage :					
	Continuously		Based on bidder's offer	Based on bidder's offer		
	During 1 second		Based on bidder's offer	Based on bidder's offer		
9.11	Permissible over current :		Based on bidder's offer	Based on bidder's offer		
9.12	Continuously		Based on bidder's offer	Based on bidder's offer		
9.13	During 1 second		Based on bidder's offer	Based on bidder's offer		
9.14	Time interval recorded before starting of the recorder		Based on bidder's offer	Based on bidder's offer		
9.15	Time interval recorded after starting of the recorder		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
9.16	Power supply:		Based on bidder's offer	Based on bidder's offer		
9.17	Rated Voltage and tolerance		Based on bidder's offer	Based on bidder's offer		
9.18	Consumption		Based on bidder's offer	Based on bidder's offer		
9.19	Supervision for failure		Based on bidder's offer	Based on bidder's offer		
9.20	Self Testing		Based on bidder's offer	Based on bidder's offer		
9.21	Mounting Position		Based on bidder's offer	Based on bidder's offer		
9.22	Specification of panel According to Item A in Guarantee Table (panels)		Based on bidder's offer	Based on bidder's offer		
9.23	Permissible ambient temperature:					
	For storage		Based on bidder's offer	Based on bidder's offer		
	For correct operation		Based on bidder's offer	Based on bidder's offer		
9.24	Consumption for analog :					
	Voltage channel		Based on bidder's offer	Based on bidder's offer		
	Current Channel		Based on bidder's offer	Based on bidder's offer		
9.25	Total recording time		Based on bidder's offer	Based on bidder's offer		
9.26	Pre fault recording time		Based on bidder's offer	Based on bidder's offer		
9.27	Event resolution time		Based on bidder's offer	Based on bidder's offer		
9.28	Synchronizing with other F/R		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA			
			REQUIRED		OFFERED	
9.29	Capacity of hard disk mass storage		Based on bidder's offer	Based on bidder's offer		
9.30	Capacity of floppy disk mass storage		Based on bidder's offer	Based on bidder's offer		
9.31	Printer specification :					
	Method of printing		Based on bidder's offer	Based on bidder's offer		
	Printing mechanism		Based on bidder's offer	Based on bidder's offer		
	Printing speed		Based on bidder's offer	Based on bidder's offer		
	Type of paper		Based on bidder's offer	Based on bidder's offer		
9.32	Operating system of computer		Based on bidder's offer	Based on bidder's offer		
9.33	The dialog language		Based on bidder's offer	Based on bidder's offer		
9.34	Which of the following possibilities provided:					
	Printing of single channel		Based on bidder's offer	Based on bidder's offer		
	Screen printing facility		Based on bidder's offer	Based on bidder's offer		
	Setting and control of acquisition		Based on bidder's offer	Based on bidder's offer		
	Presentation in color		Based on bidder's offer	Based on bidder's offer		
	List of recorded event		Based on bidder's offer	Based on bidder's offer		
	Magnification of the plot		Based on bidder's offer	Based on bidder's offer		
	Changing of scale		Based on bidder's offer	Based on bidder's offer		

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
10	OMICRON 356/256 Three Phase Secondary Injection Test Kit (N/A)			
10.1	Protocols		IEC 61850 GOOSE Monitoring IEC60870-5-104/101 MODBUS serial MODBUS TCP/IP	
10.2	Current Amplitudes	5/1A		
10.3	Features on package:			
	QuickCMC	Yes/No	Based on bidder's offer	
	State Sequencer	Yes/No	Based on bidder's offer	
	TransPlay	Yes/No	Based on bidder's offer	
	Harmonics	Yes/No	Based on bidder's offer	
	CB Configuration	Yes/No	Based on bidder's offer	
	Ramping	Yes/No	Based on bidder's offer	
	Pulse Ramping	Yes/No	Based on bidder's offer	
	Overcurrent	Yes/No	Based on bidder's offer	
	Distance	Yes/No	Based on bidder's offer	
	Advanced Distance	Yes/No	Based on bidder's offer	
	VI Starting	Yes/No	Based on bidder's offer	
	Autoreclosure	Yes/No	Based on bidder's offer	
	Single-Phase Differential	Yes/No	Based on bidder's offer	
	Advanced Differential	Yes/No	Based on bidder's offer	
	Annunciation Checker	Yes/No	Based on bidder's offer	

k) PROTECTION, CONTROL AND METERING		UNIT	DATA	
			REQUIRED	OFFERED
	Power analyze	Yes/No	Based on bidder’s offer	
	Advanced Power	Yes/No	Based on bidder’s offer	
	Advanced TransPlay	Yes/No	Based on bidder’s offer	
	Transient Ground Fault	Yes/No	Based on bidder’s offer	
	Synchronizer	Yes/No	Based on bidder’s offer	
	Meter	Yes/No	Based on bidder’s offer	
	Transducer	Yes/No	Based on bidder’s offer	
	PQ Signal Generator	Yes/No	Based on bidder’s offer	
	IEC 61850 Client/Server	Yes/No	Based on bidder’s offer	
	GOOSE Configuration	Yes/No	Based on bidder’s offer	
	Sampled Values Configuration	Yes/No	Based on bidder’s offer	
	CMControl P App	Yes/No	Optional	
	RelaySimTest	Yes/No	Optional	
	CM Engine	Yes/No	Optional	
	EnerLyzer	Yes/No	Optional	
	TransView	Yes/No	Optional	
	ADMO light	Yes/No	Optional	
	IEDScout	Yes/No	Optional	

D) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>General</u>			
1.1	Rated power of station service transformers	kVA	500	
1.2	Rated frequency	Hz	50	
1.3	Max. Permissible voltage variation	%	10	
1.4	Max. Permissible voltage drop	%	5	
1.5	Number of phases		3	
1.6	Number of wires		4	
1.7	Short circuit current/time	kA/S	25/1	
1.8	System grounding		Solid	
1.9	Control phase Unit	Yes/No	Yes	
1.10	Automatic Transfer Scheme provided	Yes/No	Yes	
2	<u>AC Main and Distribution Panels</u>			
2.1	Manufacturer of panels:			
	Name		Based on bidder's offer	
	Type		Based on bidder's offer	
	Country		Based on bidder's offer	
2.2	Degree of protection of panels:			
	- Indoor		IP51	
	- Outdoor		IP55	
2.3	Panel color		RAL7035	
2.4	Minimum thickness of steel panels	mm	2.5	

I) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
2.5	Type of main circuit breakers	ACB/ MCC B	ACB	
2.6	Type of outgoing circuit breakers	MCB/ MCC B	MCCB	
2.7	Continuous rating of busbars	A	1000	
2.8	Min. power frequency withstand voltage	kV	2.5	
2.9	Single front /double front		Based on bidder's offer	
2.10	Single front /double front		Based on bidder's offer	
2.11	Type of insulation on busbars and connections		Based on bidder's offer	
2.12	Main and earth busbar type and material		Based on bidder's offer	
2.13	Maximum temperature rise inside panel	℃	Based on bidder's offer	
2.14	Method of neutral grounding		Based on bidder's offer	
2.15	Method of grounding incoming supply circuit		Based on bidder's offer	
2.16	Type of protection provided within cubicles (shutters , insulating cover ,)		Based on bidder's offer	
2.17	Rear or front access		Based on bidder's offer	
2.18	Type of Main cubicles construction		Single Front Compartmented/Fix	
2.19	Type of Distribution cubicles construction		withdrawable	
3	<u>Air Circuit Breaker (ACB)</u>			
3.1	Manufacturer of :			
	Name		Based on bidder's offer	
	Type		Based on bidder's offer	

D) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
	Country		Based on bidder’s offer	
3.2	Degree of protection	IP	Based on bidder’s offer	
3.3	Type of circuit breaker	Drawout/ Plug-in/Fix	Draw out	
3.4	Type of mounting		Based on bidder’s offer	
3.5	Rated voltage	V	415/240	
3.6	Type of operating mechanism		Based on bidder’s offer	
3.7	Type of motor		Based on bidder’s offer	
3.8	Normal voltage for operation of motors	VDC	110	
3.9	Normal voltage for trip coils	VDC	110	
3.10	Voltage of operating mechanism motor	V	Based on bidder’s offer	
3.11	Rated making current	kA	Based on bidder’s offer	
3.12	Number of Air circuit breaker poles		4	
3.13	Breaking current :			
	Symmetrical	kA	Based on bidder’s offer	
	Asymmetrical	kA	Based on bidder’s offer	
3.14	Make time with 100% rated making current	ms	Based on bidder’s offer	
3.15	Number of N/C auxiliary contact		Based on bidder’s offer	
3.16	Number of N/O auxiliary contact		Based on bidder’s offer	
3.17	Operating duty cycle		CO-15sec-CO	

I) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
3.18	Over load relay is required	Yes/No	yes	
3.19	Short circuit relay is required	Yes/No	yes	
4	<u>Molded Case Circuit Breaker (MCCB)</u>			
4.1	Manufacturer of:			
	Name		Based on bidder's offer	
	Type		Based on bidder's offer	
	Country		Based on bidder's offer	
4.2	Degree of protection	IP	Based on bidder's offer	
4.3	Type of MCCB	Drawout/ Plug-in/Fix	Fix	
4.4	Rated voltage	V	415/240	
4.5	Rated current	A	Based on bidder's offer	
4.6	Number of poles		3	
4.7	Type of operating mechanism		Based on bidder's offer	
4.8	Whether circuit breakers are motorized	Yes/No	NO	
4.9	Normal voltage for operation of motors	VDC	110	
4.10	Normal voltage for trip coils	VDC	110	
4.11	Rated making current	KA	Based on bidder's offer	
4.12	Breaking current :			
	Symmetrical	KA	Based on bidder's offer	

D) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
	Asymmetrical	KA	Based on bidder’s offer	
4.13	Make time with 100% rated making current	ms	Based on bidder’s offer	
4.14	Number Of N/C auxiliary contact		Based on bidder’s offer	
4.15	Number of N/O auxiliary contact		Based on bidder’s offer	
4.16	Over load relay is required.....	Yes/N o	YES	
4.17	Short circuit relay is required...	Yes/N o	YES	
5	<u>Miniature Circuit Breakers (MCB)</u>			
5.1	Manufacturer of:			
	Name		Based on bidder’s offer	
	Type		Based on bidder’s offer	
	Country		Based on bidder’s offer	
5.2	Degree of protection	IP	Based on bidder’s offer	
5.3	Rated voltage	V	415/240	
5.4	Rated current	A		
5.5	Number of MCB poles		3/1	
5.6	Rated short time withstand current (1 sec.)	kA	25	
5.7	Number of poles		Based on bidder’s offer	
5.8	Service short circuit breaking capacity	kA	Based on bidder’s offer	
5.9	Rated short circuit making capacity	kA	Based on bidder’s offer	
5.10	Total fault elimination time	ms	Based on bidder’s offer	

I) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
5.11	Type of MCB characteristic		Based on bidder's offer	
6	<u>Fuse Switches</u>			
6.1	Manufacturer of :			
	Name		Based on bidder's offer	
	Type		Based on bidder's offer	
	Country		Based on bidder's offer	
6.2	Degree of protection	IP	Based on bidder's offer	
6.3	Type of mounting	Fix/plugin/ Drawable	Based on bidder's offer	
6.4	Rated voltage	V	415/240	
6.5	Rated current	A		
6.6	Max. load break capacity		Based on bidder's offer	
6.7	Making capacity	kA	Based on bidder's offer	
6.8	Breaking capacity	kA	Based on bidder's offer	
6.9	Type of operating mechanism		Based on bidder's offer	
6.10	Number of N/C auxiliary contact		Based on bidder's offer	
6.11	Number of N/O auxiliary contract		Based on bidder's offer	
7	<u>Fuses</u>			
7.1	Manufacturer of :			
	Name		Based on bidder's offer	

D) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
	Type		Based on bidder’s offer	
	Country		Based on bidder’s offer	
7.2	Rated voltage	V	415/240	
7.3	Rated current	A	Based on bidder’s offer	
7.4	Max. breaking capacity	kA	Based on bidder’s offer	
7.5	Operation indicator	Yes/No	Based on bidder’s offer	
7.6	Bases, carrier and holder required	Yes/No	Based on bidder’s offer	
8	<u>Load Breaker Switch (LBS)</u>			
8.1	Manufacturer of :			
	Name		Based on bidder’s offer	
	Type		Based on bidder’s offer	
	Country		Based on bidder’s offer	
8.2	Rated voltage	V	415/240	
8.3	Rated current	A		
8.4	Max. breaking capacity	KA	Based on bidder’s offer	
8.5	Operation indicator	Yes/No	YES	
8.6	Bases, carrier and holder required	Yes/No	YES	
8.7	Number of poles		Based on bidder’s offer	
9	<u>Contactors</u>		Based on bidder’s offer	
9.1	Manufacturer of:		Based on bidder’s offer	

I) LOW VOLTAGE AC SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
	Name		Based on bidder's offer	
	Type		Based on bidder's offer	
	Country		Based on bidder's offer	
9.2	Type of mounting	Fix/plug/D rawable	Based on bidder's offer	
9.3	Rated voltage	V	Based on bidder's offer	
9.4	Contact rating	A	Based on bidder's offer	
9.5	Number of auxiliary contacts		Based on bidder's offer	

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
1	<u>GENERAL</u>		110V	48V	110V	48V
1.1	Variation of DC voltage	%	-15 , +10	-15 , +10		
1.2	Grounding of DC system		High Resistanc e	Positive to Earth		
2	<u>DC MAIN AND DISTRIBUTION PANEL</u>					
2.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
2.2	Type of cubicles construction		Free standing front and rear acces	Free standing front and rear acces		
2.3	Finishing colour		RAL7035	RAL7035		
2.4	Continuous rating of busbars	A	Based on bidder's offer	Based on bidder's offer		
2.5	Continuous rating of incoming/bus coupler CBs	A	Based on bidder's offer	Based on bidder's offer		
2.6	Short circuit current/time	kA/S	Based on bidder's offer	Based on bidder's offer		
2.7	Applicable standards		IEC 61439	IEC 61439		
2.8	Rated current of main indoor DC panel	A	Based on bidder's offer	Based on bidder's offer		
2.9	Min. power frequency withstand voltage (kVrms)	Kv	2.5	2.5		
2.10	Rated short time withstand current (1 sec)	KA	10	6		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
2.11	Degree of protection for indoor panels	IP	IP51	IP51		
2.12	Degree of protection for outdoor panels	IP	IP55	IP55		
2.13	Reference ambient temperature	°C	40	40		
2.14	Altitude above sea level	m	1850	1850		
2.15	Padlocking facility for switches required	Yes/No	No	No		
2.16	Rated short time withstand of busbars and connections (1 sec)	KA	Based on bidder's offer	Based on bidder's offer		
2.17	Type of insulation on busbars and connections		Based on bidder's offer	Based on bidder's offer		
2.18	Whether down dropper connections segregated from incoming/outgoing connections	Yes/No	Based on bidder's offer	Based on bidder's offer		
2.19	Automatic changeover operation provided in DC main panel	Yes/No	Yes	Yes		
2.20	Main and earth busbar type and material		Based on bidder's offer	Based on bidder's offer		
2.21	Maximum temperature rise inside panel	°C	Based on bidder's offer	Based on bidder's offer		
2.22	Method of neutral grounding		Based on bidder's offer	Based on bidder's offer		
2.23	Method of grounding incoming supply circuit		Based on bidder's offer	Based on bidder's offer		
2.24	Type of protection provided within cubicles (shutters, insulating cover....)		Based on bidder's offer	Based on bidder's offer		
2.25	Rear or front access		rear and front access	Rear and front access		
2.26	Wall thickness	mm	2.5	2.5		
2.27	Height of main indoor distribution panels	mm	2.5	2.5		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
2.28	Width of main indoor distribution panels	mm	2.5	2.5		
3	<u>Batteries</u>					
3.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
3.2	Battery voltage :					
	Normal	V	110	48		
	Float	V	128.8	56		
	Boost	V	147	64		
	Min. after 10 hr discharge period	V				
3.3	Rated discharge capacity :					
	1 hr rate	Ah	Discharge characteristic to be provided by manufacturer	Discharge characteristic to be provided by manufacturer		
	10 hr rate	Ah	Min 250Ah	Min 200 Ah		
3.4	Type of cells	-	nickel-cadmium	nickel-cadmium		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
3.5	Amper hour capacity of each battery at 15°C, 10 hr rate to give final cell voltage of 1.85 V	Ah	Based on bidder's offer	Based on bidder's offer		
3.6	Amper hour capacity of each battery at max temp, 10 hr rate to give final cell voltage	Ah	Based on bidder's offer	Based on bidder's offer		
3.7	Charging current (continuous)	A	2% to 8% of the battery capacity, C (AH)	2% to 8% of the battery capacity, C (AH)		
3.8	Discharge duty :					
	Continuous load/duration		Based on bidder's offer	Based on bidder's offer		
	Emergency load/duration		Based on bidder's offer	Based on bidder's offer		
	Momentary load/duration		Based on bidder's offer	Based on bidder's offer		
3.9	Voltage per cell at end of 10 hr discharge period	V	1.0	1.0		
3.10	Min. temperature	°C	Based on bidder's offer	Based on bidder's offer-		
3.11	Max. temperature	°C	Based on bidder's offer	Based on bidder's offer		
3.12	Quantity of cells		Based on bidder's offer	Based on bidder's offer		
3.13	Quantity of cell per battery		Based on bidder's offer	Based on bidder's offer		
3.14	Quantity of cells per battery set		Based on bidder's offer	Based on bidder's offer		
3.15	Type of positive plate		Pocket Plate	Pocket Plate		
3.16	Type of negative plate		Pocket Plate	Pocket Plate		
3.17	Weight of one battery with electrolyte	Kg	Based on bidder's offer	Based on bidder's offer		
3.18	Complete mass of battery set	Kg	Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
3.19	Complete battery set dimensions		Based on bidder's offer	Based on bidder's offer		
3.20	Expected life of battery	Year	20	20		
3.21	Method of battery charging		Boost / Float	Boost / Float		
3.22	Rated discharge capacity of batteries	Ah				
3.23	Number of battery set		2	2		
3.24	Number of cells		92	40		
3.25	Cell nominal voltage		1.2	1.2		
3.26	Min. final cell voltage	V	1.14	1.14		
3.27	Material of stands		Based on bidder's offer	Based on bidder's offer		
4	<u>Battery chargers</u>					
4.1	Manufacturer :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
4.2	Type		Solid State	Solid State		
4.3	Number of battery charger set		2	2		
4.4	Input voltage	V	415/240	415/240		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
4.5	Maximum current rating	A				
4.6	Voltage ripple when charging battery	%	Based on bidder's offer	Based on bidder's offer		
4.7	AC system data :					
	Supply voltage	V	415/240	415/240		
	Supply frequency	Hz	50	50		
	Variation in supply voltage	%	0.5	0.5		
	Variation in supply frequency	%	Based on bidder's offer	Based on bidder's offer		
	Short circuit level for AC supply at charger terminals for 3 Sec./1 Sec	KA	Based on bidder's offer	Based on bidder's offer		
4.8	Load current limiter provided	Yes/No	Yes	Yes		
4.9	Float charging current of the battery	A	Based on bidder's offer	Based on bidder's offer		
4.10	Equalize charging current of the battery	A	Based on bidder's offer	Based on bidder's offer		
4.11	Initial charging current of the battery	A	Based on bidder's offer	Based on bidder's offer		
4.12	Voltage rating :					
	Input voltage	V(AC)	415	Based on bidder's offer		
	Output voltage	V(AC)	Based on bidder's offer	Based on bidder's offer		
	Rated output voltage (float)	V	128.8	56		
	Rated output voltage (boost)	V	147	64		
4.13	Method of cooling		Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
4.14	Permissive ripple of battery charger	%	Based on bidder's offer	Based on bidder's offer		
4.15	Type of outgoing feeder short circuit protection		Based on bidder's offer	Based on bidder's offer		
4.16	Boost charge with relevant timer provided	Yes/No	yes	Yes		
4.17	Ground fault protection provided	Yes/No	yes	Yes		
4.18	Percent of regulation with AVR for float charge		Based on bidder's offer	Based on bidder's offer		
4.19	Rectifier transformer :					
	Type		Based on bidder's offer	Based on bidder's offer		
	Rating		Based on bidder's offer	Based on bidder's offer		
4.20	Semi-conductor rectifiers :					
	Manufacture		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Type of cooling		Based on bidder's offer	Based on bidder's offer		
	Type of voltage surge suppression		Based on bidder's offer	Based on bidder's offer		
4.21	Ambient conditions :					
4.22	Temperature	°C	Based on bidder's offer	Based on bidder's offer		
4.23	Altitude	m	Based on bidder's offer	Based on bidder's offer		
4.24	Humidity	%	Based on bidder's offer	Based on bidder's offer		
4.25	Type of protections :					

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
	AC phase failure	Yes/No	yes	yes		
	AC phase sequence	Yes/No	yes	yes		
	Blocking diode	Yes/No	yes	yes		
4.26	Dropper	Yes/No	yes	yes		
	Inrush current	Yes/No	yes	yes		
	Battery reverse	Yes/No	yes	yes		
4.27	Alarm & Indications :					
	Over voltage alarm for AC/ DC		Based on bidder's offer	Based on bidder's offer		
	Under voltage alarm for AC/ DC		Based on bidder's offer	Based on bidder's offer		
	Earth fault alarm for AC/ DC		Based on bidder's offer	Based on bidder's offer		
	Current indication for AC/ DC		Based on bidder's offer	Based on bidder's offer		
4.28	Diode Dropper for Load Voltage Regulator	Yes/No	No	No		
4.29	IGBT Switch for Load Voltage Regulator	Yes/No	Yes	Yes		
4.30	Rated discharge period hours		10	10		
4.31	Type		Solid State	Solid State		
4.32	Number of battery charger set		2	2		
4.33	Automatic changeover operation provided in charger	Yes/No	Yes	Yes		
4.34	Charger can be parallel to another	Yes/No	Yes	Yes		
4.35	Panel :					

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
4.36	Total weight	Kg	Based on bidder's offer	Based on bidder's offer		
4.37	Dimensions (WxHxD)	cm	Based on bidder's offer	Based on bidder's offer		
4.38	Color	RAL	7035	7035		
4.39	protection degree	IP	IP51	IP51		
4.40	Rear or front access		Based on bidder's offer	Based on bidder's offer		
5	<u>Molded Case Circuit Breaker (MCCB)</u>					
5.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
5.2	Type of mounting	Fix/plugin/ Drawable	Fix	Fix		
5.3	Degree of protection	IP	Based on bidder's offer	Based on bidder's offer		
5.4	Applicable standard		Based on bidder's offer	Based on bidder's offer		
5.5	Rated voltage	V	110	48		
5.6	Rated current	A	Based on bidder's offer	Based on bidder's offer		
5.7	Rated short time withstand current (1 sec.)	KA	Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
5.8	Number of poles		2	2		
5.9	Type of operating mechanism		Based on bidder's offer	Based on bidder's offer		
5.10	Type of motor		Based on bidder's offer	Based on bidder's offer		
5.11	One minute power frequency withstand level	KV	Based on bidder's offer	Based on bidder's offer		
5.12	Whether circuit breakers are motorized	Yes/No	Based on bidder's offer	Based on bidder's offer		
5.13	Normal voltage for operation of motors	VDC	110	110/48		
5.14	Normal voltage for trip coils	VDC	110	110/48		
5.15	Rated making current	KA	Based on bidder's offer	Based on bidder's offer		
5.16	Breaking current :					
	Symmetrical	KA	Based on bidder's offer	Based on bidder's offer		
	Asymmetrical	KA	Based on bidder's offer	Based on bidder's offer		
5.17	Make time with 100% rated making current	ms	Based on bidder's offer	Based on bidder's offer		
5.18	Design:	Fix/Plug-in/Drawable	Based on bidder's offer	Based on bidder's offer		
5.19	Number Of N/C auxiliary contact		Based on bidder's offer	Based on bidder's offer		
5.20	Number of N/O auxiliary contact		Based on bidder's offer	Based on bidder's offer		
5.21	Antipumping feature is required	Yes/No	Based on bidder's offer	Based on bidder's offer		
5.22	Over load relay is required	Yes/No	Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
5.23	Short circuit relay is required	Yes/No	Based on bidder's offer	Based on bidder's offer		
6	<u>Miniature Circuit Breakers (MCB)</u>					
6.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
6.2	Type of mounting (Fix/plug in/Drawable)		Based on bidder's offer	Based on bidder's offer		
6.3	Applicable standard		Based on bidder's offer	Based on bidder's offer		
6.4	Rated voltage	V	110	48		
6.5	Rated current	A	Based on bidder's offer	Based on bidder's offer		
6.6	Rated short time withstand current (1 sec.)	KA	Based on bidder's offer	Based on bidder's offer		
6.7	Number of poles		2	2		
6.8	Service short circuit breaking capacity	KA	Based on bidder's offer	Based on bidder's offer		
6.9	Rated short circuit making capacity	KA	Based on bidder's offer	Based on bidder's offer		
6.10	Total fault elimination time	ms	Based on bidder's offer	Based on bidder's offer		
6.11	Type of MCB characteristic		Based on bidder's offer	Based on bidder's offer		
6.12	Degree of protection	IP	Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
7	<u>Fuse Switches</u>					
7.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
7.2	Type of mounting	Fix/plug in/ Drawable	Based on bidder's offer	Based on bidder's offer		
7.3	Degree of protection	IP	Based on bidder's offer	Based on bidder's offer		
7.4	Applicable standard		Based on bidder's offer	Based on bidder's offer		
7.5	Rated voltage	V	110	48		
7.6	Rated current	V	Based on bidder's offer	Based on bidder's offer		
7.7	Max. load break capacity		Based on bidder's offer	Based on bidder's offer		
7.8	Making capacity	KA	Based on bidder's offer	Based on bidder's offer		
7.9	Breaking capacity	KA	Based on bidder's offer	Based on bidder's offer		
7.10	Type of operating mechanism		Based on bidder's offer	Based on bidder's offer		
7.11	Number of N/C auxiliary contact		Based on bidder's offer	Based on bidder's offer		
7.12	Number of N/O auxiliary contract		Based on bidder's offer	Based on bidder's offer		
8	<u>Fuses</u>					

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
8.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
8.2	Type of mounting (Fix/plug in/Drawable)	Fix/plug in/Drawable	Based on bidder's offer	Based on bidder's offer		
8.3	Applicable standard		Based on bidder's offer	Based on bidder's offer		
8.4	Rated voltage	V	110	48		
8.5	Rated current	V	Based on bidder's offer	Based on bidder's offer		
8.6	Rated frequency	Hz	Based on bidder's offer	Based on bidder's offer		
8.7	Max. breaking capacity	KA	Based on bidder's offer	Based on bidder's offer		
8.8	Operation indicator	Yes/No	Based on bidder's offer	Based on bidder's offer		
8.9	Bases, carrier and holder required	Yes/No	Based on bidder's offer	Based on bidder's offer		
9	<u>Load Breaker Switch (LBS)</u>					
9.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
9.2	Type of mounting (Fix/plug in/Drawable)		Based on bidder's offer	Based on bidder's offer		
9.3	Applicable standard		Based on bidder's offer	Based on bidder's offer		
9.4	Rated voltage	V	110	48		
9.5	Rated current	V	Based on bidder's offer	Based on bidder's offer		
9.6	Rated frequency	Hz	Based on bidder's offer	Based on bidder's offer		
9.7	Max. breaking capacity		Based on bidder's offer	Based on bidder's offer		
9.8	Operation indicator	Yes/No	Based on bidder's offer	Based on bidder's offer		
9.9	Bases, carrier and holder required	Yes/No	Based on bidder's offer	Based on bidder's offer		
9.10	Number of poles		Based on bidder's offer	Based on bidder's offer		
10	<u>Contactors</u>					
10.1	Manufacturer of :					
	Name		Based on bidder's offer	Based on bidder's offer		
	Type		Based on bidder's offer	Based on bidder's offer		
	Country		Based on bidder's offer	Based on bidder's offer		
10.2	Type of mounting	Fix/plug in/Drawable	Based on bidder's offer	Based on bidder's offer		
10.3	Applicable standard		Based on bidder's offer	Based on bidder's offer		
10.4	Rated voltage	V	Based on bidder's offer	Based on bidder's offer		

m) LOW VOLTAGE DC SYSTEM		UNIT	DATA			
			REQUIRED		OFFERED	
10.5	Contact rating	A	Based on bidder's offer	Based on bidder's offer		
10.6	Number of auxiliary contacts		Based on bidder's offer	Based on bidder's offer		
11	UPS System					
11.1	Manufacturer/model		Based on bidder's offer	Based on bidder's offer		
11.2	Type of switch		Based on bidder's offer	Based on bidder's offer		
11.3	Type of MCB		Based on bidder's offer	Based on bidder's offer		
11.4	Distribution circuits (numbers and ratings)		1No. min 6000 VA	N/A		
11.5	Number of cubicles		Based on bidder's offer	N/A		
11.6	Forced limits at one meter		Based on bidder's offer	N/A		
11.7	Noise limits at one meter		Based on bidder's offer	Based on bidder's offer		
11.8	Instrumentation		Based on bidder's offer	Based on bidder's offer		
11.9	Alarms		Based on bidder's offer	Based on bidder's offer		
11.10	Efficiency and power factor at 25.50% & 100% outputs		Based on bidder's offer	Based on bidder's offer		
11.11	Modular desing/system extention facilities		Based on bidder's offer	Based on bidder's offer		
11.12	Provision of maintenance switch		Yes	N/A		
11.13	Radio ferquency interference		Based on bidder's offer	Based on bidder's offer		

n) SUBSTATION AUTOMATION SYSTEM (SAS)		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>GENERAL</u>			
1.1	Protocol communication		IEC61850	
1.2	Communication protocol for all Measuring Centers		IEC61850/MODBUS	
1.3	Vertical communication (base on Client/Server)	Yes/No	Yes	
1.4	Horizontal communication (base on peer to peer)	Yes/No	Yes	
1.5	Type of computers (Industrial / Commercial)		Industrial	
1.6	Communication technology		Ethernet LAN	
1.7	Communication topology		PRP	
1.8	Monitoring protocol in station level		SNMP	
1.9	Supported protocol for time synchronizing		SNTP/NTP	
1.10	Redundant configuration		PRP	
1.11	Number of server	No.	2	
1.12	Number of monitor for each workstation	No.	2	
1.13	Number of gateway		Two	
1.14	Indoor communication media		Fiber optic/Copper (twisted pair)	
1.15	Outdoor communication media		Fiber optic	
1.16	Workstation LAN Protocol communication		Compliant with ISO/IEEE 802.3	
1.17	Rated voltage	V	240 AC / 110V DC	
1.18	Variation of Aux. AC/DC	%	-15 , +10	
1.19	Nominal system frequency for AC	Hz	50	
1.20	maximum noise level for the operation of any equipment	dB	50	
1.21	Separate BCU provided		Yes	
1.22	Consideration of future extension in SW (Yes/No)		Yes	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
1.23	Consideration of future extension in HW (Yes/No)			Yes (in station level)	
1.24	SCADA remote center			R.C.C , N.S.C.C , N.C.C	
1.25	SCADA remote center protocols			Acc. to DWGs	
2	Substation Automation System (SAS) Design				
2.1	Manufacturer's Name			Based on bidder's offer	
2.2	Manufacturer's Country			Based on bidder's offer	
2.3	Type designation			Based on bidder's offer	
2.4	No. of references, indicating similar transmission level projects included in the reference list (Manufacturer's Reference list)			As per EQC	
2.5	No. of references in similar transmission level projects included in the reference list			As per EQC	
2.6	User friendly Software (As generally accepted, comparing MicroSoft products)			Yes	
2.7	Maintenance, modification or extension of components without a shutdown of the whole station automation system			Yes	
2.8	Is protection an integral part of the SAS system?	Yes/No		Yes	
2.9	Possibility to read and alter relay settings, extract fault, event and disturbance records from SAS	Yes/No		yes	
2.10	Analysis software for protection relays provided	Yes/No		yes	
2.11	Years of experience in design and supply of numerical equipment related to SAS			15	
2.12	Specify the Kind of LAN used for IED & protection level			PRP	

n) SUBSTATION AUTOMATION SYSTEM (SAS)		UNIT	DATA	
			REQUIRED	OFFERED
2.13	Specify Data exchange rate between the electronic devices on IED level LAN (Preferably at 10/100 M bit/s)		100	
2.14	Ethernet LAN used for Station level		PRP	
2.15	Data exchange between the electronic devices on Station level shall take place via LAN at 10/100 M bit/s		100	
2.16	Possibility to control, monitor and protect each individual bay from the respective bay level equipment for maintenance purposes or if the communication to a particular bay should fail.	Yes/No	Yes	
2.17	Prevent initiation of operation of a single switch at the same time from more than one of the various control levels via, control center, remote computer, station level, bay level.		Yes	
2.18	Does ‘System’ functioning require multiple alarm acknowledgement or manual entries (at different workstations) for the same data.		Yes	
2.19	Substation, by single line displays with paging		Yes	
2.20	Multiple windows facility with size selectable		Yes	
2.21	Event processing facility	Yes/No	yes	
2.22	Alarm processing facility	Yes/No	yes	
2.23	Separate loud ringing audible alarm	Yes/No	Yes	
2.24	Analogue measurement handling (e.g. ‘change of state’ or other methods)		Yes	
2.25	MWH & MVARH data from substation or calculated		Yes	
2.26	Individual and sequence control facilities		Yes	
2.27	Event printing highlighting		Yes	
2.28	Scheduled logging facility		Yes	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
2.29	Page logging facility to hard copy color printer			Yes	
2.30	Method of storage of historical data			Based on bidder’s offer	
2.31	Trend displays of analogues			Yes	
2.32	Plant database schedule			Yes	
2.33	Record of number of operations of plant			≥1000	
2.34	Operator manual entry facility etc.			Yes	
2.35	SCMS equipment status display			Yes	
2.36	Fault incident record facility			Yes	
2.37	Operator defined formats			Yes	
2.38	Transfer of control between SCS & SMS and SCADA			Yes	
2.39	Tap position by binary or digital input			Yes	
2.40	Provision of simple method of database and display updating system manager tasks. Details of proposals included			Yes	
2.41	Tagging facility			Yes	
2.42	Interlocking / redundancy feature			Yes	
2.43	Distributed Synchro-check facility			Yes	
2.44	Automatic and manual tap change control via SCMS			Yes	
2.45	Protection relay and fault recorder data, work station display			Yes	
2.46	Dynamic busbar coloring feature		Yes/No	yes	
2.47	Possibility of displaying of all substation and AC interlocking by the special picture			Yes	
2.48	IEC61850 Standard Protocol Supporting		Yes/No	yes	

n) SUBSTATION AUTOMATION SYSTEM (SAS)		UNIT	DATA	
			REQUIRED	OFFERED
3	<u>SCMS Hardware and Software</u>			
3.1	Identification of any special hardware and software required to be developed, with estimate of the work required		Based on bidder’s offer	
3.2	Design life, in service experience, design history and future development plans		Based on bidder’s offer	
3.3	Computer equipping for ultimate system		Based on bidder’s offer	
3.4	Integrated SCS & SMS database/more than one database		Yes	
3.5	Database tools compliant with ODBC		Yes	
3.6	Compatibility of database tools with tools at SCADA control center		Yes	
3.7	Editing tools for sequential / logic functions		Yes	
3.8	Analogue accuracy from bay unit to display		Based on bidder’s offer	
3.9	Automatic/manual diagnostics provided for all SCS & SMS equipment		Yes	
3.10	Automatic system restart following power interruption		Yes	
3.11	Stall alarm facility		Yes	
3.12	Fault / event record files auto upload to SCMS		Yes	
3.13	No. of levels of system access protection		Based on bidder’s offer	
3.14	Multiple passwords available within each level of system access	Yes/No	yes	
3.15	Any specified SCS & SMS function propose		Yes	
3.16	System redundancy in station computer configuration		Yes, PRP	
3.17	System redundancy in LAN communication configuration		Yes, PRP	

n) SUBSTATION AUTOMATION SYSTEM (SAS)		UNIT	DATA	
			REQUIRED	OFFERED
3.18	System redundancy in communication server configuration		Yes, PRP	
3.19	Communication between bay level and station level		Yes, PRP	
4	<u>Station Computer (Server)</u>			
4.1	Manufacturer / model		Based on bidder’s offer	
4.2	Type	Industrial/Commercial	Industrial	
4.3	Real time industrial strength equipment		Based on bidder’s offer	
4.4	AC voltage working range.	V	240	
4.5	Service conditions (temperature & RH)		Based on bidder’s offer	
4.6	Power consumption.	W	Based on bidder’s offer	
4.7	Architecture		PRP	
4.8	Individual processors for each function		Based on bidder’s offer	
4.9	Operating system software		Windows 11	
4.10	Method of processor Expansion (e.g. Number of free slots when supplied)		Based on bidder’s offer	
4.11	Main (semiconductor) memory			
	Type		Based on bidder’s offer	
	Supplied size		16 GB	
	Maximum size		16 GB	
4.12	Hard Disc storage			
	Type		Based on bidder’s offer	
	Supplied size		1 TB	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Maximum size			1 TB	
4.13	Clock			Based on bidder's offer	
4.14	Type				
	Drift per day (when not synchronized to master clock)			Based on bidder's offer	
	Method of synchronization with master clock			Based on bidder's offer	
	Battery back up			Based on bidder's offer	
4.15	Details of mass storage devices and data archiving devices			Based on bidder's offer	
5	<u>Operator/Engineering Workstation (MMI)</u>				
5.1	Manufacturer / model			Based on bidder's offer	
5.2	Type	Industrial/Commercial		Industrial	
5.3	AC voltage working range	V		240	
5.4	Service conditions (temperature and RH)			Based on bidder's offer	
5.5	Power consumption	W		Based on bidder's offer	
5.6	Architecture			PRP	
5.7	Operating system software			Windows 11	
5.8	Method of processor expansion (e.g. number of free slots when supplied)			Based on bidder's offer	
5.9	Main (semiconductor) memory				
	Type			Based on bidder's offer	
	Supplied size			16 GB	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Maximum size			16 GB	
5.10	Hard Disc storage				
	Type			Based on bidder's offer	
	Supplied size			1`TB	
	Maximum size			1 TB	
5.11	Clock				
	Type			Based on bidder's offer	
	Drift per day (when not synchronized to master clock)			Based on bidder's offer	
	Method of synchronization with master clock			Based on bidder's offer	
5.12	Processing system intercommunications interface				
	Number supported			Based on bidder's offer	
	Type (e.g. LAN etc.)			Based on bidder's offer	
	Speed			Based on bidder's offer	
5.13	Video Display Unit (VDU)				
	Type			Based on bidder's offer	
	Number to be supplied at a workstation			4	
	Screen size			30 inch	
	Screen pixel resolution			Based on bidder's offer	
	Compliance with recognized EMC and safety standards			Based on bidder's offer	
	Type of interface			Based on bidder's offer	
5.14	Keyboard				

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Type			Based on bidder's offer	
	Number to be supplied			4	
	Total number of keys			Based on bidder's offer	
	Alphanumeric character key set			Based on bidder's offer	
	Control keys provided			Based on bidder's offer	
	Number of special function keys			Based on bidder's offer	
	Type of interface			Based on bidder's offer	
5.15	Cursor control device (Mouse)				
	Number to be supplied			4	
	Number of buttons			Based on bidder's offer	
	Type (e.g. optical)			Based on bidder's offer	
	Mat			Yes	
	Type of interface			Based on bidder's offer	
5.16	C.D Writer			Yes	
	Manufacturer			Based on bidder's offer	
	Speed			Based on bidder's offer	
	Type			Based on bidder's offer	
5.17	D.V.D Writer				
	Manufacturer			Based on bidder's offer	
	Speed			Based on bidder's offer	
	Type			Based on bidder's offer	

n) SUBSTATION AUTOMATION SYSTEM (SAS)		UNIT	DATA	
			REQUIRED	OFFERED
6	<u>Event/Operator Log Printer</u>			
6.1	Manufacturer/model		Based on bidder’s offer	
6.2	Type	Dot matrix /Other type	other	
6.3	AC voltage working range.	V	240	
6.4	Power consumption.	W	Based on bidder’s offer	
6.5	Service conditions (temperature & RH)		Based on bidder’s offer	
6.6	Print speed	ppm.	Based on bidder’s offer	
6.7	Printing pitch/width		Based on bidder’s offer	
6.8	No. of print pins/jets or resolution		Based on bidder’s offer	
6.9	No. of fonts/character sets		Based on bidder’s offer	
6.10	Paper feed proposed/width		A3	
6.11	Self-test facility		Based on bidder’s offer	
6.12	Number of colors		Based on bidder’s offer	
6.13	Type of interface		Based on bidder’s offer	
6.14	Stand/trays		Based on bidder’s offer	
6.15	Acoustic noise at one meter	dB	Based on bidder’s offer	
6.16	Alarms local and remote		Based on bidder’s offer	
6.17	Configuration/dual network connection		Based on bidder’s offer	
7	<u>Hard Copy Color Laser Printer</u>			
7.1	Manufacturer/model		Based on bidder’s offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
7.2	Type			Printer + Scanner	
7.3	AC voltage working range	V		240	
7.4	Power consumption	W		Based on bidder's offer	
7.5	Service conditions (temperature & RH).			Based on bidder's offer	
7.6	Print speed for color graphics printing (PPM)	Ppm.		Based on bidder's offer	
7.7	No. of colors/toners			Based on bidder's offer	
7.8	Resolution			Based on bidder's offer	
7.9	Paper handling			Based on bidder's offer	
7.10	Paper size			A3 and A4	
7.11	Type of interface			Based on bidder's offer	
7.12	Stand / trays			Based on bidder's offer	
7.13	Acoustic noise at one meter	dB		Based on bidder's offer	
7.14	Alarms local and remote			Based on bidder's offer	
7.15	Configuration/dual network connection			Based on bidder's offer	
8	<u>Master Clock/G.P.S</u>				
8.1	Manufacturer/model			Based on bidder's offer	
8.2	Type			Based on bidder's offer	
8.3	AC/DC voltage working range	V		110 V DC	
8.4	Power consumption	W		Based on bidder's offer	
8.5	Service conditions (temperature & RH)			Based on bidder's offer	
8.6	Battery standby capacity			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
8.7	Type, speed and no. of output interfaces			As per technical requirements	
8.8	Time and date facility			Based on bidder's offer	
8.9	Seasonal changeover/automatic			Based on bidder's offer	
8.10	Local display				
	Day : Mon : Yr			Yes	
	HH : MM : SS			Yes	
8.11	Drift per day (when not synchronized to radio signal)			Based on bidder's offer	
8.12	Receiver for UT from NVASTAR satellites			Based on bidder's offer	
8.13	Loss of radio synch alarm			Based on bidder's offer	
8.14	Other alarms			Based on bidder's offer	
8.15	Local alarms and contacts for alarms to SCMS			Based on bidder's offer	
8.16	Synchronization of station server with G.P.S			NTP, Network-Link status	
8.17	Accuracy class			Based on bidder's offer	
9	<u>Furniture</u>				
9.1	Workstation desk			1	
9.2	Material of desk			Based on bidder's offer	
9.3	Durable desk top surface			Yes	
9.4	Writing area			Yes	
9.5	Drawers/shelves			Minimum 2 drawers and 2 shelves	
9.6	Support for VDUs			Yes	
9.7	Size			Minimum 2.4 meters	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
9.8	Height		m	0.8	
9.9	Workstation chair			Minimum 6	
9.10	Material			Based on bidder's offer	
9.11	Swivel and castor action			Yes	
9.12	High backed design			Yes	
9.13	Arm rests			Yes	
9.14	Desk lighting			Yes	
9.15	Window blinds			Yes	
10	<u>Workstation LAN</u>				
10.1	Manufacturer/model			Based on bidder's offer	
10.2	Type			Based on bidder's offer	
10.3	Coaxial / optical fiber cable			Based on bidder's offer	
10.4	Operating speed.		Hz	Based on bidder's offer	
10.5	Protocols/compliance with IEC Standard-			Based on bidder's offer	
10.6	Media connection			Based on bidder's offer	
10.7	Network functionality			Based on bidder's offer	
10.8	Network management software			Based on bidder's offer	
10.9	Software packages			Based on bidder's offer	
10.10	Dual redundant configuration			PRP	
11	<u>Real Time LAN</u>				
11.1	Manufacturer/model			Based on bidder's offer	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
11.2	Type			Based on bidder's offer	
11.3	Coaxial/optical fiber cable			Based on bidder's offer	
11.4	Operating speed.	Hz		Based on bidder's offer	
11.5	Protocols/compliance with IEC Standard			Based on bidder's offer	
11.6	Media connection			Based on bidder's offer	
11.7	Network functional			Based on bidder's offer	
11.8	Network management			Based on bidder's offer	
11.9	Software packages			Based on bidder's offer	
11.10	Dual redundant configuration			PRP	
11.11	Deterministic operational behavior			Based on bidder's offer	
11.12	Peer to peer communications			Based on bidder's offer	
12	<u>Communications</u>				
12.1	Manufacturer/model			Based on bidder's offer	
12.2	Type			Based on bidder's offer	
12.3	Protocol/between station computer and BCU/BCPU			IEC61850	
	Manufacturer/model			Based on bidder's offer	
	Compliant with IEC 60870-5-101 and IEC61850			Based on bidder's offer	
	Info transfer efficiency		data bits/total bits	Based on bidder's offer	
	Hamming distance			Based on bidder's offer	
	Security of control messages			Based on bidder's offer	
	Interface			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Transmission rate			Based on bidder's offer	
12.4	Type and no. of communication cables to BCU/BCPU			Based on bidder's offer	
12.5	Type & no. of communications cables to protection relay and disturbance recorder			Based on bidder's offer	
12.6	Peer to Peer signaling/client server architecture			Based on bidder's offer	
12.7	Cyclic & event initiated transmissions initiated by BCU/BCPU			Based on bidder's offer	
12.8	Continued functioning of station computer and data management in the event of workstations out of service. Limitations applicable			Based on bidder's offer	
12.9	Protocol between SCMS and SCADA				
	Emulation of functionality of existing SCADA RTU			Based on bidder's offer	
	Support Protocol Indactive 33			Based on bidder's offer	
	Support Protocol HDLC			Based on bidder's offer	
	Support Protocol IEC101			Based on bidder's offer	
	Download of database from SCADA control center			Based on bidder's offer	
12.10	LDC modem				
	Manufacturer and model			Based on bidder's offer	
	Type			Based on bidder's offer	
	DC voltage working range.	V		Based on bidder's offer	
	Service conditions (temperature and RH).			Based on bidder's offer	
	Signaling method			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Transmission rate and frequency			Based on bidder's offer	
	Range of transmitter output			Based on bidder's offer	
	Range of receiver input			Based on bidder's offer	
	Low level receive alarm			Based on bidder's offer	
	Compliant with ITU-T recommendations			Based on bidder's offer	
	Modem switchover			Based on bidder's offer	
12.11	Laptop workstation and SCMS fault analysis				
	Modem manufacturer and model			Based on bidder's offer	
	Type			Based on bidder's offer	
	DC voltage working range	V		Based on bidder's offer	
	Service conditions (temperature and RH)			Based on bidder's offer	
	Signaling method			Based on bidder's offer	
	Transmission rate and frequency			Based on bidder's offer	
	Range of transmitter output			Based on bidder's offer	
	Range of receiver input			Based on bidder's offer	
	Low level receive alarm			Based on bidder's offer	
	Compliant with ITU-T recommendations			Based on bidder's offer	
12.12	Communications with adjacent SCMS system				
	Details of gateway			Based on bidder's offer	
	Provision of optical fiber link			Based on bidder's offer	
	Protocol			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Transmission rate			Based on bidder's offer	
13	<u>BCU/BCPU</u>				
13.1	Manufacturer/model			Based on bidder's offer	
13.2	Type			Based on bidder's offer	
13.3	DC voltage working range	V		110	
13.4	Service conditions (temperature)			Based on bidder's offer	
13.5	Power consumption	W		Based on bidder's offer	
13.6	Architecture			PRP	
13.7	Memory type			Based on bidder's offer	
13.8	Memory maximum			Based on bidder's offer	
13.9	Memory supplied			Based on bidder's offer	
13.10	System bus interface/speed			Based on bidder's offer	
13.11	Provision of two redundant interfaces to LANs.			Based on bidder's offer	
13.12	Method of loading/extending database			Based on bidder's offer	
13.13	Logic functions & sequences			Based on bidder's offer	
13.14	Clock				
	Type			Based on bidder's offer	
	Drift per day (when not synchronized to master clock)			Based on bidder's offer	
	Method of synchronization to master clock			Based on bidder's offer	
13.15	I/O equipping including 10% spare provided			Based on bidder's offer	
13.16	Method of data exchange with station computer (e.g. peer to peer).			Based on bidder's offer	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
13.17	Provision of logic functions and sequences			Based on bidder's offer	
13.18	Direct AC input from CT/VT for analogue values				
	Model			Based on bidder's offer	
	Maximum no. inputs per card			Based on bidder's offer	
	Outputs available per input			Based on bidder's offer	
	Resolution/accuracy			Based on bidder's offer	
	Scan cycle			Based on bidder's offer	
	Burden	VA		Based on bidder's offer	
	Input CT/VT range			Based on bidder's offer	
	Input isolation			Based on bidder's offer	
	Analogue limit monitoring facility at BCU			Based on bidder's offer	
	No. of limits per analogue			Based on bidder's offer	
	Analogue threshold monitoring range/steps available			Based on bidder's offer	
13.19	Transducer				
	Model			Based on bidder's offer	
	Maximum no. inputs per card			Based on bidder's offer	
	Outputs available per input			Based on bidder's offer	
	Resolution/accuracy			Based on bidder's offer	
	Scan cycle			Based on bidder's offer	
	Burden	VA		Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Input CT/VT range			Based on bidder's offer	
	Input isolation			Based on bidder's offer	
	Analogue limit monitoring facility at BCU			Based on bidder's offer	
	No. of limits per analogue			Based on bidder's offer	
	Analogue threshold monitoring range/steps available			Based on bidder's offer	
13.20	Conventional DC analogue inputs				
	Model			Based on bidder's offer	
	Maximum no. of inputs per card			Based on bidder's offer	
	ADC resolution/accuracy			Based on bidder's offer	
	Current input values supported			Based on bidder's offer	
	Solid state switching of inputs to ADC			Based on bidder's offer	
	Scan cycle per ADC			Based on bidder's offer	
	Input isolation (common/series mode)			Based on bidder's offer	
	Series and common mode noise rejection			Based on bidder's offer	
	Analogue limit monitoring facility at BCU			Based on bidder's offer	
	No. of limits per analogue			Based on bidder's offer	
	Analogue threshold monitoring range/steps available			Based on bidder's offer	
13.21	Digital inputs			Based on bidder's offer	
	Number of inputs per module			Based on bidder's offer	
	Digital/software filtering to suppress plant contact bounce			Based on bidder's offer	
	Plant common connection at +48V (earth)			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Maximum input contact frequency			Based on bidder's offer	
	Minimum contact closure capture time			Based on bidder's offer	
	Time tagging resolution			Based on bidder's offer	
	Isolation withstand			Based on bidder's offer	
13.22	Pulse counter signal inputs				
	Number of inputs per module			Based on bidder's offer	
	Digital / software filtering to suppress plant contact bounce			Based on bidder's offer	
	Plant common connection at +48V (earth)			Based on bidder's offer	
	Maximum input contact frequency			Based on bidder's offer	
	Minimum contact closure capture time			Based on bidder's offer	
	Time tagging resolution			Based on bidder's offer	
	Isolation withstand			Based on bidder's offer	
13.23	Digital outputs				
	Number of outputs per module			Based on bidder's offer	
	Select/check back/execute facility			Based on bidder's offer	
	Measurement of output circuit facility			Based on bidder's offer	
	Double pole switching of output			Based on bidder's offer	
	Output rating (VER)			Based on bidder's offer	
	Range of output pulse			Based on bidder's offer	
	Isolation withstand			Based on bidder's offer	
13.24	Set point outputs				

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
	Maximum numbers			Based on bidder's offer	
	Number of outputs per module			Based on bidder's offer	
	Output rating			Based on bidder's offer	
	Digital set point / number of digits possible			Based on bidder's offer	
	Analogue set point/output values			Based on bidder's offer	
	Isolation withstand			Based on bidder's offer	
13.25	Serial link to protection relay				
	Protocols supported			Based on bidder's offer	
	Protocols required for this project			Based on bidder's offer	
	Interface			Based on bidder's offer	
	Transmission rate			Based on bidder's offer	
	Optical fiber cable			Based on bidder's offer	
13.26	Hardware interlocking with backup mimic (if the BCU fail)			Based on bidder's offer	
14	<u>Gateway</u>				
14.1	Manufacturer / model			Based on bidder's offer	
14.2	Type			Based on bidder's offer	
14.3	Service conditions (temperature, RH)			Based on bidder's offer	
14.4	Protocol supporting	IEC10 1/103/ DNO3 /HDL C/IND UCTI C33		IEC104	
14.5	Designation type (Hardware/Software)			Based on bidder's offer	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
14.6	Processor speed			Based on bidder's offer	
14.7	Size of hard disc			Based on bidder's offer	
14.8	Size of RAM			Based on bidder's offer	
14.9	Operating system			Based on bidder's offer	
14.10	Modem / speed / connecting lead			Based on bidder's offer	
15	<u>External Modem</u>				
15.1	Manufacturer / model			Based on bidder's offer	
15.2	Type			Based on bidder's offer	
15.3	Service conditions			Based on bidder's offer	
15.4	Speed			Based on bidder's offer	
15.5	Connecting lead			Based on bidder's offer	
15.6	Software and provide compatible with AT & T ,			Based on bidder's offer	
16	<u>System Software</u>				
16.1	Manufacturer/model			Based on bidder's offer	
16.2	Type			Based on bidder's offer	
16.3	Make and version of operating systems			Based on bidder's offer	
16.4	Details of programming languages			Based on bidder's offer	
16.5	Release versions of software			Based on bidder's offer	
16.6	Details of any software development			Based on bidder's offer	
16.7	Software licensing details			Based on bidder's offer	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
16.8	Fault and event analysis software			Based on bidder's offer	
16.9	SCADA protocol			Based on bidder's offer	
16.10	SCMS protocol to BCUs/BCPUs and speed			Based on bidder's offer	
16.11	Reconfiguration system software (Yes/No)			Based on bidder's offer	
16.12	Supporting Future extension according to SLD			Based on bidder's offer	
16.13	Geographical information system software			Based on bidder's offer	
16.14	Diagnose software			Based on bidder's offer	
17	<u>LAPTOP</u>				
17.1	Manufacturer/model			Based on bidder's offer	
17.2	Type			Based on bidder's offer	
17.3	Service conditions			Based on bidder's offer	
17.4	Method of processor expansion (e.g. number of free slots when supplied).			Based on bidder's offer	
17.5	Amount of main memory			16 GB	
17.6	Size of hard disc.			1 TB	
17.7	Processor speed			Based on bidder's offer	
17.8	Size of color display			17.3 Inches	
17.9	Build in mouse			Yes	
17.10	Operating system software			Windows 11	
17.11	SCMS application software			Yes	
17.12	Relay and fault recorder analysis software			Yes	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
17.13	Mains power supply unit			Yes	
17.14	Battery backup period			18 hours	
17.15	Carry case			Yes	
17.16	Modem/speed/connecting lead			Yes	
17.17	Other Accessories			Yes	
18	<u>Performance/Availability</u>				
18.1	Compliance with performance requirements (start and restart)				
	Time for redundant station computer to assume online duties			Based on bidder's offer	
	Time for full updating of information			Based on bidder's offer	
	Confirmation the redundant station computer database is in step with the one line computer			Based on bidder's offer	
18.2	Inclusion of availability calculations			Based on bidder's offer	
19	<u>Inverter System</u>				
19.4	Manufacturer/model			Based on bidder's offer	
19.5	Type			Based on bidder's offer	
19.6	Input DC voltage and range	V		110V DC $\pm 10\%$	
19.7	Input AC voltage and range	V		240 V DC $\pm 10\%$	
19.8	Service conditions (temperature and RH)			Based on bidder's offer	
19.9	Output AC voltage	V		415V	
19.10	Output AC voltage dynamic response	V		Based on bidder's offer	
19.11	Output AC voltage and static regulation	%		± 5	

n)	SUBSTATION SYSTEM (SAS)	AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
19.12	Output frequency regulation (unsynchronized)	%		Based on bidder's offer	
19.13	Output AC voltage harmonic distortion	V		Based on bidder's offer	
19.14	Output rating	VA		Min 6000	
19.15	Output current overload	A		Based on bidder's offer	
19.16	Output frequency tracking range	Hz		Based on bidder's offer	
19.17	Thermal trip	A		Based on bidder's offer	
19.18	Output load power factor			Based on bidder's offer	
19.19	Efficiency at 25, 50, 75 and 100% output			Based on bidder's offer	
20	<u>AC Main Power Transient Protector</u>				
20.1	Manufacturer/model			Based on bidder's offer	
20.2	Type			Based on bidder's offer	
20.3	Nominal AC voltage and range.	V		Based on bidder's offer	
20.4	Input AC frequency and range	Hz		Based on bidder's offer	
20.5	Service conditions (temperature and RH).			Based on bidder's offer	
20.6	Power factor			Based on bidder's offer	
20.7	Peak discharge current	A		Based on bidder's offer	
20.8	Leakage current			Based on bidder's offer	
20.9	Connection details			Based on bidder's offer	
20.10	Dimensions/housing			Based on bidder's offer	
21	<u>Inverter Distribution</u>				
21.1	Manufacturer/model			Based on bidder's offer	

n) SUBSTATION SYSTEM (SAS)		AUTOMATION	UNIT	DATA	
				REQUIRED	OFFERED
21.2	Type of switch			Based on bidder's offer	
21.3	Type of MCB			Based on bidder's offer	
21.4	Distribution circuits (numbers and ratings)			Based on bidder's offer	
21.5	Number of cubicles			Based on bidder's offer	
21.6	Forced limits at one meter			Based on bidder's offer	
21.7	Noise limits at one meter			Based on bidder's offer	
21.8	Instrumentation			Based on bidder's offer	
21.9	Alarms			Based on bidder's offer	
21.10	Efficiency and power factor at 25.50% & 100% outputs			Based on bidder's offer	
21.11	Modular testing/system extension facilities			Based on bidder's offer	
21.12	Provision of maintenance switch			Based on bidder's offer	
21.13	Radio frequency interference			Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
1.	FAULT MONITORING SYSTEM			
1.1	Manufacturer		Based on bidder's offer	
1.2	Type reference			
	– DAU unit type		Based on bidder's offer	
	– Master Station type		Based on bidder's offer	
	– HMI type		Based on bidder's offer	
	– Printer type		Based on bidder's offer	
1.3	Auxiliary voltage range ($V_n = 110V_{dc}$)	Vdc	Based on bidder's offer	
1.4	Analogue Inputs		Based on bidder's offer	
1.5	Binary inputs		Based on bidder's offer	
1.6	A/D converter	bit	Based on bidder's offer	
1.7	Current input max amplitude	In	Based on bidder's offer	
1.8	Current/voltage accuracy	% fsd	≤ 0.5	
1.9	Scan Rate			
	– Analogue Channel	Hz	≥ 4000	
	– Event Channel	Hz	≥ 2000	
1.10	Time stamp resolution	ms	1	
1.11	Recording range			
	– Pre Fault	ms	≥ 500	
	– Post Fault	ms	≥ 2000	
1.12	Trigger response time			

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
	– Analogue	ms	Based on bidder's offer	
	– Event	ms	Based on bidder's offer	
1.13	Memory			
	– RAM (Non Volatile)	GB	>16	
	– HDD	Terabyte	>1	
1.14	Battery back-up duration	days	≥14	
1.15	GPS clock input	Yes/No	Yes	
1.16	System software		Based on bidder's offer	
1.17	Self-monitoring and alarm facility	Yes/No	Yes	
1.18	Communications			
	– Communication ports (Front/rear etc.)			
	RS232	Yes/No	Based on bidder's offer	
	RS485	Yes/No	Based on bidder's offer	
	RJ45	Yes/No	Based on bidder's offer	
	Other	Yes/No	Based on bidder's offer	
	– Protocols supported		Based on bidder's offer	
	IEC 61850	Yes/No	Based on bidder's offer	
	Others (please list)		Based on bidder's offer	
	– Graphical data presentation on SCADA HMI	Yes/No	Yes	
1.19	Type Tests			
1.19.1	Atmospheric Environment			

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
	– Operation -25°C and 55°C for 96hrs, IEC 60068-2-1	Yes/No	Yes	
	– Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2	Yes/No	Yes	
1.19.2	Relative Humidity			
	– Operation at 93%	Yes/No	Yes	
	– Tested to IEC 60068-2-3 with severity class 56 days	Yes/No	Yes	
1.19.3	Enclosure			
	– IEC 60529		IP50	
1.19.4	Mechanical Environment			
	– Vibration IEC 60255-21-1	Yes/No	Yes	
	– Shock and bump IEC 60255-21-2	Yes/No	Yes	
	– Seismic IEC 60255-21-3	Yes/No	Yes	
1.19.5	Insulation			
	– Rated insulation		Based on bidder's offer	
	1000V high impedance protection CT inputs	Yes/No	Yes	
	250V for other circuits	Yes/No	Yes	
	1000V open contact withstand	Yes/No	Yes	
	– Dielectric Tests IEC 60255-5 – Series C of table 1	Yes/No	Yes	
	– Impulse voltage IEC 60255-5 test voltage 5kV	Yes/No	Yes	
1.19.6	Electromagnetic compatibility			
	– 1MHz Burst disturbance test, IEC 60255-22-1 severity class III	Yes/No	Yes	
	– Electrostatic Discharge IEC 60255-22-2 severity class III	Yes/No	Yes	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
	– Radiated Electromagnetic Field Disturbance IEC 60255-22-3 severity class III	Yes/No	Yes	
	– Electromagnetic Emissions IEC 60255-25	Yes/No	Yes	
	– Fast Transient Disturbance IEC 60255-22-4 severity level IV	Yes/No	Yes	
1.19.7	Type test certificate provided	Yes/No	Yes	
2.	PHASOR MEASUREMENT UNIT			
2.1	Applicable Standards		IEEE C37.118 IEC 61850	
2.2	Environmental Conditions			
2.2.1	Working Temperature	°C	Based on bidder’s offer	
2.2.2	Storage Temperature	°C	Based on bidder’s offer	
2.2.3	Maximum Humidity	%	< 90%	
2.3	Type			
2.3.1	Phasor Measurement Unit		Based on bidder’s offer	
2.3.2	GPS Clock		Based on bidder’s offer	
2.3.4	Ethernet Switch		Based on bidder’s offer	
2.3.5	Industrial PC 4U Rack		Based on bidder’s offer	
2.3.6	Laser Printer		Based on bidder’s offer	
2.3.7	LED Monitor+Keyborad+Mouse		Based on bidder’s offer	
2.4	Model			
2.4.1	Phasor Measurement Unit		Based on bidder’s offer	
2.4.2	GPS Clock		Based on bidder’s offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.4.3	Ethernet Switch		Based on bidder's offer	
2.4.4	Industrial PC 4U Rack		Based on bidder's offer	
2.4.5	Laser Printer		Based on bidder's offer	
2.4.6	LED Monitor+Keyborad+Mouse		Based on bidder's offer	
2.5	Make			
2.5.1	Phasor Measurement Unit		Based on bidder's offer	
2.5.2	GPS Clock		Based on bidder's offer	
2.5.3	Ethernet Switch		Based on bidder's offer	
2.5.4	Industrial PC 4U Rack		Based on bidder's offer	
2.5.5	Laser Printer		Based on bidder's offer	
2.5.6	LED Monitor+Keyborad+Mouse		Based on bidder's offer	
2.6	Cabinet			
2.6.1	Mounting		Based on bidder's offer	
2.6.2	Case type		Based on bidder's offer	
2.6.3	IP degree		Based on bidder's offer	
2.6.4	Weight		Based on bidder's offer	
2.6.5	Dimensions in mm (w x h x l)		Based on bidder's offer	
2.6.6	Isolation withstand		Based on bidder's offer	
2.6.7	Fan	Yes/No	Based on bidder's offer	
2.6.8	AC Socket	Yes/No	Based on bidder's offer	
2.6.9	Fuses	Yes/No	Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.6.10	Terminals with Labels	Yes/No	Based on bidder's offer	
2.6.11	Wire Marks	Yes/No	Based on bidder's offer	
2.6.12	Door Micro Switch	Yes/No	Based on bidder's offer	
2.6.13	Swing Door Lock	Yes/No	Based on bidder's offer	
2.6.14	Lighting	Yes/No	Based on bidder's offer	
2.6.15	Loop Test Switch	Yes/No	Based on bidder's offer	
2.6.16	Thermostat	Yes/No	Based on bidder's offer	
2.7	PMU			
2.7.1	Power Supply Unit		Based on bidder's offer	
2.7.2	Central Processor Unit board		Based on bidder's offer	
2.7.3	Digital Signal Processing board		Based on bidder's offer	
2.7.4	Backplane board		Based on bidder's offer	
2.7.5	Network interface board		Based on bidder's offer	
2.7.6	Analog acquisition board		Based on bidder's offer	
2.7.7	Digital inputs and alarm board		Based on bidder's offer	
2.7.8	RS232 serial links		Based on bidder's offer	
2.7.9	RJ45 Copper Ethernet links		Based on bidder's offer	
2.7.10	Internal GPS / External GPS		Based on bidder's offer	
2.7.11	GPS ports		Based on bidder's offer	
2.7.12	Memory Type and Capacity		>1TB	
2.7.13	Current Inputs Board		Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.7.14	Voltage Inputs Board		Based on bidder's offer	
2.7.15	Digital inputs Board		Based on bidder's offer	
2.7.16	System bus interface/speed		Based on bidder's offer	
2.7.17	Provision of two redundant interfaces to LANs		Based on bidder's offer	
2.7.18	Test block /test plug for secondary injection test		Based on bidder's offer	
2.7.19	Data measurement/calculation such as V,I,F, ROCOF, P ,Q , Wh , Varh, power factor, THD ,harmonics up to 11th , ...		Based on bidder's offer	
2.7.20	Time tag accuracy		1 μ S	
2.7.21	Support class	P	Based on bidder's offer	
2.7.22	Reporting rate	Frame /sec	60	
2.7.23	Rated voltage	V	Based on bidder's offer	
2.7.24	Rated current	A	Based on bidder's offer	
2.7.25	Nominal frequency	Hz	50	
2.7.26	Operating frequency	Hz	45-55	
2.7.27	Auxiliary DC Voltage	V DC	Based on bidder's offer	
2.7.28	Auxiliary AC Voltage	V AC	Based on bidder's offer	
2.7.29	Power consumption	W	Based on bidder's offer	
2.7.30	Total Vector Error (TVE)		<1%	
2.7.31	Number of analog channels for synchrophasor measurement		Based on bidder's offer	
2.7.32	Number of opto – insulated digital channels voltage range 24-240		Based on bidder's offer	
2.7.33	Number of digital output contacts		Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.7.34	Digital output contacts making/breaking capacity for DC with DR<40 ms		Based on bidder's offer	
2.7.35	Voltage measuring rang	V	Based on bidder's offer	
2.7.36	Over voltage capability	V	Based on bidder's offer	
2.7.37	Current measuring range	A	Based on bidder's offer	
2.7.38	Over current capability	A	100A, 1Sec	
2.7.39	Min voltage measurement resolution /accuracy			
2.7.40	Phase measurement accuracy		Based on bidder's offer	
2.8	Time synchronization (GPS)		Based on bidder's offer	
2.8.1	Type		Based on bidder's offer	
2.8.2	Internal GPS card/External GPS		Based on bidder's offer	
2.8.3	AC/DC voltage working range	V	Based on bidder's offer	
2.8.4	Power consumption	W	Based on bidder's offer	
2.8.5	Battery standby		Based on bidder's offer	
2.8.6	Type, speed and no. of output interfaces		Based on bidder's offer	
2.8.7	Time and data facility		Based on bidder's offer	
2.8.8	Local time compensation		Based on bidder's offer	
2.8.9	Seasonal changeover/automatic		Based on bidder's offer	
2.8.10	Synchronizing time accuracy		1 μ s	
2.8.11	GPS ports		Based on bidder's offer	
2.8.12	GPS Antenna type		Based on bidder's offer	
2.8.13	GPS antenna connector type		Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.8.14	Cable length and type		Based on bidder's offer	
2.9	Analog to Digital converter		Based on bidder's offer	
2.9.1	Model		Based on bidder's offer	
2.9.2	Maximum no inputs per card		Based on bidder's offer	
2.9.3	Outputs available per input		Based on bidder's offer	
2.9.4	Resolution/accuracy		Based on bidder's offer	
2.9.5	Sampling rate		Based on bidder's offer	
2.9.6	Burden	VA	Based on bidder's offer	
2.9.7	Input CT/VT range		Based on bidder's offer	
2.9.8	Analogue limit monitoring facility at PMU		Based on bidder's offer	
2.9.9	No of input analog quantity per board		Based on bidder's offer	
2.9.10	Digital inputs		Based on bidder's offer	
2.9.11	Number of inputs		Based on bidder's offer	
2.9.12	Rated nominal voltage	V	Based on bidder's offer	
2.9.13	Operating range	V	Based on bidder's offer	
2.9.14	Digital/software filtering to suppress plant contact		Based on bidder's offer	
2.9.15	Maximum input contact frequency		Based on bidder's offer	
2.9.16	Minimum contact closure capture time		Based on bidder's offer	
2.9.17	Time tagging resolution		Based on bidder's offer	
2.9.18	Isolation withstand		Based on bidder's offer	
2.10	Digital outputs		Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.10.1	Number of outputs		Based on bidder's offer	
2.10.2	Rated nominal voltage	V	Based on bidder's offer	
2.10.3	Operating range	V	Based on bidder's offer	
2.10.4	Double pole switching of output		Based on bidder's offer	
2.11	Software			
2.11.1	Monitoring and configuration software		Based on bidder's offer	
2.11.2	Configure all PMU parameters by connecting directly (local /remote)		Based on bidder's offer	
2.11.3	Adding /relocation/rename of PMUs and feeders.		Based on bidder's offer	
2.11.4	Deliver real time measurement and real time waveforms and harmonic up to 11th V ,I , F, E, P , Q, angle difference.		Based on bidder's offer	
2.11.5	Event monitoring		Based on bidder's offer	
2.11.6	Recording and download		Based on bidder's offer	
2.11.7	Installation utility		Based on bidder's offer	
2.11.8	Network server configuration		Based on bidder's offer	
2.11.9	Communication configuration		Based on bidder's offer	
2.11.10	Dynamic Analyzer software		Based on bidder's offer	
2.11.11	Recording software		Based on bidder's offer	
2.11.12	Self-monitoring and problem reporting /alarming		Based on bidder's offer	
2.11.13	Security requirements		Based on bidder's offer	
2.12	WAMPAC infrastructure			
2.12.1	Interface type for Ethernet communication		Based on bidder's offer	

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT		UNIT	DATA	
			Required	Offered
2.12.2	Supported protocol		Based on bidder's offer	
2.12.3	Number of normally open contacts		Based on bidder's offer	
2.13	Communication to PDC		Based on bidder's offer	
2.13.1	Compliant with IEEE C37.118		Based on bidder's offer	
2.13.2	Communication mode		Based on bidder's offer	
2.13.3	Media		Based on bidder's offer	
2.13.4	Type of ports		Based on bidder's offer	
2.13.5	Transfer rate		Based on bidder's offer	
2.14	Communication to Control Centers			
2.14.1	Compliant with IEEE C37.118		Based on bidder's offer	
2.14.2	Communication mode		Based on bidder's offer	
2.14.3	Media		Based on bidder's offer	
2.14.4	Type of ports		Based on bidder's offer	
2.14.5	Transfer rate		Based on bidder's offer	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>SDH</u>			
1.1	Manufacturer's name		Based on bidder’s offer	
1.2	Product Trade Name		Based on bidder’s offer	
1.3	Type of Model /Version Number		Based on bidder’s offer	
1.4	Production Number		Based on bidder’s offer	
1.5	FAT Location		Based on bidder’s offer	
1.6	Applicable Standard(s)		ITU-T,IEEE,IEC	
1.7	Platform		To be defined	
1.8	Type tests reports and certification docs		Required	
1.9	Availability (based on MTBF)		To be defined	
1.10	Flexibility		Required	
1.11	Expandability		Required	
1.12	Automatic Laser Shutdown (ALS)		G.664 Appendix III.2	
1.13	Rack & Shelf Information			
1.13.1	19" or ETSI rack mounting (44U)		Required	
1.13.2	Sub rack Dimension	mm	To be defined	
1.13.3	Rack Dimension	mm	To be defined	
1.13.4	Sub rack Weight (fully populated)	kg	To be defined	
1.13.5	Power Consumption (fully populated)	watt	To be defined	
1.13.6	Power Supply	VDC	(-48 VDC)	
1.13.7	Numbers of Slots (Total & Traffic)		To be defined	
1.13.8	Numbers of Traffic Slots		To be defined	
1.13.9	Traffic Slot Capacity (Full duplex)		To be defined	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
1.14	Environment Condition			
1.14.1	Transport			
1.14.1.1	Max. Transport Temperature	°C	(+ 60)	
1.14.1.2	Min. Transport Temperature	°C	(- 20)	
1.14.1.3	Humidity		(0% to 90%)	
1.14.2	Storage			
1.14.2.1	Max. Transport Temperature	°C	(+ 60)	
1.14.2.2	Min. Transport Temperature	°C	(- 10)	
1.14.2.3	Humidity (0% to 90%)	%	(0% to 90%)	
1.14.3	Operation			
1.14.3.1	Max. Transport Temperature	°C	(+ 55)	
1.14.3.2	Min. Transport Temperature	°C	(- 5)	
1.14.3.3	Humidity	%	(0% to 90%)	
1.15	Certifications (MANDATORY)			
1.15.1	EMC		Required	
1.15.2	EMI		Required	
1.15.5	Reference List only for Proposed systems		Required	
1.16	Redundancy			
1.16.1	CPU		(1+1)	
1.16.2	CXC (Cross connection)		(1+1)	
1.16.3	Power supply		(1+1)	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
1.16.4	2M Electrical port (E1)		1:N (N shall be specified)	
1.16.5	clock card		shall be specified	
1.16.6	Protection for STM16 (G.841 - clause 7.1)		1+1 Linear MSP(G.841 - clause 7.1)	
1.17	Network Side Protection			
1.17.1	1+1 Linear MSP		Yes	
1.17.2	SNCP		Yes	
1.18	Switch Capacity Centralized architecture			
1.18.1	TDM- STM 16 system	Gigab/s	Min 20	
1.18.2	TDM- STM 1 system	Gigab/s	Min 10	
1.18.3	Packet		Yes	
1.19	Ethernet interfaces			
1.19.1	10/100 Base-TX L2 switching Ethernet port		Yes	
1.19.2	Auto-negotiation		Yes	
1.19.3	Auto-crossover		Yes	
1.19.4	Unique MAC address to each Ethernet port		Yes	
1.20	Ethernet services			
1.20.1	E-Line		Yes	
1.20.2	E-LAN		Yes	
1.21	Ethernet protection			

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
1.21.1	Spanning Tree Protocol		Yes	
1.21.2	Rapid Spanning Tree Protocol		Yes	
1.22	NG-SDH Management LCT Functionalities			
1.22.1	local and remote management of NE's over the network		Yes	
1.22.2	Alarm display		Yes	
1.22.3	Fault Management		Yes	
1.22.4	Performance Monitoring and Management		Yes	
1.22.5	Configuration Management		Yes	
1.22.6	Remote operation		Yes	
1.22.7	Access and testing functions		Yes	
1.22.8	Graphical view of entire network		Yes	
1.22.9	Local Craft terminal Port		Yes	
1.23	LCT Hardware (Laptop specification)			
1.23.1	Type & CPU	G	CPU: Core I7	
1.23.2	HHD Capacity	G	>500	
1.23.3	RAM		6	
1.23.4	LCD size (inch)		Less than 15	
2	<u>Access Multiplexer</u>			
2.1	GENERAL			
2.1.1	Manufacturer name		Based on bidder's offer	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
2.1.2	Product trade name		Based on bidder's offer	
2.1.3	Type of Model/Version Number		Based on bidder's offer	
2.1.4	FAT location		Based on bidder's offer	
2.1.5	Applicable Standard(s)		ITU-T	
2.1.6	Type tests reports and certification documents		To be defined	
2.1.7	Availability (based on MTBF)		To be defined	
2.1.8	Flexibility		Yes	
2.1.9	Expandability		Yes	
2.2	Rack and shelf information			
2.2.1	19" or ETSI rack mounting		Yes	
2.2.2	Shelf Dimension (height x width x length)	mm	Yes	
2.2.3	Shelf Weight(fully populated)	kg	Yes	
2.2.4	Power Consumption(fully populated)	watt	Yes	
2.2.5	Power Supply	V Dc	Yes	
2.2.6	Numbers of Slots (Total & Traffic)		Yes	
2.2.7	Numbers of Traffic Slots		Yes	
2.3	General Functionality			
2.3.1	Time multiplexing/ de-multiplexing of all voice and data channels		Yes	
2.3.2	Sub rate data multiplexing based on ITU-T V-Series synch/a synch data		Yes	
2.3.3	Cross-Connecting		at n×64 Kbps, 64 Kbps,	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
			Time Slot and Bit levels	
2.3.4	Cross-connect capacity		To be defined	
2.3.5	Drop/Insert		Yes	
2.3.6	IP routing		Optional	
2.3.7	VF operation		Yes	
2.3.8	Signaling		To be defined	
2.3.9	Transmission delay	μs	<250	
2.4	Line Interface			
2.4.1	E1		Yes	
2.4.2	STM1		Advantage	
2.5	Interfaces			
2.5.1	6 wire E&M signaling with ring generator		Yes	
2.5.2	2 wire voice channel		Yes	
2.5.3	FXO/FXS		Yes	
2.5.4	0.3-64 Kbps Sync. /A sync. V.24/V.28		Yes	
2.5.5	N × 64 Kbps Sync. /A sync.		Yes	
2.5.6	RS-232, RS-485		Yes	
2.5.7	Ethernet		Yes	
2.6	Redundancy			
2.6.1	Line card redundancy		1+1	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
2.6.2	Power Supply redundancy		1+1	
2.6.3	Cross Connection redundancy		1+1	
2.6.4	Redundancy of Processor		1+1	
2.6.5	Clock		To be defined	
2.6.6	Cooling fans redundancy		To be defined	
2.7	Environmental condition			
2.7.1	Operating Temperature (Long/Short term)		To be defined	
2.7.2	Storage & Transportation temperature		To be defined	
2.7.3	Humidity (St., Tr., Op.) (%)		To be defined	
2.8	Configurations			
2.8.1	Terminal with Multiplexing & Sub multiplexing		Yes	
2.8.2	ADM in Linear & Ring		Yes	
2.8.3	CXC in Mesh & Tree		Advantage	
2.9	Access MUX Management LCT Functionalities			
2.9.1	local and remote management of NE's over the network		Yes	
2.9.2	Alarm display		Yes	
2.9.3	Fault Management		Yes	
2.9.4	Performance Monitoring and Management		Yes	
2.9.5	Configuration Management		Yes	
2.9.6	Remote operation		Yes	

p) SDH AND MULTIPLEXER		UNIT	DATA	
			REQUIRED	OFFERED
2.9.7	Access and testing functions		Yes	
2.9.8	Graphical view of entire network		Yes	

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
1	MANUFACTURER		Based on bidder’s offer	
1.1	NAME AND COUNTRY		Based on bidder’s offer	
1.2	TYPE REFERENCE		Based on bidder’s offer	
2	COMMANDS		4 or Upper	
2.1	COMMANDS PRIORITY		Yes	
2.2	TYPE OF COMMAND TRANSMISSION:			
2.2.1	CODED		Yes	
2.2.2.	NONCODED		Yes	
3	ALL OF THE PERIPHERAL EQUIPMENTS, TOOLS, HARDWARE, SOFTWARE AND TECHNICAL DOCUMENTS INCLUDED WITH EACH TPS TERMINAL			
4	Power consumption		shall be defined	
5	High voltage interfaces		48 -220 VDC	
5.1	Type of command contacts		To be defined	
5.2	Type of alarm contacts		To be defined	
6	Tripping type:			
6.1	Inter-tripping (Direct)		Yes	
6.2	Permissive tripping (under reach)		Yes	
6.3	Permissive tripping (over reach)		Yes	
6.4	Blocking		Yes	

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
7	Operation time			
7.1	Direct tripping	ms	< 14	
7.2	Permissive tripping	ms	< 14	
7.3	Blocking tripping	ms	< 14	
7.4	Minimum initialization time for command	ms	2	
7.5	Maximum acceptable propagation time for telecommunication link	ms	100	
7.6	Additional delay by noise range	ms	40	
7.7	Distortion of the total pulse at the output of the receiving compared to the sending equipment	ms	4	
8	Transmitter			
8.1	Tx level range for :			
8.1.1	Command	dBm	-15 to 0	
8.1.2	Guard	dBm	-25 to -10	
8.2	Return loss	dBm	≥ 20	
8.3	Number of signals for each command		1	
8.4	Harmonic distortion		$\%5 \geq$	
8.5	Level boosting of commands	dB	≥ 9	
9	Receiver			
9.1	Rx level range for :			

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
9.1.1	Command	dBm	-15 to 0	
9.1.2	Guard	dBm	-25 to -10	
9.2	Return loss	dB	≥ 20	
9.3	Dynamic range	dB	≥ 25	
9.4	Receiver selectivity – 300 Hz out of guard's and command's range	dBm0	≥ 55	
9.5	S/N Ratio	dB	≥ 5	
10	High voltage interfaces			
10.1	Command and start input voltage ranges	V	220 ~ 48	
10.2	Number of contacts for each command		≥ 6	
10.3	Number of alarm contact for each command		≥ 4	
10.4	Command and alarm contacts ratings	VA	250	
10.5	Duration time before operating of alarm relays	ms	Based on bidder's offer	
11	Alarm conditions			
11.1	Transmitter failed		Yes	
11.2	PLC failed		Yes	
11.3	Guard signal absence		Yes	
11.4	Low S/N Ratio		Yes	

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
11.5	No card located		Yes	
11.6	Any damaged board		Yes	
11.7	Far-end TPS turned off		Yes	
11.8	Presence of guard and command signal simultaneously		Yes	
11.9	Presence of command signal continuously		Yes	
11.10	Watch dog activation alarm		Yes	
12	Basis of time			
12.1	Internal time base		Yes	
12.2	External time base – real time		Yes	
	clock such as GPS interface			
13	Dependability and security (pu<10⁻⁶)			
13.1	S / N Ratio	dB	≤ 5	
13.2	Operating time	ms	≤ 15	
14	Power supply			
14.1	Nominal supply voltage	V dc	48	
14.2	Supply tolerance		-15%,+20%	
14.3	Power supply ripple		<%5	
15	Environmental condition			
15.1	Operation			

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
15.1.1	Temperature range	°C	-5 ~+55°C	
15.1.2	Relative Humidity	%	≥ 95% @ 40°C	
15.1.3	Class of standard for mechanical		IEC 721 .3.3	
			CLASS 3 M 1	
15.2	Storage			
15.2.1	Temperature range	°C	40 ~ +70°C	
15.2.2	Relative humidity	%	≥ 95% @ 40°C	
15.2.3	Class of standard for mechanical		IEC.721.3.3	
			CLASS 1 K 5	
16	Electromagnetic and insulation			
16.1	HF disturbance		2500 V / IEC.255.22.1	
16.2	Fast transient burst		2000 V / IEC.801.4	
16.3	Electromagnetic discharge		8000 V / IEC.801.2	
17	Valid Test Reference			
17.1	According to IEC-60834 and other relative standards		Yes	
18	Interfaces			
18.1	Interface between TPS and PLC Based on IEC495 Clause 3.10.5.1		ANALOG 600Ω, 300~2400Hz	
18.2	Interface between TPS and other telecommunication systems such as Fiber Optic or Digital channel		OPTICAL INTERFACE / G.703-64Kbps	
19	Commands			

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
19.1	Number of independent commands		≤ 4	
19.2	Number of simultaneous commands at least		2	
20	Software Facilities			
20.1	TPS hardware assignment		Yes	
20.2	TPS configuration		Yes	
20.3	Command assignment		Yes	
20.4	Command and alarm assignment		Yes	
20.5	Operation time assignment for each command independently		Yes	
20.6	Duration and Delay time assignment for each command independently		Yes	
20.7	Record for counters, Events and Faults with Time Tag		Yes	
20.8	Remote TPS configuration and monitoring		Yes	
21	Test Facilities			
21.1	Local test		Yes	
21.2	Local loop test		Yes	
21.3	Remote loop test		Yes	
21.4	Periodically auto test		Yes	
22	Diagnostic			
22.1	Online maintenance and diagnostic		Yes	
22.2	Checking Facilities:			

q) TPS SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
	Power Supply		Yes	
	Others		Yes	
23	Interfaces for connecting distance protection devices:		Yes	
23.1	- IEC 61850 interface (GOOSE)		Yes	
23.2	- Binary command I/O interface		Yes	
24	Interfaces for integration into telecommunication networks:		Yes	
24.1	Digital electrical interface (PDH, SDH)		Yes	
24.2	Ethernet line interface (MPLS-TP)		Yes	
25	Combinations of path protection for alternative transmission routes		Yes	
26	Event memory with time stamp 8000 events ,1 ms resolution,		Yes	
27	date- and time-stamped, nonvolatile		Yes	
28	Remote access to devices via TCP/IP and Remote readout of the event recorder		Yes	
29	SNMP agent for NMS integration		Yes	
30	Message authentication to ensure Cyber Security Real-time clock, external synchronization sources (NTP)		Yes	

r) FIREWALL & SWITCH		UNIT	DATA	
			REQUIRED	OFFERED
A	Switch			
1	Manufacturer name			
2	Manufacturer part number			
3	Form Factor		Fixed, Rack mutable 1u, stackable/Clusterin g	
4	Specifications			
4.1	Standards		<ul style="list-style-type: none"> • IE10Base-T /100Base-TX and 100Base-FX/1000Base-T/Gigabit Fiber • IEEE 802.11n, 802.11g, 802.11b, • 802.3, 802.3/3u/3ab/3z • 802.1X (security authentication) • 802.1Q (VLAN) Tagging • 802.1w Rapid Spanning Tree Protocol • 802.3ad LACP • 802.11i (Wi-Fi Protected Access [WPA2] security) • 802.11e (wireless quality of service [QoS]) • IPv4 (RFC 791), IPv6 (RFC 2460) • Routing Information Protocol (RIP) v1 (RFC 1058), RIP v2 (RFC 1723) 	
4.2	Features		<ul style="list-style-type: none"> •Flow control •Full Duplex capability •Layer 3 Switching •Auto sensing per device •IP routing 	

r) FIREWALL & SWITCH		UNIT	DATA	
			REQUIRED	OFFERED
			<ul style="list-style-type: none"> • DHCP support • Auto-negotiating • ARP support • RSTP support • MSTP support • ACL • Qos • RADIUS • TFTP • DTP • PAgP • LACP • RSPAN • Static IP • PPPoE • PPTP • L2TP • STP • DDNS 	
4.3	Routing protocols		<ul style="list-style-type: none"> • Static • RIP 	
4.4	NAT protocol		<ul style="list-style-type: none"> • PAT • NAT • SIP ALG 	
4.5	IPv6 / IPv4		Yes	
4.6	Network edge (DMZ)		Yes	
4.7	VLAN support		Yes	
5	Performance and Scalability			
5.1	Switch port density Uplink	Port/Gbps	At least 4x 1G fixed uplinks	
5.2	Forwarding bandwidth	Gbps	17.8 Mpps or Higher	
5.3	Switching Bandwidth	Gbps	Based on bidder's offer	
5.4	Maximum active VLANs		Based on bidder's offer	
5.5	MAC Address Table Size		12K entries	

r) FIREWALL & SWITCH		UNIT	DATA	
			REQUIRED	OFFERED
5.6	VLAN IDs available		1K	
5.7	Maximum transmission unit (MTU)-L3 packet	bytes	Based on bidder's offer	
5.8	Jumbo frame -Ethernet frame Support	bytes	Yes	
6	Security		Based on bidder's offer	
6.1	Firewall		Yes /No	
6.2	Access control		Yes	
6.3	Content filtering		Yes	
7	Secure management			
7.1	802.1x supplicant		Yes	
7.2	802.3x flow control support		Yes	
7.3	Certificates		Yes	
7.4	VPN		Yes	
7.5	IP sec		Yes	
7.6	QuickVPN		Yes	
7.7	SSL VPN		Yes	
7.8	SSL VPN platforms	Gbps	Based on bidder's offer	
7.9	PPTP		Yes	
7.10	Encryption		DES 3DES AES	
7.11	Authentication		Yes	

r) FIREWALL & SWITCH		UNIT	DATA	
			REQUIRED	OFFERED
7.12	VPN pass-through		PPTP, L2TP, Ipsec	
7.13	Advanced VPNs		DPD Ipsec Group VPN	
7.14	Quality of Service		Yes	
7.15	Prioritization types		Yes	
7.16	Queues		Yes	
7.17	Performance		Yes	
7.18	NAT throughput	Mbps	To be determined	
7.19	Concurrent sessions		Yes	
7.20	IPsec VPN throughput (3DES / AES)	Mbps	To be determined	
7.21	SSL VPN throughput	Mbps	To be determined	
7.22	Configuration		Yes	
7.23	Web user interface		HTTP/HTTPS	
8	Management			
8.1	Management protocols		SNMP UPnP SNTP SSH Syslog RMON CLI	
8.2	Event logging		Yes	
8.3	Upgradability		Yes	
8.4	Wireless LAN Specification		Yes	
8.5	Recovery Time		< 50 ms	

r) FIREWALL & SWITCH		UNIT	DATA	
			REQUIRED	OFFERED
9	Interface			
9.1	RJ45 Ports	Ports	At least 24 ports 10/100/1000 Mbps Cat 3,4,5,6 Cable	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>General</u>			
1.1	Rated voltage	V	415/240	
1.2	Rated frequency	HZ	50	
1.3	Max. Permissible voltage drop	%	2	
1.4	Number of phases		3	
1.5	Number of wires		4/5	
1.6	Short circuit current/time	kA/ S	Acc. To short circuit level of main LVAC panel	
2	<u>Degree of protection</u>			
2.1	Outdoor equipment	IP	IP55	IP55
2.2	Indoor equipment	IP	IP52	IP52
3	<u>Normal illumination level:</u>			
3.1	Control areas/room	Lux	350	
3.2	Data printers	Lux	300	
3.3	Project Managers/offices	Lux	400	
3.4	Monitoring room	Lux	300	
3.5	Telecoms room	Lux	300	
3.6	Mess room	Lux	200	
3.7	Metering room	Lux	200	
3.8	Switch room	Lux	200	
3.9	Toilets	Lux	150	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
3.10	Access corridors	Lux	150	
3.11	HV equipment floors	Lux	150	
3.12	Marshalling room/stairwells	Lux	150	
3.13	Cable floor/cable risers	Lux	50	
3.14	Battery room	Lux	200	
3.15	Entrance	Lux	150	
3.16	Fuel oil plant room	Lux	150	
3.17	Stairwells/corridors	Lux	150	
3.18	Station unit switch room	Lux	200	
3.19	Workshop/store	Lux	300	
3.20	C&I equipment	Lux	300	
3.21	Electronics room	Lux	300	
3.22	Switchgear room	Lux	200	
3.23	Prayer room	Lux	250	
3.24	Stores	Lux	200-300	
3.25	Kitchens	Lux	500	
3.26	Conference rooms	Lux	300-500	
3.27	Locker rooms	Lux	200	
3.28	Cable tunnels	Lux	50	
3.29	Transformer compounds	Lux	40	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
3.30	Transformer area	Lux	40	
3.31	Operating plant areas:			
3.32	○ Machinery areas	Lux	200	
3.33	○ Platforms/ladders (active)	Lux	50	
3.34	○ Walkways	Lux	50	
3.35	○ Road, platform/ladders (inactive),	Lux	20	
4	<u>Minimum illumination level (emergency lighting):</u>			
4.1	Control room	Lux	100	
4.2	AC/DC room	Lux	100	
4.3	Relay room	Lux	100	
4.4	Battery room	Lux	100	
4.5	Transformers and circuit breakers	Lux	100	
5	<u>Lighting factors taken in to consideration</u>			
5.1	Uniformity factor(Emin/Eave), (Emin/Emax)		1:3, 1:6	
5.2	Maintenance factor for indoor lighting		0.7	
5.3	Maintenance factor for outdoor lighting		0.65	
5.4	The minimum p.f. of the lighting		0.9	
6	<u>Switchyard lighting:</u>			
6.1	Manufacturer		Based on bidder's offer	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
6.2	Type of fixture		Flood light	
6.3	Type and power of lamp	w	(LED)	
6.4	Type of fixture mounting		Structure mounted	
6.5	lamp life	hr	>50000	
6.6	Lamp efficiency	Lum /w	125	
6.7	Lamp flux	lm		
6.8	Fixture mounted height	m	Based on bidder's offer	
6.9	Number of fixture		Based on bidder's offer	
7	<u>Access and main road lighting</u>			
7.1	Manufacturer		Based on bidder's offer	
7.2	Type of fixture		Street light	
7.3	Type and power of lamp	w	(LED)	
7.4	Type of mounting		Pole mounted	
7.5	Pole distance from road	m	0.9	
7.6	Pole height	m	Based on bidder's offer	
7.7	Fixture mounting height	m	Based on bidder's offer	
7.8	lamp life	hr	>50000	
7.9	Lamp flux	lm		
7.10	Lamp efficiency	Lum /w	125	
7.11	Type of lighting poles		Hot dip galvanized steel	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
7.12	Thickness of painting	μm	80~120	
8	<u>110 V DC emergency lighting:</u>			
8.1	Manufacturer		Based on bidder's offer	
8.2	Type of fitting		Based on bidder's offer	
8.3	Type of outdoor lamp	w	LED	
8.4	Type of indoor lamp	w	LED	
8.5	Location mounted for outdoor DC lighting		Based on bidder's offer	
8.6	Degree of protection	IP	55(Outdoor) /42(Indoor)	
9	<u>Main indoor lighting equipment</u>			
9.1	Manufacturer		Based on bidder's offer	
9.2	Type of lighting fixture		LED	
9.3	Type and power of lamp	w	bi-pin cap & white type lamp	
10	<u>Lighting Panel</u>			
10.1	Type of incoming circuit breaker		MCCB	
10.2	Type of outgoing circuit breakers		(MCCB or MCB)	
11	<u>Minimum cross section of lighting cables</u>	mm ²		
11.1	Minimum cross section of outdoor lighting cables		4	
11.2	Minimum cross section of indoor lighting cables		1.5	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
11.3	Minimum cross section of socket cables		2.5	
12	<u>Photo-cell</u>			
12.1	Type		Based on bidder's offer	
12.2	Location		Based on bidder's offer	
13	<u>Electrical Socket</u>			
13.1	Manufacturer		Based on bidder's offer	
13.2	Type(s)		Based on bidder's offer	
13.3	Voltage Rating		415/240	
13.4	Phases		1/3	
13.5	Rating of socket		Based on bidder's offer	
13.6	Single phase	A	>16	
13.7	Three phase	A	Acc. To calculation	
13.8	Current Rating		Based on bidder's offer	
13.9	Quantity		Based on bidder's offer	
14	<u>Telephone System</u>			
14.1	Subsets		Based on bidder's offer	
14.2	Manufacturer		Based on bidder's offer	
14.3	Type		Desk mounted / wall mounted/VOIP	
14.4	Type of control & communication cable in telephone system		Twisted pair/copper conductor/ 0.6mm2 diameter colored PE insulation/overall screen with tinned	

s) LIGHTING AND TELEPHONE SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
			copper drain wire/overall PVC sheath /Ethernet Cable	
14.5	Degree of protection for terminal boxes		Based on bidder’s offer	
14.6	Indoor	IP	51	
14.7	Outdoor	IP	55	
14.8	Quantities Required (minimum):		Based on bidder’s offer	
14.9	Desk Mounted Type		Based on bidder’s offer	
14.10	Wall Type		Based on bidder’s offer	
14.11	Spare Units:		Based on bidder’s offer	
14.12	Desk Mounted Type		Based on bidder’s offer	
14.13	Wall Type		Based on bidder’s offer	
14.14	Outdoor Wall Type		Based on bidder’s offer	
15	<u>Type of equipment in battery room</u>		explosion proof Zone0 Group IIC	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
1.0	OUTDOOR IP CAMERA			
1.1	Manufacturer and Country of Origin		To be Specified	
1.2	Type		Outdoor IP Camera	
1.3	Standards		EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B, IEC62262, IEC61000-4-5, IEC60068-2-11.	
1.4	Image Sensor		1/2.8” 2.0-megapixel progressive scan CMOS sensor	
1.5	Resolution and Day/Night Mode		1920*1080 resolution Auto/Color/Monochrome (removable infrared-cut filter) mode	
1.6	Shutter Speed		1/100000s to 1s electronic shutter speed	
1.7	Dynamic Range		128dB wide dynamic mode	
1.8	Digital Noise Reduction		Self-adaptive to 2D or 3D DNR	
1.9	Backlight Compensation		Supported	
1.10	Defog		Automatic/manual	
1.11	Image Stabilisation		Electronic Image Stabilisation	
1.12	IR coverage		Up to 80meters	
1.13	Angular Field of View		Horizontal: [43° Wide 14°(Tele)] and Vertical: [22° (Wide) 9° (Tele)]	
1.14	Video Compression		H.265/H.264/MJPEG	
1.15	Multiple streaming		Double Full HD streams and Treble	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			streams (30fps or 25fps)	
1.16	Audio Compression		G.711a/G.711u/G.726/OPUS	
1.17	Network Protocols		TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS	
1.18	Streaming Transmission and Encryption		Unicast/Multicast AES 128/192/256 encryption algorithm	
1.19	Intelligent Analytics		Loitering detection, Intrusion detection, Abandoned object detection, removed object detection, Target color recognition, Humans and vehicles distinguish, motion detection, tampering detection	
1.20	Electrical and Serial Interfaces		1xRJ-45 10/100Base-T self-adaptive Ethernet port, At least 1*RJ-45 10/100Base-T self-adaptive Ethernet port	
1.21	Alarm and Audio Interfaces		Alarm: 2 channel input and 2 channel output, Audio: 1 channel input and 1 channel output	
1.22	Memory card Slot		Built in 32G memory slot	
1.23	Power Supply		DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at)	
1.24	Physical Characteristics		6kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			protection, 10-day salt spray test rating	
2.0	IP PAN TILT ZOOM CAMERA			
2.1	Manufacturer and Country of Origin		To be specified	
2.2	Type		IP Pan Tilt Zoom Camera	
2.3	Standards		EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B, IEC62262, IEC61000-4-5, IEC60068-2-11.	
2.4	Image Sensor		1/2.8" 2.0-megapixel progressive scan CMOS sensor	
2.5	Resolution and Day/Night Mode		1920*1080 resolution Auto/Color/Monochrome	
2.6	Shutter Speed and Iris Diaphragm		1/100000s to 1s, Automatic iris diaphragm	
2.7	Dynamic Range	dB	120dB WDR	
2.8	Digital Noise Reduction		self-adaptive to 2D or 3D	
2.9	Backlight Compensation and highlight suppression		Supported	
2.1	Defog		Automatic/Manual	
2.11	Image Stabilisation		G-Sensor Unit Electronic Image stabilization	
2.12	Lens		Focal Length: 4.5mm-135mm, Zoom: 30X Optical zoom and 16X Digital zoom,	
2.13	Angular and Rotational Field of View		Angular: [60.89° Wide 2.67°(Tele)] and Vertical: [37.34° (Wide) 1.51° (Tele)]	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			Rotation: (Horizontal:0° to 360°, Vertical: -20° to +90°), Horizontal Rotation Speed: [Manual: 0.1°/s to 450°/s, Preset≥450°/s], Vertical rotation speed: [Manual: 0.1°/s to 400°/s, Preset≥400°/s], 256 preset positions, : 8 scan lines each with 32 preset positions Max of 5 scan lines each 10minutes,	
2.14	Video Compression		H.265/H.264/MJPEG	
2.15	Multiple streaming		Double Full HD streams and Treble streams (30fps or 25fps)	
2.16	Media Encryption		AES128/192/256 encryption algorithm	
2.17	Network Protocols		TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS	
2.18	Streaming Transmission and Encryption		Unicast/multicast streaming transmission and stream encryption capable	
2.19	Intelligent Analytics		Park Action: Home position, preset position tour, pattern scan, horizontal scan, vertical scan, random scan, frame scan and panoramic scan ISP Packages: 5 defined scenarios (outdoor, indoor, motion capture, lowlight, and backlight modes),	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			Event Triggers: motion detection, covering detection, alarm input, intelligent analytics alarm and network disconnection	
2.2	Electrical and Serial Interfaces		One RJ-45 10/100/1000Base-TX self-adaptive Ethernet port	
2.21	Alarm Interfaces		4-channel alarm input and 1-channel alarm output(pigtail)	
2.22	Memory card Slot		Micro SD cards in 64GB maximum memory slot of Speed class≥6	
2.23	Power Supply		DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at)	
2.24	Maximum Power consumption		45W	
2.25	Physical Characteristics		6kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP protection, 10-day salt spray test rating	
3.0	IP DOME CAMERA			
3.1	Manufacturer and Country of Origin		To be Specified	
3.2	Type		IP Dome Camera	
3.3	Standards		EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B, IEC62262, IEC61000-4-5, IEC60068-2-11.	
3.4	Image Sensor		1/2.7" 2.0-megapixel progressive scan CMOS sensor	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
3.5	Resolution and Day/Night Mode		1920*1080 resolution Auto/Multicolor/Mono chrome (removable infrared-cut filter)	
3.6	Shutter Speed and Iris Diaphragm		1/100000s to 1s Automatic iris diaphragm Gain Control: Automatic/Manual	
3.7	Dynamic Range		120dB wide dynamic mode	
3.8	Digital Noise Reduction		Self-adaptive to 2D or 3D	
3.9	Backlight Compensation and highlight suppression		Supported	
3.10	IR coverage		30m minimum	
3.11	Image Stabilisation		G-Sensor Unit Electronic Image stabilization	
3.12	Lens		Focal Length: 2.8- 12mm F1.4max, Zoom: 30X Optical zoom and 16X Digital zoom	
3.13	Angular Field of view and Camera Angle Adjustment		Angular field of view: Horizontal: [106° Wide 36°(Tele)] and Vertical: [57° (Wide) 20° (Tele)], Camera angle adjustment: (Pan:0° to 356°, Tilt: 0° to 75°, Rotation: 0° to 356°),	
3.14	Video and Audio Compression		Video: H.265/H.264/MJPEG Audio: G.711a/G.711u/G.726/ OPUS	
3.15	Multiple streaming		Double Full HD streams and Treble streams (30fps or 25fps)	
3.16	Media Encryption		AES128/192/256 encryption algorithm,	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
3.17	Network Protocols		TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS	
3.18	Streaming Transmission and Encryption		Unicast/multicast steaming transmission and stream encryption capable	
3.19	Intelligent Analytics		Intelligent detections: (motion detection, covering detection), Event actions: [Alarm output, SD card recording and snapshot],	
3.20	Electrical and Serial Interfaces		1xRJ-45 10/100Base-T self-adaptive Ethernet port, 1*RS485 serial port	
3.21	Alarm Interfaces		1-channel alarm input and 1-channel alarm output	
3.22	Memory card Slot		64GB	
3.23	Power Supply		DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at)	
3.24	Maximum Power consumption	W	9W	
3.25	Physical Characteristics		4kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP protection, 10-day salt spray test rating	
4.0	VIDEO SURVEILLANCE SERVER			
4.1	Manufacturer and Country of Origin		To be Specified	
4.2	Type		Video Surveillance Server	
4.3	Access Channels		8 maximum video access channels, 8	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			video playback and download channels	
4.4	Bandwidth	Mbit/s	input bandwidth: 128Mbit/s, Video forwarding channels: 32 output bandwidth: 256Mbit/s,	
4.5	Video Formats		H.264/H.265	
4.6	Decoding Performance		1-channel 4K or 8-channel 1080p or 16-channel 720p	
4.7	Preview Modes		1/4/8/9/16 panes	
4.8	Stacking function		2 to 16 such modules, 2 number if storage disks with Hot-swappable SATA3.0	
4.9	Disk type		50TB enterprise-level hard disk	
4.10	RAID Level		non-RAID mode/RAID1	
4.11	Recording modes		(supported manual recording, scheduled recording, and alarm-triggered recoding), Query by time or events option, Batch download or download by time segment options	
4.12	Media Encryption		supports multiple encryption algorithms such as AES256	
4.13	Compatibility		Supports access of devices that comply with the GB/T 28181, ONVIF 2.4, or ONVIF Profile S protocol, DHSDK, also supports connection to other platforms that comply with various protocols such as GB/T 28181 to implement diverse	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			functions such as live video viewing and PTZ control and alarm reporting	
4.14	Protocols		TCP, UDP, IPv4, HTTPS, RTP, RSTP, RTCP, AIP, SSL, NTP, HTTP	
4.15	External Interfaces		at least 1*HDMI 2.0, 1*VGA, 2*10/100/1000Mbit/s Ethernet ports, 1*USB3.0, 1*USB2.0, 1*BNC Audio input, 1*BNC Audio output, 2*input Alarm channels, 1*output Alarm channels	
4.16	Power Consumption	W	<60W	
4.17	Power Supply	VAC	100VAC to 240VAC(50Hz/60Hz)	
4.18	Cabinet		Standard 19-inch 9U cabinet	
5.0	3KVA BATTERY BACKUP SUPPLY (N/A)			
5.1	Manufacturer and Country of Origin		To be Specified	
5.2	Type		3kVA Battery Backup Supply	
5.3	Output Power Capacity		2.7kW/3.0kVA	
5.4	Output Voltage and distortion	V	230V nominal, configurable for 220V, 230V, or 240V nominal output voltage, distortion less than 5% at full load	
5.5	Output Frequency	Hz	47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal	
5.6	Output Connections		(8) IEC 320 C13 (Battery Backup), (2) IEC Jumpers (Battery	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			Backup), (1) IEC 320 C19 (Battery Backup)	
5.7	Input Voltage	V	230V, 220V or 240V	
5.8	Input Frequency	Hz	50/60 Hz +/- 3 Hz (auto sensing)	
5.9	Input Connections		IEC-320 C20, Schuko CEE 7 / EU1-16P, British BS1363A	
5.10	Input Voltage Range	V	160-286V	
5.11	Battery Type		Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak proof	
5.12	Recharge Time	Hours	3hrs	
5.13	Interface Ports		USB	
5.14	Control Panel		Multi-function LCD status and control console	
5.15	Audible Alarm		Alarm when on battery, distinctive low battery alarm, configurable delays	
5.16	Surge Energy Rating	Joules	365 Joules	
5.17	Filtering		Full time multi-pole noise filtering, 0.3% IEEE surge let-through, zero clamping response time, meets UL 1449	
5.18	Operating Temperature	°C	0 - 40 °C	
5.19	Audible Noise	dBA	53.0dBA at 1 meter from surface of unit	
5.20	Online Thermal Dissipation	TU/hr	375.0BTU/hr	
5.21	Protection Class		Minimum IP20	
5.22	Certification		CE, CSA, EAC, EN/IEC 62040-1, EN/IEC 62040-2, RCM, VDE	
6.0	5KVA BATTERY BACKUP SUPPLY			

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
6.1	Manufacturer and Country of Origin		To be Specified	
6.2	Type		5kVA Battery Backup Supply	
6.3	Output Power Capacity		3.5kW/5.0kVA	
6.4	Output Voltage and distortion	V	230V, configurable for 220V, 230V, or 240V nominal output voltage, distortion less than 5% at full load	
6.5	Efficiency at Full load	%	92%	
6.6	Output Frequency	Hz	47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal	
6.7	Output Connections		8) IEC 320 C13 (Battery Backup), (2) IEC Jumpers (Battery Backup), (1) IEC 320 C19 (Battery Backup)	
6.8	Input Voltage	V	230V, 220V or 240V	
6.9	Input Frequency	Hz	50/60 Hz +/- 5 Hz (auto sensing)	
6.10	Input Connections		IEC-320 C20, Schuko CEE 7 / EU1-16P, British BS1363A	
6.11	Input Voltage Range	V	140-280V	
6.12	Battery Type		Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak proof	
6.13	Recharge Time	Hours	3hrs maximum	
6.14	Interface Ports		USB	
6.15	Control Panel		ED status display with load and battery bar-graphs and On Line: On Battery: Replace Battery: Overload and Bypass Indicators	
6.16	Audible Alarm		Alarm when on battery, distinctive low	

t) CCTV SURVEILLANCE AND ACCESS CONTROL		UNIT	DATA	
			REQUIRED	OFFERED
			battery alarm, configurable delays	
6.17	Surge Energy Rating	Joules	555 Joules	
6.18	Filtering		Full time multi-pole noise filtering, 0.3% IEEE surge let-through, zero clamping response time, meets UL 1449	
6.19	Operating Temperature	°C	0 - 40 °C	
6.20	Audible Noise	dBA	55.0dBA at 1 meter from surface of unit	
6.21	Online Thermal Dissipation	TU/hr	1057.0BTU/hr	
6.22	Protection Class		Minimum IP20	
6.23	Certification		CE, EN 50091-1, EN 50091-2, EN 55022 Class A, EN 60950, EN 61000-3-2, GOST, UL 1778, VDE	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>FACP (FIRE ALARM CONTROL PANEL)</u>			
1.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
1.2	Amb. Relative Hummidity Max.	%	95%	
1.3	Normal operation temperature	°C	-20 TO 50C	
1.4	Input voltage	V	240 VAC	
1.5	Output voltage	V	24VDC	
1.6	Output current		Based on bidder's offer	
1.7	Manufactured to which standard		Based on bidder's offer	
1.8	Dimensions		Based on bidder's offer	
1.9	Weight		Based on bidder's offer	
1.10	Color		Based on bidder's offer	
1.11	Fully programmable	Yes/No	Yes	
1.12	Password protection	Yes/No	Yes	
1.13	Event History	Yes/No	Yes	
1.14	RS 232 / RS 485	Yes/No	Yes	
1.15	Isolation facility	Yes/No	Yes	
1.16	Paging System interface	Yes/No	Yes	
1.17	Network facility		Based on bidder's offer	
1.18	Ingress protection		IP51	
1.19	Temperature rating	°C	MAX. 50C	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
1.20	MOUNTING		wall mounted	
1.21	cable access		Bottom	
1.22	Quantity	No.	According To Design	
1.23	Other specifications		Based on bidder's offer	
1.24	Loop number	No.	According To Design	
1.25	Backup Battery	Yes/No	YES	
1.26	DISPLAY		LCD	
1.27	LED ZONE (INDICATOR)	Yes/No	Yes	
1.28	Charger	Yes/No	Yes	
1.29	Type	Address able/ Conventi onal		
1.30	Certificate		Based on bidder's offer	
1.31	Relay card		Based on bidder's offer	
1.32	Model No.		Based on bidder's offer	
1.33	Manufacturer		Based on bidder's offer	
1.34	Requisition No.		Based on bidder's offer	
1.35	P.O. No.		Based on bidder's offer	
2	<u>FIX HEAT DETECTOR</u>			
2.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
2.2	Ambient Relative Humidity Max.	%	95%	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
2.3	Normal operation temperature	°C	-20 TO 50C	
2.4	Type and model	Address able/Conventional		
2.5	Function		Heat Detector	
2.6	Supply voltage	V	17-28 v dc	
2.7	Current at 24 Vdc		Based on bidder's offer	
2.8	Alarm current at 24vdc		Based on bidder's offer	
2.9	Humidity	%	0-95%	
2.10	Manufactured to which standard		Based on bidder's offer	
2.11	Dimensions		Based on bidder's offer	
2.12	Weight		Based on bidder's offer	
2.13	Color		WHITE	
2.14	Ingress protection		Based on bidder's offer	
2.15	Sensibility range for		SENSITIVITY IS AUTOMATICALLY ADJUST	
2.16	Alarm indicator	Color/type	Red LED	
2.17	Grade		1	
2.18	Response time	Low/Fast	Fast	
2.19	Initiating temperature		Based on bidder's offer	
2.20	Mounting		Base	
2.21	Body & housing material		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
2.22	Output signal		Serial out put	
2.23	Detector type		Ionization and Photoelectric	
2.24	Material		Fire Retardant Plastic	
2.25	Sensor Type		fixed temperature	
2.26	Certificate		Based on bidder's offer	
2.27	Model No.		Based on bidder's offer	
2.28	Manufacturer		Based on bidder's offer	
2.29	Requisition No.		Based on bidder's offer	
2.30	P.O. No.		Based on bidder's offer	
3	<u>RATE OF RISE HEAT DETECTOR</u>			
3.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
3.2	Amb. Relative Humidity Max.	%	95%	
3.3	Normal operation temperature	°C	-20 TO 50C	
3.4	Type and model	Address able/Con ventiona l		
3.5	Function		Heat Detector	
3.6	Supply voltage	V	17-28 v dc	
3.7	Current at 24 Vdc		Based on bidder's offer	
3.8	Alarm current at 24vdc		Based on bidder's offer	
3.9	Humidity	%	0-95%	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
3.10	Manufactured to which standard		Based on bidder's offer	
3.11	Dimensions		Based on bidder's offer	
3.12	Weight		Based on bidder's offer	
3.13	Color		White	
3.14	Ingress protection		IP53	
3.15	Sensibility range for		Sensitivity Is Automatically Adjust	
3.16	Alarm indicator	Color/type	Red LED	
3.17	Grade		1	
3.18	Response time	TEMP.R ISE °c/min	1, 3, 5, 10, 20, 30	
		GRADE 1:min/secs	34:11, 9:33, 5:24, 2:52, 1:42, 1:17	
3.19	Initiating temperature		Based on bidder's offer	
3.20	Mounting		Base	
3.21	Body & housing material		Based on bidder's offer	
3.22	Output signal		Serial out put	
3.23	Detector type		Ionization and Photoelectric	
3.24	Material		Fire Retardant Plastic	
3.25	Sensor Type		Rate of rise	
3.26	Certificate		Based on bidder's offer	
3.27	Model No.		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
3.28	Manufacturer		Based on bidder's offer	
3.29	Requisition No.		Based on bidder's offer	
3.30	P.O. No.		Based on bidder's offer	
4	<u>SMOKE DETECTOR</u>			
4.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
4.2	Amb. Relative Humidity Max.	%	95%	
4.3	Normal operation temperature	°C	-20 TO 50C	
4.4	Type and model	Address able/ Conventi onal		
4.5	Supply voltage	V	17-28 v dc	
4.6	Current at 24 Vdc		Based on bidder's offer	
4.7	Alarm current at 24vdc		Based on bidder's offer	
4.8	Humidity	%	0-95%	
4.9	Manufactured to which standard		Based on bidder's offer	
4.10	Dimensions		Based on bidder's offer	
4.11	Weight		WHITE	
4.12	Color		Based on bidder's offer	
4.13	Ingress protection		IP43	
4.14	Sensibility range for		SENSITIVITY IS AUTOMATICALLY ADJUST	
4.15	Alarm indicator	Color/ty pe	Red LED	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
4.16	Response time	Low/Fast	FAST	
4.17	Initiating temperature		Based on bidder's offer	
4.18	Temperature rating	°C	MAX. 50C	
4.19	Quantity (CON.-ADD.-EX.-ISO.)		ACCORDING TO DESIGN	
4.20	Detector type		Ionization and Photoelectric	
4.21	Material		Fire Retardant Plastic	
4.22	Certificate		Based on bidder's offer	
4.23	Model No.		Based on bidder's offer	
4.24	Manufacturer		Based on bidder's offer	
4.25	Requisition No.		Based on bidder's offer	
4.26	P.O. No.		Based on bidder's offer	
5	<u>BEAM DETECTOR</u>			
5.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
5.2	Amb. Relative Humidity Max.	%	0.95	
5.3	Normal operation temperature	°C	-20 TO 50C	
5.4	Type and model	Addressable/Conventional		
5.5	Supply voltage	V	17-28 v dc	
5.6	Current at 24 vdc		Based on bidder's offer	
5.7	Alarm current at 24vdc		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
5.8	Humidity	%	0-95%	
5.9	Manufactured to which standard		Based on bidder's offer	
5.10	Dimensions		Based on bidder's offer	
5.11	Weight		Based on bidder's offer	
5.12	Color		WHITE	
5.13	Ingress protection		IP53 (Indoor) , IP65 (Outdoor)	
5.14	Diameter of infra-red	m	min:3m	
5.15	Alarm indicator	Color/type	Red LED	
5.16	maximum distance	m	100	
5.17	Normal operation temperature	°C	-20 TO 60C	
5.18	Quantity		ACCORDING TO DESIGN	
5.19	Automatic Gain Control	Yes/No	Yes	
5.20	Fault alarm indication	Yes/No	Yes	
5.21	Material		Fire Retardant Plastic	
5.22	Certificate		Based on bidder's offer	
5.23	Model No.		Based on bidder's offer	
5.24	Manufacturer		Based on bidder's offer	
5.25	Requisition No.		Based on bidder's offer	
5.26	P.O. No.		Based on bidder's offer	
6	<u>LHD (LINEAR HEAT DETECTOR)</u>			

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
6.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
6.2	Amb. Relative Humidity Max.	%	95%	
6.3	Normal operation temperature	°C	-20 TO 50C	
6.4	Type and model	Address able/ Conventi onal		
6.5	Supply voltage	V	17-28 v dc	
6.6	Current at 24 vdc		Based on bidder's offer	
6.7	Maximum Ambient Install Temperature		Based on bidder's offer	
6.8	Manufactured to which standard		Based on bidder's offer	
6.9	Ingress protection		IP53 (Indoor) , IP65 (Outdoor)	
6.10	Alarm Temp.	°C	60-70c	
6.11	Manufactured to which standard		Based on bidder's offer	
6.12	Sheath		Advanced Polymer Thermal Reactant. twisted pair	
6.13	Metallic Core		Tin For Corrosion Resistance. steel provides tensile strength copper increases conductivity	
6.14	Outer Covering		Chemical and UV Resistant	
6.15	Quantity		According To Design	
6.16	Certificate		Based on bidder's offer	
6.17	Model No.		Based on bidder's offer	
6.18	Manufacturer		Based on bidder's offer	
6.19	Requisition No.		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
6.20	P.O. No.		Based on bidder's offer	
7	<u>GD (GAS DETECTOR)</u>			
7.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
7.2	Amb. Relative Humidity Max.	%	95%	
7.3	Normal operation temperature	°C	-20 TO 50C	
7.4	Type and model		Electro Chemical (Domestic gas)	
7.5	Supply voltage	V	17-28 v dc	
7.6	Current at 24 Vdc		Based on bidder's offer	
7.7	Sensor life		Based on bidder's offer	
7.8	Humidity	%	0-95%	
7.9	Manufactured to which standard		proper type suitable for area classification	
7.10	Weight		Based on bidder's offer	
7.11	Dimensions		Based on bidder's offer	
7.12	Color		WHITE	
7.13	Manufactured to which standard		Based on bidder's offer	
7.14	Ingress protection		IP54	
7.15	Body material		316 stainless steel	
7.16	Alarm indication	Yes/No	Yes	
7.17	Set point adjustment	PPM	0-50 PPM	
7.18	Normal operation temperature	°C	-20 TO 60C	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
7.19	Quantity		According To Design	
7.20	output signal	No.	1 No SPDT,1Amp-24VDC	
7.21	Material		Fire Retardant Plastic	
7.22	Certificate		Based on bidder's offer	
7.23	Model No.		Based on bidder's offer	
7.24	Manufacturer		Based on bidder's offer	
7.25	Requisition No.		Based on bidder's offer	
7.26	P.O. No.		Based on bidder's offer	
8	<u>H2 GAS DETECTOR</u>			
8.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
8.2	Amb. Relative Humidity Max.	%	95%	
8.3	Normal operation temperature	°C	-20 TO 50C	
8.4	Type and model		Electro Chemical (H2 Gas)	
8.5	Supply voltage	V	17-28 v dc	
8.6	Alarm current at 24vdc		Based on bidder's offer	
8.7	Current at 24 Vdc		Based on bidder's offer	
8.8	Sensor life	Year	at least 3 years	
8.9	Manufactured to which standard			
8.10	Dimensions		Based on bidder's offer	
8.11	Weight		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
8.12	Color		WHITE	
8.13	Ingress protection		IP54	
8.14	Body material		Based on bidder's offer	
8.15	Alarm indication	Yes/No	Yes	
8.16	Set point adjustment	PPM	0-50 PPM	
8.17	Normal operation temperature	°C	-20 TO 60C	
8.18	Quantity		According To Design	
8.19	output signal		1 No SPDT,1Amp-24VDC	
8.20	Material		Fire Retardant Plastic	
8.21	Certificate		Based on bidder's offer	
8.22	Area Classification		Explosion proof	
8.23	Model No.		Based on bidder's offer	
8.24	Manufacturer		Based on bidder's offer	
8.25	Requisition No.		Based on bidder's offer	
8.26	P.O. No.		Based on bidder's offer	
9	<u>BEACONE</u>			
9.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
9.2	Amb. Relative Humidity Max.	%	95%	
9.3	Normal operation temperature	°C	-20 TO 50C	
9.4	Type and model	Address able/Con		

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
		ventional		
9.5	Current at 24 Vdc		Based on bidder's offer	
9.6	Alarm current at 24vdc		Based on bidder's offer	
9.7	Nominal voltage		Based on bidder's offer	
9.8	Manufactured to which standard		Based on bidder's offer	
9.9	Dimensions		Based on bidder's offer	
9.10	Color		Red	
9.11	Weight		Based on bidder's offer	
9.12	Ingress protection		IP53 (Indoor) , IP65 (Outdoor)	
9.13	Temperature rating	°C	-25 TO 55C	
9.14	Flash rate		Based on bidder's offer	
9.15	Quantity		According To Design	
9.16	Response time		Immediate Response	
9.17	MOUNTING		Wall Mounted	
9.18	Nominal voltage	V	6-25VDC	
9.19	Initiating temperature		Based on bidder's offer	
9.20	Material		Fire Retardant Plastic	
9.21	Certificate		Based on bidder's offer	
9.22	Model No.		Based on bidder's offer	
9.23	Manufacturer		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
9.24	Requisition No.		Based on bidder's offer	
9.25	P.O. No.		Based on bidder's offer	
10	<u>SOUNDER</u>			
10.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
10.2	Amb. Relative Humidity Max.	%	95%	
10.3	Normal operation temperature	°C	-20 TO 50C	
10.4	Type and model	Address able/Con ventiona l		
10.5	Nominal voltage		Based on bidder's offer	
10.6	Current at 24 Vdc		Based on bidder's offer	
10.7	Alarm current at 24vdc		Based on bidder's offer	
10.8	Manufactured to which standard		Based on bidder's offer	
10.9	Adjustable Volume Control	Yes/No	Yes	
10.10	Dimensions		Based on bidder's offer	
10.11	Weight		Based on bidder's offer	
10.12	Ingress protection		IP53 (Indoor) , IP65 (Outdoor)	
10.13	Temperature rating	°C	-25 TO 55C	
10.14	Flash rate			
10.15	Quantity		According To Design	
10.16	Response time		Immediate Response	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
10.17	Nominal voltage	V	6-25VDC	
10.18	Initiating temperature		Wall Mounted	
10.19	MOUNTING		Based on bidder's offer	
10.20	SOUND LEVEL		105 db (with volume control)	
10.21	Material		Based on bidder's offer	
10.22	Certificate		Based on bidder's offer	
10.23	Model No.		Based on bidder's offer	
10.24	Manufacturer		Based on bidder's offer	
10.25	Requisition No.		Based on bidder's offer	
10.26	P.O. No.		Based on bidder's offer	
11	<u>POWER SUPPLY</u>			
11.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
11.2	Amb. Relative Humidity Max.	%	95%	
11.3	Normal operation temperature	°C	-20 TO 50C	
11.4	Input voltage	V	220 VAC	
11.5	Output voltage	V	24VDC	
11.6	Output current		Based on bidder's offer	
11.7	Manufactured to which standard		Based on bidder's offer	
11.8	Dimensions		Based on bidder's offer	
11.9	Weight		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
11.10	Color		Based on bidder's offer	
11.11	Ingress protection		IP42	
11.12	Temperature rating	°C	MAX. 50C	
11.13	Quantity		According To Design	
11.14	Other specifications		Based on bidder's offer	
11.15	Backup Battery		Yes (According To NFPA)	
11.16	Quantity		According To Design	
11.17	Other specifications		For Details Refer To Detail Design	
11.18	LED (INDICATOR)	Yes/No	Yes	
11.19	Charger	Yes/No	Yes	
11.20	Certificate		Based on bidder's offer	
11.21	Model No.		Based on bidder's offer	
11.22	Manufacturer		Based on bidder's offer	
11.23	Requisition No.		Based on bidder's offer	
11.24	P.O. No.		Based on bidder's offer	
12	<u>CALL POINT</u>			
12.1	Amb. Temp. Min / Max	°C	-16 TO 45.6	
12.2	Amb. Relative Humidity Max.	%	95%	
12.3	Normal operation temperature	°C	-20 TO 50C	
12.4	Type and model	Address able/Con		

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
		ventional		
12.5	Nominal voltage	V	15-28VDC	
12.6	Current at 24 Vdc		Based on bidder's offer	
12.7	Alarm current at 24vdc		Based on bidder's offer	
12.8	Manufactured to which standard		Based on bidder's offer	
12.9	Dimensions		Based on bidder's offer	
12.10	Weight		Based on bidder's offer	
12.11	color		Red	
12.12	Ingress protection		IP53 (Indoor) , IP65 (Outdoor)	
12.13	Temperature	°C	-10 To 50c	
12.14	Quantity		According To Design	
12.15	Other specifications		Fast Response Operation In Two Wires On Line Test Facility - Break Glass	
12.16	MOUNTING		Wall Mounted	
12.17	LED INDICATOR	Yes/No	Yes	
12.18	Material		Fire Retardant Plastic	
12.19	Breaking glass type	Yes/No	Yes	
12.20	Certificate		Based on bidder's offer	
12.21	Model No.		Based on bidder's offer	
12.22	Manufacturer		Based on bidder's offer	

u) FIRE DETECTION, ALARM SYSTEM		UNIT	DATA	
			REQUIRED	OFFERED
12.23	Requisition No.		Based on bidder's offer	
12.24	P.O. No.		Based on bidder's offer	

NOTE:

1 - It shall be possible to test the sensitivity of a gas detector in the field.

2 - The sensor shall be suitable for easy on site calibration.

3 - Each gas detector shall be provided with its associated connection box.

4 - The gas detectors shall still work after an extended period in operation, without any low concentration of the specific gas, or none at all.

5 - The detector shall be designed in such a way that ambient conditions, humidity temperature and wind cannot affect the sensor signal.

6 - The gas detectors must be resistant against high concentration of gases, which may be present, when serious leaks occur. The full scale reading shall not turn down, when full scale gas concentration is exceeded.

7 - Cable Gland is included in vendor scope of supply.

8 - Mounting Accessories is included in vendor scope of supply.

9 - The detector shall be inserted into or removed from the base by a simple push twist

10 - The detector shall be designed for fast and simple laboratory cleaning.

11 - All circuitry must be protected against electrical transients and electromagnetic interferences.

12 - There should be provided an alarm indicator lamp on detector.

13 - The detector shall be procurement by relevant base.

14 - Fire alarm system shall provide for all buildings (control building, guard house, all BCRs, Shelter and all other buildings).

15 - Fire alarm system shall equip with Auto dialer system.

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
1.	Transformer Nitrogen Injection and Oil Evacuation Fire Protection System			
1.1	Manufacturer		Based on bidder's offer	
1.2	Country of manufacturing		Based on bidder's offer	
1.3	Details of System equipment (Model name)		Based on bidder's offer	
1.4	Applicable standards		UL, FM, VdS, LPCB, NFPA	
1.5	Certified By		Based on bidder's offer	
1.6	Power Supply for control		110/ 48 V DC, variation $\pm 15\%$	
1.7	Power supply for service/lighting		220 V AC, variation $\pm 10\%$	
1.8	Fire Extinguishing cubicle (FEC)			
1.8.1	Dimension	L x W x H mm	Based on bidder's offer	
1.8.2	Weight	Kg	Based on bidder's offer	
1.8.3	Capacity of nitrogen cylinder	m ³	60,000 lit oil	
1.8.4	Number of cylinders	nos.	Based on bidder's offer	
1.8.5	Pressure of nitrogen filling	Kg/cm ²	150	
1.8.6	Minimum distance of FEC from the transformer	m	5-10	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
1.8.7	Method of mounting		Based on bidder's offer	
1.8.8	Whether the following items are provided in FEC. If so, furnish make, type and other details		Based on bidder's offer	
1.8.8.1	Contact Manometer		Based on bidder's offer	
1.8.8.2	Pressure Regulator		Based on bidder's offer	
1.8.8.3	Oil release unit		Based on bidder's offer	
1.8.8.4	Gas release unit		Based on bidder's offer	
1.8.8.5	Oil drain assembly		Based on bidder's offer	
1.8.8.6	Pressure switch : Back up for nitrogen release		Based on bidder's offer	
1.8.8.7	Limit switch: No. of contacts and spare contacts (NO & NC)		Based on bidder's offer	
1.8.9	Oil drain valve (above FEC)	No.	1	
1.8.9.1	Make		Based on bidder's offer	
1.8.9.2	Type		Based on bidder's offer	
1.8.9.3	Size	mm	80	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
1.8.9.4	Type of metal		Based on bidder's offer	
1.8.10	Nitrogen injection valve (above FEC)	No.	4	
1.8.10.1	Make		Based on bidder's offer	
1.8.10.2	Type		Based on bidder's offer	
1.8.10.3	Size	mm	25	
1.8.11	Oil drain pipe		Based on bidder's offer	
1.8.11.1	Size	mm	150	
1.8.11.2	Length		Based on bidder's offer	
1.8.11.3	Number of openings in the transformer tank		Based on bidder's offer	
1.8.11.4	Material		Based on bidder's offer	
1.9	Control Box			
1.9.1	Dimension	L x W x H mm	Based on bidder's offer	
1.9.2	Weight	Kg	Based on bidder's offer	
1.9.3	Type & thickness of sheet steel		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
1.9.4	Details of components provided in the control box		Based on bidder's offer	
1.9.5	Control voltage	V	Based on bidder's offer	
1.9.6	Method of mounting		Based on bidder's offer	
1.9.7	Whether audio and visual alarms provided?	Yes/No	Based on bidder's offer	
1.10	Transformer Conservator isolation valve (TCIV)			
1.10.1	Make		Based on bidder's offer	
1.10.2	Type		Based on bidder's offer	
1.10.3	Location of installation		Based on bidder's offer	
1.10.4	Whether suitable for pipe of size 80mm diameter	Yes/No	Based on bidder's offer	
1.10.5	Provision for glass window for inspection	Yes/No	Based on bidder's offer	
1.10.6	No. of contacts & spare contacts (NO & NC)	Nos.	Based on bidder's offer	
1.10.7	Padlocking provision for service position	Yes/No	Based on bidder's offer	
1.10.8	Padlocking provision for filtration/filing/refilling position	Yes/No	Based on bidder's offer	
1.11	Fire Detectors			
1.11.1	Make		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
1.11.2	Type		Based on bidder's offer	
1.11.3	Quantity required	Nos.	Based on bidder's offer	
1.11.4	Method of fixing		Based on bidder's offer	
1.11.5	Effective heat sensing area	m ²	Based on bidder's offer	
1.11.6	Temperature recommended for effective heat sensing	°C	Based on bidder's offer	
1.11.7	Number of contacts NO/NC	Nos.	Based on bidder's offer	
1.11.8	Necessity and condition of refilling		Based on bidder's offer	
1.12	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004	Yes/No	Yes	
2.	Firefighting Equipment for Hydrants and Sprinkler Systems			
<u>2.1</u>	<u>Firefighting Equipment</u>			
2.1.1	Main Pump	Yes/No	Yes	
2.1.2	Jockey Pump	Yes/No	Yes	
2.1.3	Stand by pump	Yes/No	Yes	
2.1.4	Booster pump	Yes/No	Based on bidder's offer	
2.1.5	Electric Motor	Yes/No	Yes	
2.1.6	Diesel Engine	Yes/No	Yes	
2.1.7	Control panel (Instrumentation & Control System)	Yes/No	Yes	
2.1.8	Pressure Gauge and Switches	Yes/No	Yes	
2.1.9	Pipes, Nozzles, Fittings and Accessories	Yes/No	Yes	
2.1.10	Pressure Tank	Yes/No	Yes	
2.1.11	Suction Line	Yes/No	Yes	
2.1.12	Common Fabricated steel base frame	Yes/No	Yes	
2.1.13	Fire Detection and Alarm System	Yes/No	Yes	
2.1.14	Sprinkler System	Yes/No	Yes	
2.1.15	Hydrant Valves	Yes/No	Yes	
2.1.16	Firefighting box (containing hose and fire extinguisher)	Yes/No	Yes	
<u>2.2</u>	<u>Firefighting Package (Fire Pump Package)</u>			

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.1	General information			
2.2.1.1	Manufacturer		Based on bidder's offer	
2.2.1.2	Country of manufacturing		Based on bidder's offer	
2.2.1.3	Year of manufacturing		Based on bidder's offer	
2.2.1.4	System type		Based on bidder's offer	
2.2.1.5	System model		Based on bidder's offer	
2.2.1.6	Applicable standards		Based on bidder's offer	
2.2.1.7	Certification		Based on bidder's offer	
2.2.1.8	Pressure vessel		Based on bidder's offer	
2.2.1.9	No. of pumps		3	
2.2.1.10	No. of Electric motors		2	
2.2.1.11	Motor pump	Yes/No	Yes	
2.2.1.12	Diesel pump	Yes/No	Yes	
2.2.1.13	Control panel (Instrumentation & Control System)		Based on bidder's offer	
2.2.1.14	Annunciation System		Based on bidder's offer	
2.2.1.15	Power Supply for control system		Based on bidder's offer	
2.2.1.16	Power supply for service/lighting		Based on bidder's offer	
2.2.2	Main pump		Based on bidder's offer	
2.2.2.1	Standby Pump	Yes/No	Yes/No	
2.2.2.2	Manufacturer		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.2.3	Country of manufacturing		Based on bidder's offer	
2.2.2.4	Year of manufacturing		Based on bidder's offer	
2.2.2.5	Applicable standard		Based on bidder's offer	
2.2.2.6	Certification		UL&FM	
2.2.2.7	Listed	Yes/No	Based on bidder's offer	
2.2.2.8	Type		Split case	
2.2.2.9	Model		Based on bidder's offer	
2.2.2.10	Size		Based on bidder's offer	
2.2.2.11	Dimensions		Based on bidder's offer	
2.2.2.12	Dry Weight	kg	Based on bidder's offer	
2.2.2.13	Flow (Capacity)	GPM	1000	
2.2.2.14	Head	m	102	
2.2.2.15	Discharge pressure	bar	10	
2.2.2.16	Speed	rpm	Based on bidder's offer	
2.2.2.17	Mounting		Based on bidder's offer	
2.2.2.18	Casing material		Based on bidder's offer	
2.2.2.19	Impeller material		Based on bidder's offer	
2.2.2.20	Shaft material		Based on bidder's offer	
2.2.2.21	Wearing rings material		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.2.22	Mechanical seal material		Based on bidder's offer	
2.2.2.23	Bearing lubrication		Based on bidder's offer	
2.2.2.24	Operating temperature		Based on bidder's offer	
2.2.2.25	Suction x delivery dia.	mm x mm	Based on bidder's offer	
2.2.2.26	Painting		Based on bidder's offer	
2.2.2.27	Required electric motor power	HP	Based on bidder's offer	
	- Electric motor manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- Year of manufacturing		Based on bidder's offer	
	- Model name		Based on bidder's offer	
	- Certification		Based on bidder's offer	
	- Rated power	kW	Based on bidder's offer	
	- Applicable standard		Based on bidder's offer	
	- Voltage	V	415	
	- Frequency		Based on bidder's offer	
	- Speed	RPM	Based on bidder's offer	
	- Current	A	Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Service factor		Based on bidder's offer	
	- Service duty		Based on bidder's offer	
	- Starting	DOL/Soft starter/VFD	Based on bidder's offer	
	- Enclosure		Based on bidder's offer	
	- Ingress protection		Based on bidder's offer	
	- Insulation class		Based on bidder's offer	
	- Design temperature	°C	Based on bidder's offer	
	- Design altitude (above sea level)	m	Based on bidder's offer	
	- Temperature rise		Based on bidder's offer	
	- Efficiency class		Based on bidder's offer	
	- Frame size		Based on bidder's offer	
	- Mounting		Based on bidder's offer	
	- Direction of rotation (view from drive end)		Based on bidder's offer	
	- Painting		Based on bidder's offer	
2.2.3	Jockey pump		Based on bidder's offer	
2.2.3.1	Manufacturer		Based on bidder's offer	
2.2.3.2	Country of manufacturing		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.3.3	Year of manufacturing		Based on bidder's offer	
2.2.3.4	Applicable standard		Based on bidder's offer	
2.2.3.5	Certification		Based on bidder's offer	
2.2.3.6	Listed	Yes/No	Based on bidder's offer	
2.2.3.7	Type		Based on bidder's offer	
2.2.3.8	Model		Based on bidder's offer	
2.2.3.9	Size		Based on bidder's offer	
2.2.3.10	Dimensions		Based on bidder's offer	
2.2.3.11	Dry Weight	kg	Based on bidder's offer	
2.2.3.12	Flow (Capacity)	m ³ /h	Based on bidder's offer	
2.2.3.13	Head	m	Based on bidder's offer	
2.2.3.14	Discharge pressure	psi	Based on bidder's offer	
2.2.3.15	Speed	rpm	Based on bidder's offer	
2.2.3.16	Mounting		Based on bidder's offer	
2.2.3.17	Casing material		Based on bidder's offer	
2.2.3.18	Impeller material		Based on bidder's offer	
2.2.3.19	Shaft material		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.3.20	Wearing rings material		Based on bidder's offer	
2.2.3.21	Mechanical seal material		Based on bidder's offer	
2.2.3.22	Bearing lubrication		Based on bidder's offer	
2.2.3.23	Operating temperature		Based on bidder's offer	
2.2.3.24	Suction x delivery dia.	mm x mm	Based on bidder's offer	
2.2.3.25	Painting		Based on bidder's offer	
2.2.3.26	Required electric motor power	HP	Based on bidder's offer	
	- Electric motor manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- Year of manufacturing		Based on bidder's offer	
	- Model name		Based on bidder's offer	
	- Certification		Based on bidder's offer	
	- Rated power	kW	Based on bidder's offer	
	- Applicable standard		Based on bidder's offer	
	- Voltage	V	Based on bidder's offer	
	- Frequency		Based on bidder's offer	
	- Speed	RPM	Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Current	A	Based on bidder's offer	
	- Service factor		Based on bidder's offer	
	- Service duty		Based on bidder's offer	
	- Starting	DOL/Soft starter/VFD	Based on bidder's offer	
	- Enclosure		Based on bidder's offer	
	- Ingress protection		Based on bidder's offer	
	- Insulation class		Based on bidder's offer	
	- Design temperature	°C	Based on bidder's offer	
	- Design altitude (above sea level)	m	Based on bidder's offer	
	- Temperature rise		Based on bidder's offer	
	- Efficiency class		Based on bidder's offer	
	- Frame size		Based on bidder's offer	
	- Mounting		Based on bidder's offer	
	- Direction of rotation (view from drive end)		Based on bidder's offer	
	- Painting		Based on bidder's offer	
2.2.4	Booster pump		Based on bidder's offer	
2.2.4.1	Manufacturer		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.4.2	Country of manufacturing		Based on bidder's offer	
2.2.4.3	Year of manufacturing		Based on bidder's offer	
2.2.4.4	Applicable standard		Based on bidder's offer	
2.2.4.5	Certification		Based on bidder's offer	
2.2.4.6	Listed	Yes/No	Based on bidder's offer	
2.2.4.7	Type		Based on bidder's offer	
2.2.4.8	Model		Based on bidder's offer	
2.2.4.9	Size		Based on bidder's offer	
2.2.4.10	Dimensions		Based on bidder's offer	
2.2.4.11	Dry Weight	kg	Based on bidder's offer	
2.2.4.12	Flow (Capacity)	m ³ /h	Based on bidder's offer	
2.2.4.13	Head	m	Based on bidder's offer	
2.2.4.14	Discharge pressure	bar	Based on bidder's offer	
2.2.4.15	Speed	rpm	Based on bidder's offer	
2.2.4.16	Mounting		Based on bidder's offer	
2.2.4.17	Casing material		Based on bidder's offer	
2.2.4.18	Impeller material		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.4.19	Shaft material		Based on bidder's offer	
2.2.4.20	Wearing rings material		Based on bidder's offer	
2.2.4.21	Mechanical seal material		Based on bidder's offer	
2.2.4.22	Bearing lubrication		Based on bidder's offer	
2.2.4.23	Operating temperature		Based on bidder's offer	
2.2.4.24	Suction x delivery dia.	mm x mm	Based on bidder's offer	
2.2.4.25	Painting		Based on bidder's offer	
2.2.4.26	Required electric motor power	kW	Based on bidder's offer	
	- Electric motor manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- Year of manufacturing		Based on bidder's offer	
	- Model name		Based on bidder's offer	
	- Certification		Based on bidder's offer	
	- Rated power	kW	Based on bidder's offer	
	- Applicable standard		Based on bidder's offer	
	- Voltage	V	Based on bidder's offer	
	- Frequency		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Speed	RPM	Based on bidder's offer	
	- Current	A	Based on bidder's offer	
	- Service factor		Based on bidder's offer	
	- Service duty		Based on bidder's offer	
	- Starting	DOL/Soft starter/VFD	Based on bidder's offer	
	- Enclosure		Based on bidder's offer	
	- Ingress protection		Based on bidder's offer	
	- Insulation class		Based on bidder's offer	
	- Design temperature	°C	Based on bidder's offer	
	- Design altitude (above sea level)	m	Based on bidder's offer	
	- Temperature rise		Based on bidder's offer	
	- Efficiency class		Based on bidder's offer	
	- Frame size		Based on bidder's offer	
	- Mounting		Based on bidder's offer	
	- Direction of rotation (view from drive end)		Based on bidder's offer	
	- Painting		Based on bidder's offer	
2.2.5	Engine		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.5.1	Manufacturer		Based on bidder's offer	
2.2.5.2	Country of manufacturing		Based on bidder's offer	
2.2.5.3	Year of manufacturing		Based on bidder's offer	
2.2.5.4	Applicable standards		UL&FM	
2.2.5.5	Design temperature	°C	Based on bidder's offer	
2.2.5.6	Design altitude (above sea level)	m	Based on bidder's offer	
2.2.5.7	Air inlet temperature	°C	Based on bidder's offer	
2.2.5.8	Fuel inlet temperature	°C	Based on bidder's offer	
2.2.5.9	Power rating	HP	Based on bidder's offer	
2.2.5.10	Speed	RPM	Based on bidder's offer	
2.2.5.11	Min. and Max. rating	kW @ RPM	Based on bidder's offer	
2.2.5.12	Min. and Max. torque	Nm @ RPM	Based on bidder's offer	
2.2.5.13	Engine type		Based on bidder's offer	
2.2.5.14	Injection Type		Based on bidder's offer	
2.2.5.15	Model		Based on bidder's offer	
2.2.5.16	Service	Indoor/ outdoor	indoor	
2.2.5.17	Intake type		Based on bidder's offer	
2.2.5.18	Starting type		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.5.19	No. of cylinders		Based on bidder's offer	
2.2.5.20	Bore x Stroke	mm	Based on bidder's offer	
2.2.5.21	Displacement	cm ³	Based on bidder's offer	
2.2.5.22	Compression ratio		By vendor	
2.2.5.23	Emission certification		Based on bidder's offer	
2.2.5.24	Max. Temp. rise between ambient air and Engine air inlet	°C	Based on bidder's offer	
2.2.5.25	Air cleaner element		Based on bidder's offer	
2.2.5.26	Exhaust temperature	°C	Based on bidder's offer	
2.2.5.27	Exhaust gas flow	L/sec	Based on bidder's offer	
2.2.5.28	Max. back pressure imposed by exhaust system	kPa	Based on bidder's offer	
2.2.5.29	Exhaust pipe size	mm	Based on bidder's offer	
2.2.5.30	Exhaust protection		Based on bidder's offer	
2.2.5.31	Aspiration		Based on bidder's offer	
2.2.5.32	Fuel type		Gas Oil	
2.2.5.33	Max. fuel temperature @ lift pump inlet	°C	Based on bidder's offer	
2.2.5.34	Oil consumption	Kg/hr	0.2	
2.2.5.35	Oil sump capacity	Liter	Based on bidder's offer	
2.2.5.36	Dry weight	kg	Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.5.37	Wet weight	kg	Based on bidder's offer	
2.2.5.38	Lubrication type		Based on bidder's offer	
2.2.5.39	Lubrication system oil pressure	psi	Based on bidder's offer	
2.2.5.40	Lube oil filter		Based on bidder's offer	
2.2.5.41	Oil capacity of pan (High-Low)	Liter	Based on bidder's offer	
2.2.5.42	Lube oil cooler		Based on bidder's offer	
2.2.5.43	Lube oil pump		Based on bidder's offer	
2.2.5.44	Battery voltage	V DC	Based on bidder's offer	
2.2.5.45	Battery capacity	Ah	Based on bidder's offer	
2.2.5.46	Valves per cylinder: Intake / Exhaust		Based on bidder's offer	
2.2.5.47	Gate valves		Based on bidder's offer	
2.2.5.48	Check valves		Based on bidder's offer	
2.2.5.49	Power take off flywheel		Based on bidder's offer	
2.2.5.50	Flywheel size		Based on bidder's offer	
2.2.5.51	Direction of rotation (view from power take-off side)		Based on bidder's offer	
2.2.5.52	Cooling fan		Based on bidder's offer	
2.2.5.53	Fitted water radiator (heat exchanger)		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.5.54	Raw water pressure at heat exchanger	psi	Based on bidder's offer	
2.2.5.55	Coolant water capacity (engine side)	Liter	Based on bidder's offer	
2.2.5.56	Water temperature switch		Based on bidder's offer	
2.2.5.57	Engine heater	VAC, Watt	Based on bidder's offer	
2.2.5.58	Centrifugal speed governor		Based on bidder's offer	
2.2.5.59	Torque regulator		Based on bidder's offer	
2.2.5.60	Manual start control		Based on bidder's offer	
2.2.5.61	Overspeed control		Based on bidder's offer	
2.2.5.62	Run-stop control		Based on bidder's offer	
2.2.5.63	Run solenoid		Based on bidder's offer	
2.2.5.64	Stop solenoid		Based on bidder's offer	
2.2.5.65	Throttle control		Based on bidder's offer	
2.2.5.66	Water pump type		Based on bidder's offer	
2.2.5.67	Sound pressure level (front / side / exhaust)	dB(A)	Based on bidder's offer	
2.2.5.68	Crankcase material		Based on bidder's offer	
2.2.5.69	Painting		Based on bidder's offer	
2.2.6	Control panel		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
2.2.6.1	Manufacturer		Based on bidder's offer	
2.2.6.2	Country of manufacturing		Based on bidder's offer	
2.2.6.3	Year of manufacturing		Based on bidder's offer	
2.2.6.4	Applicable standards		Based on bidder's offer	
2.2.6.5	Design temperature	°C	Based on bidder's offer	
2.2.6.6	Enclosure IP		Based on bidder's offer	
2.2.6.7	Main door lock disconnect switch		Based on bidder's offer	
2.2.6.8	MCB		Based on bidder's offer	
2.2.6.9	Fuses		Based on bidder's offer	
2.2.6.10	No. of switching battery chargers		Based on bidder's offer	
2.2.6.11	Control circuits relay		Based on bidder's offer	
2.2.6.12	Thermal overload relay		Based on bidder's offer	
2.2.6.13	Terminal board		Based on bidder's offer	
2.2.6.14	Motor-Pump-Engine control unit		Based on bidder's offer	
2.2.6.15	Multifunction instrument with display		Based on bidder's offer	
	- Voltmeter		Based on bidder's offer	
	- Ammeter		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Rev counter		Based on bidder's offer	
	- Duty hours counter		Based on bidder's offer	
	- Fuel level gauge		Based on bidder's offer	
	- Oil pressure gauge		Based on bidder's offer	
	Start and stop pushbuttons		Based on bidder's offer	
2.2.6.16	Indicator lights		Based on bidder's offer	
2.2.6.17	Test button for first start-up		Based on bidder's offer	
2.2.6.18	AUT - 0 - MAN selector with key		Based on bidder's offer	
2.2.6.20	Contacts on the terminal board to remote signals panel		Based on bidder's offer	
	- Pump running		Based on bidder's offer	
	- Selector not on AUT		Based on bidder's offer	
	- Failed starting		Based on bidder's offer	
	- Control panel and/or batteries fault		Based on bidder's offer	
2.2.6.21	Automatic engine cranking system		Based on bidder's offer	
2.2.6.22	Automatic battery charger		Based on bidder's offer	
2.2.7	Pipes and valves and fittings		Based on bidder's offer	
2.2.7.1	Pipe		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- Year of manufacturing		Based on bidder's offer	
	- manufacturing standards		Based on bidder's offer	
	- OD	mm	Based on bidder's offer	
	- Thickness	mm	Based on bidder's offer	
	- Material		Based on bidder's offer	
2.2.7.2	Valves		Based on bidder's offer	
	- Manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- Year of manufacturing		Based on bidder's offer	
	- Manufacturing standard		Based on bidder's offer	
	- Testing standard		Based on bidder's offer	
	- Type		Based on bidder's offer	
	- Model		Based on bidder's offer	
	- Size		Based on bidder's offer	
	- Quantity		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Service condition		Based on bidder's offer	
	- Construction		Based on bidder's offer	
	- End connections		Based on bidder's offer	
	- Rating		Based on bidder's offer	
	- Face to face		Based on bidder's offer	
	- Size		Based on bidder's offer	
	- M.O.C		Based on bidder's offer	
	- Body		Based on bidder's offer	
	- Adaptor		Based on bidder's offer	
	- Ball/ Disc material		Based on bidder's offer	
	- Gland		Based on bidder's offer	
	- Spindle		Based on bidder's offer	
	- Seat		Based on bidder's offer	
	- Seal		Based on bidder's offer	
	- Packing		Based on bidder's offer	
	- Fasteners		Based on bidder's offer	
	- Actuation		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Hydro Test pressure	Kg/cm2	Based on bidder's offer	
	- Pneumatic Test pressure	Kg/cm2	Based on bidder's offer	
2.2.7.3	Fittings		Based on bidder's offer	
	- Manufacturer		Based on bidder's offer	
	- Country of manufacturing		Based on bidder's offer	
	- No. and type		Based on bidder's offer	
	- Material		Based on bidder's offer	
	- Applicable standard		Based on bidder's offer	
2.3	<u>Deluge and Sprinkler System</u>		Based on bidder's offer	
	Location in the substation		Based on bidder's offer	
	Manufacturer		Based on bidder's offer	
	Country of manufacturing		Based on bidder's offer	
	Year of manufacturing		Based on bidder's offer	
	Applicable standard		Based on bidder's offer	
	Spatial structure made of pipes	Yes/No	Based on bidder's offer	
	Automatic spray type Fire Protection System	HVW/MV W	Based on bidder's offer	
	- Main Transformer		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	- Aux. Transformer		Based on bidder's offer	
	- Shunt Reactor		Based on bidder's offer	
	Water supply System		Based on bidder's offer	
	No. of sprinklers		Based on bidder's offer	
	No. of actuator stations		Based on bidder's offer	
	Type of actuator stations		Based on bidder's offer	
	Diaphragm flood valve		Based on bidder's offer	
	Bolted flange joints	Yes/No	Based on bidder's offer	
	Certification		Based on bidder's offer	
	VdS and FM Approves	Yes/No	Yes	
	Hot-dip galvanized pipes	Yes/No	Yes	
	Anti-corrosion coatings	Yes/No	Yes	
	Manual activation in the control room	Yes/No	Based on bidder's offer	
	Manual opening of the flood valves	Yes/No	Based on bidder's offer	
	Fire detection system by temp. sensor		Based on bidder's offer	
	Temperature thresholds		Based on bidder's offer	
	Sensor cable		Based on bidder's offer	
	Initiating gases in Buchholz relay		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	Automatic activation by		Based on bidder's offer	
	Pressure of system pressure test	MPa, hours	Based on bidder's offer	
	Sound alarm	Yes/No	Based on bidder's offer	
2.4	<u>Fire hydrant system (only after full electrical isolation)</u>			
	Manufacturer		Based on bidder's offer	
	Country of manufacturing		Based on bidder's offer	
	Year of manufacturing		Based on bidder's offer	
	Fire hydrant No.		6	
	Fire hydrants locations		Based on bidder's offer	
	- Near buildings		Yes	
	- Transformers		Yes	
	- Reactors		Yes	
	Fire hydrant type		Based on bidder's offer	
	Fire hydrant dimensions		Based on bidder's offer	
	Fire hydrant class		C	
	Fire hydrant flow	GPM	500	
	Fire hydrant working pressure	psi	10	
	Fire hydrant hydrostatic test pressure	psi	12	
	Fire hydrant clearance	m	Based on bidder's offer	
	Size of nozzle	inch	Based on bidder's offer	
	Pumper nozzle size	inch	Based on bidder's offer	
	Fire hydrants installation		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	Applicable standard		Based on bidder's offer	
	Hydrants distance from substation buildings	m	12	
	Hydrants distance from each other	m	90	
	Water Supply		Based on bidder's offer	
	Hose Boxes		Based on bidder's offer	
	- Hose Pipe size and material		2 1/2", The single jacket hose made of high tenacity polyester staple and polyester filaments. Lining is natural rubber	
	- Branch pipes size and material			
	- Nozzles size and material		2 1/2", Bronze	
	Provision of Hose Reel and wet Riser in the buildings	Yes/No	Yes	
	Hydrant system design for farthest point of the switchyard considering the present scope & future bays	Yes/No	Yes	
	Warning plates	Yes/No	Yes	
2.5	<u>Fire water tank</u>			
	Capacity		230	
	Construction type		Based on bidder's offer	
	Manufacturer		Based on bidder's offer	
	Country of origin		Based on bidder's offer	
	Model		Based on bidder's offer	
	International listing UL, FM, VdS or LPCB		UL	
2.6	<u>Main fire alarm & extinguishing control panel</u>			
	Manufacturer		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
	country of origin		Based on bidder's offer	
	Model		Based on bidder's offer	
	Type		Analogue addressable	
	International listing UL, FM, VdS or LPCB		Based on bidder's offer	
	Number of loops		Based on bidder's offer	
	Display type		LCD	
	Enclosure		Based on bidder's offer	
	Mounting		Floor	
	Rack size		19" rack system	
	Dimension		2.2x0.8x0.8	
	Batteries for fire alarm panel		Based on bidder's offer	
	Type		Maintenance free	
	Voltage	V DC	48	
	Backup	hr	24	
	Primary power supply voltage	V	220	
	Printer		Non-thermal	
	Battery type		Maintenance free, dry fit and gas tight	
	Secondary power supply from UPS	Yes/No	Yes	
	Mimic Panel	Yes/No	Yes	
	- Fascia material		SS (matte finish)	
	- Size	mm	800 x 800	
3.	Fire Extinguishers			
3.1.	CO2 Wall Mounting Extinguisher			
3.1.1	Manufacturer		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
3.1.2	Country of manufacturing		Based on bidder's offer	
3.1.3	Year of manufacturing		Based on bidder's offer	
3.1.4	Dimensions		Based on bidder's offer	
3.1.5	Weight	Kg	Based on bidder's offer	
3.1.6	Type of dry powder		CO2	
3.1.7	Test pressure	Bar g	250	
3.1.8	Working pressure	Bar g	60	
3.1.9	Applicable standards		NFPA	
3.1.10	International listing UL, FM, VdS or LPCB		Based on bidder's offer	
3.2.	Dry Powder Wall Mounting Extinguisher		Based on bidder's offer	
3.2.1	Manufacturer		Based on bidder's offer	
3.2.2	Country of manufacturing		Based on bidder's offer	
3.2.3	Year of manufacturing		Based on bidder's offer	
3.2.4	Dimensions		Based on bidder's offer	
3.2.5	Weight	Kg	Based on bidder's offer	
3.2.6	Type of dry powder		ABC	
3.2.7	Test pressure	Bar g	27	
3.2.8	Working pressure	Bar g	15	
3.2.9	Applicable standards		NFPA	
3.2.10	International listing UL, FM, VdS or LPCB		Based on bidder's offer	
3.3.	CO2 wheeled Extinguisher		Based on bidder's offer	

v) FIRE FIGHTING SYSTEM		UNIT	DATA	
			Required	Offered
3.3.1	Manufacturer		Based on bidder's offer	
3.3.2	Country of manufacturing		Based on bidder's offer	
3.3.3	Year of manufacturing		Based on bidder's offer	
3.3.4	Dimensions		Based on bidder's offer	
3.3.5	Weight	Kg	Based on bidder's offer	
3.3.6	Type of dry powder		CO2	
3.3.7	Test pressure	Bar g	250	
3.3.8	Working pressure	Bar g	55	
3.3.9	Applicable standards		NFPA	
3.3.10	International listing UL, FM, VdS or LPCB		Based on bidder's offer	
4.	Fire Blanket			
4.1	Manufacturer		Based on bidder's offer	
4.2	Weight	Kg	Based on bidder's offer	
4.3	Temperature Resistance	°C	Based on bidder's offer	
4.4	Size	m	Based on bidder's offer	
4.5	Material		Based on bidder's offer	
4.6	Applicable standards		BS 7944, BS EN 1869:1997	

w) HEATING VENTILATION AND AIR CONDITIONING (HVAC)		UNIT	DATA	
			Required	Offered
1.	MAIN HVAC CONTROL PANEL			
	Manufacturer / country of origin		Based on bidder's offer	
	Model		Based on bidder's offer	
	Applicable standards		Based on bidder's offer	
			Based on bidder's offer	
	Enclosure color code		Based on bidder's offer	
	HVAC CONTROL PANEL FIRE PUMP ROOM		Based on bidder's offer	
	Manufacturer / country of origin		Based on bidder's offer	
	Model (wall mounted)		Based on bidder's offer	
	Applicable standards		Based on bidder's offer	
	Enclosure color code		Based on bidder's offer	
2.	SPLIT UNITS			
	Manufacturer / country of origin		Based on bidder's offer	
	Quantity	NO	44	
	Model		Based on bidder's offer	
	Applicable standards		Based on bidder's offer	
	Type		Based on bidder's offer	
	Power	kW	Based on bidder's offer	
	Condenser model		Based on bidder's offer	
3.	AIR COOLED CONDENSING UNITS			
	Manufacturer / country of origin		Based on bidder's offer	
	Quantity		Based on bidder's offer	
	Model		Based on bidder's offer	
	Applicable standards		Based on bidder's offer	
	Type of refrigerant		Based on bidder's offer	
	Cooling capacity	Btu/hr	9000,12000,18000,24000	

w) HEATING VENTILATION AND AIR CONDITIONING (HVAC)		UNIT	DATA	
			Required	Offered
	Number of cooling circuit	No	Based on bidder's offer	
	Compressors per cooling circuit	No	Based on bidder's offer	
	Compressor model		Based on bidder's offer	
	Compressor type		Based on bidder's offer	
	Condenser coil		Based on bidder's offer	
	Fin material		Based on bidder's offer	
	Tube material		Based on bidder's offer	
4.	EXHAUST FANS			
	Manufacturer / country of origin		Based on bidder's offer	
	Quantity		25	
	Model		Based on bidder's offer	
	International approvals		Based on bidder's offer	
	Fan Speed	rpm	Based on bidder's offer	
	Fan impeller material		Based on bidder's offer	
	Fan Shaft Material		Based on bidder's offer	
	Voltage/Frequency	V/Hz	Based on bidder's offer	
	Capacity for Battery room, toilet, pantry, basement	m ³ /hr	2900, 240, 270,770	
	Capacity for gas cylinder room, staircase pressurization fans, diesel pump exhaust		Based on bidder's offer	
	Gas flooded room fan type		Based on bidder's offer	
	Type		Based on bidder's offer	
	Capacity		Based on bidder's offer	
	Basement extract fans		Based on bidder's offer	
	Battery room fan type		Suitable for hazardous area	
	Storage warehouse		Based on bidder's offer	
	DG house		Based on bidder's offer	

w) HEATING VENTILATION AND AIR CONDITIONING (HVAC)		UNIT	DATA	
			Required	Offered
5.	EXHAUST AIR FLOW RATES			
5.1	Control Building		Based on bidder’s offer	
	Telecommunication room	m³/s	2	
	Battery room	m³/s	15	
	Relay room	m³/s	2	
	LVAC/DC room	m³/s	2	
	Cable basement	m³/s	Based on bidder’s offer	
	Operator room	m³/s	2	
	Office	m³/s	2	
	Kitchen or pantry	m³/s	12	
	Store	m³/s	Based on bidder’s offer	
	Toilet	m³/s	10	
5.2	Guard House and Telecom Room	m³/s	Based on bidder’s offer	
	Main equipment room	m³/s	2	
	Customer equipment room	m³/s	2	
	Battery room	m³/s	15	
	Guard room	m³/s	2	
	Kitchen	m³/s	12	
	Toilet	m³/s	10	
5.3	Staff Housings	m³/s	Based on bidder’s offer	
5.3.1	Technical staff housing	m³/s	Based on bidder’s offer	
	- Bedroom	m³/s	2	
	- Living room	m³/s	2	
	- Kitchen	m³/s	12	
	- Toilet	m³/s	10	
5.3.2	Security staff housing	m³/s	Based on bidder’s offer	

w) HEATING VENTILATION AND AIR CONDITIONING (HVAC)		UNIT	DATA	
			Required	Offered
	- Bedroom	m ³ /s	2	
	- Living room	m ³ /s	2	
	- Kitchen	m ³ /s	12	
	- Toilet	m ³ /s	10	
5.4	DG house	m ³ /s	Based on bidder's offer	
5.5	Fire pump house	m ³ /s	Based on bidder's offer	
6.	SOUND ATTENUATORS			
6.1	Manufacturer / country of origin		Based on bidder's offer	
6.2	Model		Based on bidder's offer	
6.3	International approvals		Based on bidder's offer	
6.4	Main supply air		Based on bidder's offer	
6.5	Main return air		Based on bidder's offer	
6.6	Pressure drop across attenuators	Pa	Based on bidder's offer	
6.7	Main supply air	Pa	Based on bidder's offer	
6.8	Main return air	Pa	Based on bidder's offer	

x) LOW VOLTAGE CABLES		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>Low Voltage Power Cable</u>			
1.1	Manufacturer		Based on bidder’s offer	
	Name		Based on bidder’s offer	
	Country		Based on bidder’s offer	
	Type designation		Based on bidder’s offer	
1.2	Applicable standard		Based on bidder’s offer	
1.3	Rated voltage	kV rms	Based on bidder’s offer	
1.4	Number of cores / size		Based on bidder’s offer	
1.5	Conductor material (Cu/Al) and its class acc. to IEC		High conductivity/plain annealed/copper	
1.6	Type of conductor		Stranded	
1.7	Min thickness & material of insulation	mm	Based on bidder’s offer	
1.8	Type and thickness of inner sheath material	mm	extruded P.V.C	
1.9	Whether shield is provided? (Yes/No)		Based on bidder’s offer	
1.10	Type and material of armor (wire/tape & Steel/Al)		Galvanized steel wire	
1.11	Type and thickness of outer sheath material	mm	extruded P.V.C	
1.12	High voltage test	kV	Based on bidder’s offer	
1.13	Short circuit withstand current/time of conductor.	kA/Sec	Based on bidder’s offer	
1.14	Minimum bending radius at minimum temperature		Based on bidder’s offer	
1.15	Conductor DC resistance at 20°c	Ω/km	Based on bidder’s offer	

x) LOW VOLTAGE CABLES		UNIT	DATA	
			REQUIRED	OFFERED
1.16	Minimum temperature during installation	°C	Based on bidder's offer	
1.17	Minimum pulling tension	N	Based on bidder's offer	
1.18	Approx. weight of cable	kg/m	Based on bidder's offer	
1.19	Core identification required	Yes/No	yes	
1.20	Type and routine tests required	Yes/No	yes	
1.21	Distance between cables laid horizontally or in flat		equal to the outer diameter of cables	
2	<u>Control Cable</u>			
2.1	Manufacturer		Based on bidder's offer	
	Name		Based on bidder's offer	
	Country		Based on bidder's offer	
	Type designation		Based on bidder's offer	
2.2	Applicable standard		Based on bidder's offer	
2.3	Rated voltage	kV rms	Based on bidder's offer	
2.4	Type and material of conductor		Stranded/ high conductivity plain annealed copper	
2.5	Diameter of each strand	mm	Based on bidder's offer	
2.6	Number and cross section of wires in each cable		Based on bidder's offer	
	For CT cable		4 mm ²	
	For CVT cable		2.5 mm ²	
	For control cable		2.5 mm ²	

x) LOW VOLTAGE CABLES		UNIT	DATA	
			REQUIRED	OFFERED
2.7	Insulation material		P.V.C or X.L.P.E	
2.8	Material and thickness of inner sheath	mm	extruded P.V.C	
2.9	Material and thickness of shield	mm	Lead or copper	
2.10	Material and thickness of bedding for armor	mm	Based on bidder's offer	
2.11	Material and thickness of armor	mm	Aluminium or galvanized steel	
2.12	Material and thickness of outer sheath	mm	extruded P.V.C	
2.13	Type of sheath between shield and armor		Based on bidder's offer	
2.14	Short circuit withstand current/time of conductors	kA/Sec	Based on bidder's offer	
2.15	Minimum bending radius at minimum temperature		Based on bidder's offer	
2.16	Conductor DC resistance at 20°c	Ω/km	Based on bidder's offer	
2.17	Minimum temperature during installation	°C	Based on bidder's offer	
2.18	Minimum pulling tension	N	Based on bidder's offer	
2.19	Core identification required	Yes/No	yes	
2.20	Type and routine tests required	Yes/No	yes	
3	<u>Fiber Optic Cables</u>			
3.1	Manufacturer		Based on bidder's offer	
3.2	Type of optical fiber cable		G652.D/G655	
3.3	Number of cores		48	
3.4	Mode - field diameter at 1550 nm &	µm	10.4 ± 0.5	
	Mode - field diameter at 1310 nm		9.2 ± 0.4	

x) LOW VOLTAGE CABLES		UNIT	DATA	
			REQUIRED	OFFERED
3.5	Effective core area	μm^2	100	
3.6	Mode field concentricity error at 1550 nm &	$\leq \mu\text{m}$	0.8	
3.7	Mode field concentricity error at 1310 nm		1	
3.8	Mode field non - circularity error		6	
3.9	Cut - off wavelength λ_{CC}		$\leq 1450 \text{ nm}$	
3.10	Attenuation coefficient : in 1550 nm &	dB/K m	0.30 typical / max.	
	Attenuation coefficient : in 1310 nm		0.40 typical / max.	
3.11	1550 nm bend performance	$\leq \text{db}$	≤ 0.05	
3.12	Non - zero dispersion region	nm	1300-1324	
3.13	Zero dispersion wavelength	$< \mu\text{m}$	1302 – 1322	
3.14	Cladding diameter	μm	125.0	
3.15	Cladding non - circularity	$\leq \%$	± 0.7	
3.16	Primary coating diameter	μm	245 ± 10	
3.17	Primary coating concentricity error	$\leq \mu\text{m}$	250 ± 15	
3.18	Primary coating non- circularity error	$\leq \%$	12.5	
3.19	Fiber materials		Core: Germanium doped silica Clad : Silica, step index and matched clad type	
3.20	Fiber coating material		Dual layers of UV-cured acrylat	

x) LOW VOLTAGE CABLES		UNIT	DATA	
			REQUIRED	OFFERED
3.21	Number of armor		To be defined	
3.22	Material of outer jacket		PE, PVC, PVDF, LSZH	
3.23	Color coding of fiber		To be defined	
3.24	Normal drum length	m	4000	
3.25	Proof stress level	≥ Gpa	0.69	
4	<u>Cable Gland</u>			
4.1	Cable glands		Based on bidder's offer	
	Manufacturer		Based on bidder's offer	
	Material		Based on bidder's offer	
	Type designation		Based on bidder's offer	
5	<u>Cable Tray, Ladder and Accessories</u>			
5.1	Manufacturer		Based on bidder's offer	
	Name		Based on bidder's offer	
	Country		Based on bidder's offer	
	Type designation		Based on bidder's offer	
5.2	Material		Based on bidder's offer	
5.3	Galvanized thickness		Based on bidder's offer	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
1	<u>General</u>			
1.1	Design Ambient Temperature	°C(min), °C(max)	According to General requirements document	
1.2	Humidity	%	According to General requirements document	
1.3	Installation		indoor	
1.4	ELECTRICAL SYSTEM		Based on bidder's offer	
	ALTERNATOR		Based on bidder's offer	
	Model		Based on bidder's offer	
	AVR Model		Based on bidder's offer	
	Rated Cont. Power Output		500 kVA for Main Generator 200 kVA for Housing Generator	
	Rated Voltage (no load)	V , %	415 , ±5	
	Alternator Matched to Engine Output		yes	
	Main Exciter(brushless)		yes	
	Earthing		Solidly grounded	
	Over Speed Rating	%	120	
1.5	CONTROL INSTRUMENTS		Based on bidder's offer	
	Control Card	Yes/No	yes	
	Auto Start-up , Mains Failure	Yes/No	yes	
	Manual Start-up	Yes/No	yes	
	ALARMS		Based on bidder's offer	
	Start-up Failure	Yes/No	yes	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
	Battery Change Failure	Yes/No	yes	
	Low Oil Pressure	Yes/No	yes	
	High Engine Water Temperature	Yes/No	yes	
	Low Fuel Level	Yes/No	yes	
	Low Radiator Water Level	Yes/No	yes	
	Emergency Stop	Yes/No	yes	
	Over speed	Yes/No	yes	
	PROTECTION DEVICE		Based on bidder's offer	
	Emergency Stop Button	Yes/No	yes	
	ATS (optional)		Based on bidder's offer	
2	<u>A.C. Generator</u>			
2.1	General		Based on bidder's offer	
	Manufacturer		Based on bidder's offer	
	country		Based on bidder's offer	
2.2	Degree Of Protection For GEN		Ip23	
2.3	Degree Of Protection For Term Box		Ip55	
2.4	Type designation		Based on bidder's offer	
2.5	Number of Poles		Based on bidder's offer	
2.6	Class of insulation:		Based on bidder's offer	
	Stator		Based on bidder's offer	
	Rotor		Based on bidder's offer	
2.7	Rated voltage	V rms	415 , 3ph , ±5%	
2.8	Rated current	A rms	Based on bidder's offer	
2.9	Rated out put	kVA	315	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
2.10	Rated Power Factor	lag	0.8	
2.11	Total Harmonic Distortion	%	<3	
2.12	Over-load rating and time duration	kW.h	Based on bidder's offer	
2.13	Short circuit withstand in 1 second (with submission of calculation)	kA (rms)	Based on bidder's offer	
2.14	Rated frequency	HZ	50 , ± 2	
2.15	Emergency Standby Duty	Yes/No	yes	
2.16	Time to Accept Full Load After Start up	% step load , sec	100 / 10	
2.17	Load in % of Rated Continuous Power	%	25,50,75,100,110	
2.18	Voltage stability equipment and range		Based on bidder's offer	
2.19	frequency stability equipment and range		Based on bidder's offer	
2.20	Connection of windings		Based on bidder's offer	
2.21	Neutral grounding		Based on bidder's offer	
2.22	Is generator brushless?		Based on bidder's offer	
2.23	Number of Phases		Based on bidder's offer	
2.24	Reactances:		Based on bidder's offer	
2.25	Synchronous X _d	%	Based on bidder's offer	
2.26	Transient X' _d	%	Based on bidder's offer	
2.27	Sub transient X'' _d	%	Based on bidder's offer	
2.28	Type of cooling		Based on bidder's offer	
2.29	Efficiency at rated voltage and frequency:		Based on bidder's offer	
2.30	75% rated load		Based on bidder's offer	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
2.31	100% rated load		Based on bidder's offer	
2.32	Exciter details:		Based on bidder's offer	
2.33	Manufacturer		Based on bidder's offer	
2.34	Power rating	kW	Based on bidder's offer	
2.35	Voltage rating	V-DC	Based on bidder's offer	
2.36	Max. instantaneous change in frequency for instantaneous load change from zero to full load		Based on bidder's offer	
3	<u>Diesel Engine</u>			
3.1	Manufacture		Based on bidder's offer	
3.2	country		Based on bidder's offer	
3.3	Type designation		Based on bidder's offer	
3.4	Number of cylinders		6	
3.5	Speed	r.p.m	1500	
3.6	Type of cooling		Based on bidder's offer	
3.7	Compression Ratio		By vendor	
3.8	Coupling		Based on bidder's offer	
3.9	Start-up time from initiation until circuit breaker closes	S	Based on bidder's offer	
3.10	Number of strokes		Based on bidder's offer	
3.11	Compression ratio		Based on bidder's offer	
3.12	Efficiency at rated load	%	Based on bidder's offer	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
3.13	Fuel Type		HSD	
3.14	Rated Overload Power(1hr in 24 hr)	% of Rated Load	110	
3.15	Cylinders Wet or Dry		wet	
3.16	Frame		cast	
3.17	Starter Motor		Based on bidder's offer	
3.18	Fuel Tank Capacity		Based on bidder's offer	
3.19	Fuel injection system		Based on bidder's offer	
3.20	Specific fuel consumption at:(Based on generation output)		Based on bidder's offer	
3.21	Aspiration (Natural or supercharger)		Based on bidder's offer	
3.22	ENGINE SAFETY SHUTDOWN WITH ALARM & INDICATION		Based on bidder's offer	
3.23	Engine Over Speed	Yes/No	yes	
3.24	Low lube Oil Pressure	Yes/No	yes	
3.25	High Jacket Water Temperature	Yes/No	yes	
3.26	Fuel Engine Leakage	Yes/No	yes	
3.27	Flow of Air From Fan	m³/min	Based on bidder's offer	
3.28	Water Jacket Heater	Yes/No	yes	
3.29	LUBRICATION SYSTEM		Based on bidder's offer	
3.30	Maximum Oil Consumption (% Fuel Consumption)		0.2	
4	<u>Governor</u>			

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
4.1	Type	Electric /Hydraulic	Electronic	
4.2	Manufacturer and country		Based on bidder's offer	
5	<u>Starting system</u>			
5.1	Type of the battery		Based on bidder's offer	
5.2	Number of Batteries		1	
5.3	Capacity of the battery	Ah	Based on bidder's offer	
5.4	Rated voltage of the battery	V DC	24	
5.5	Type of starter		Based on bidder's offer	
5.6	Type of charger		Based on bidder's offer	
5.7	charger voltage supply		Based on bidder's offer	
6	<u>Control and indication</u>			
6.1	Type of control cubicle (local console or control panel)		Based on bidder's offer	
6.2	Number and type of alarms		Based on bidder's offer	
6.3	Number and type of alarms		Based on bidder's offer	
6.4	Type of remote alarms		Based on bidder's offer	
6.5	Metering equipment (manufacturer, type and range):		Based on bidder's offer	
	A.C. ammeter		Based on bidder's offer	
	A.C. voltmeter		Based on bidder's offer	
	Frequency-meter		Based on bidder's offer	

y) DIESEL GENERATOR		UNIT	DATA	
			REQUIRED	OFFERED
	Water temperature indicator		Based on bidder's offer	
	Oil pressure indicator		Based on bidder's offer	
	Running hour-meter		Based on bidder's offer	
6.6	Control switches and knobs (manufacturer and type)		Based on bidder's offer	
6.7	Protective relaying (manufacturer and type)		Based on bidder's offer	
6.8	Circuit breaker (contactor):		Based on bidder's offer	
	Manufacturer and type		Based on bidder's offer	
	Current rating	A(rms)	Based on bidder's offer	
7	<u>Weight and dimension</u>			
7.1	Main fuel tank		Based on bidder's offer	

z) TARIFF METERING SYSTEM		UNIT	DATA	
			Required	Offered
1.	TARIFF METER			
1.1	Manufacturer			
1.2	Model			
1.3	Construction			
	Measuring Principle		3ph, 4wire	
	Type		Numerical	
	Display/Reading digits		≥7	
	Backlit LCD		Yes	
1.4	Auxiliary voltage range			
	DC (V _n = 110Vdc)	Vdc	88@125	
	AC	Vac	230	
1.5	CT analog inputs			
	Rated current	A	1	
	Current measuring range	pu	1.2	
	Power consumption (burden)	VA		
1.6	VT analog inputs			
	Rated voltage	V	110	
	Voltage measuring range	pu	0.8 – 1.15	
	Power consumption (burden)	VA		
1.7	Accuracy Class			
	Watt hour (IEC 602053-22)		0.2s	

z) TARIFF METERING SYSTEM		UNIT	DATA	
			Required	Offered
	VAr hour (IEC 62053-23)		2.0	
1.8	Measurements			
	kWh, MWh, kVArh, MVarh (Accumulated values)	Yes/No	Yes	
	kW, kVAr, MW, MVar	Yes/No	Yes	
	V, I	Yes/No	Yes	
	Four quadrant reactive energy	Yes/No	Yes	
	Max Demand	Yes/No	Yes	
	THD	Yes/No	Yes	
1.9	Outputs			
	Pulsed Outputs (IEC 62053-1)		5 (min)	
1.10	Data Logging			
	Integral Logging/Storage function			
	Duration	days	180	
	Channels		4	
	Programmable Periods	Yes/No	Yes	
	Inputs from external meters	Yes/No		
1.11	Other functions			
	Battery Back-up	Yes/No	Yes	
	Back-up duration	days	≥14	
	GPS clock	Yes/No	Yes	
	Self-monitoring and alarm facility	Yes/No	Yes	
	Dual supply changeover (VT)	Yes/No	Yes	

z) TARIFF METERING SYSTEM		UNIT	DATA	
			Required	Offered
	Remote Transmission of Energy and Power Values	Yes/No	Yes	
	Remote Interrogation via TCP/IP Link	Yes/No	Yes	
1.12	Communications			
	Local Communication ports (Front/rear etc.)			
	RS232	Yes/No	Yes	
	RS485	Yes/No	Yes	
	Optical (IEC 62056-21)	Yes/No	Yes	
	Ethernet-IEC 61850	Yes/No	Yes	
	Remote communication options			
	<u>5G</u> /4G/3G/GPRS/GSM	Yes/No	Yes	
	Wifi	Yes/No	Yes	
	Protocols supported			
	IEC 62056-21,	Yes/No	Yes	
	IEC 61850	Yes/No	Yes	
	DLMS/COSEM	Yes/No	Yes	
	MODBUS	Yes/No	Yes	
	Others (please list)			
1.13	Type Tests			
1.13.1	Atmospheric Environment			
	Operation -25°C and 55°C for 96hrs, IEC 60068-2-1	Yes/No	Yes	
	Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2	Yes/No	Yes	
1.13.2	Relative Humidity			
	Operation at 93%	Yes/No	Yes	
	Tested to IEC 60068-2-3 with severity class 56 days	Yes/No	Yes	
1.13.3	Enclosure			
	IEC 60529		IP5 2 ⁹	

z) TARIFF METERING SYSTEM		UNIT	DATA	
			Required	Offered
1.13.4	Mechanical Environment			
	Vibration IEC <u>60255-2</u>	Yes/No	Yes	
	Shock and bump IEC <u>60255-2</u>	Yes/No	Yes	
	Seismic IEC <u>60255-2</u>	Yes/No	Yes	
1.13.5	Insulation			
	Rated insulation			
	1000V high impedance protection CT inputs	Yes/No	Yes	
	250V for other circuits	Yes/No	Yes	
	1000V open contact withstand	Yes/No	Yes	
	Dielectric Tests IEC 60255-5 – Series C of table 1	Yes/No	Yes	
	Impulse voltage IEC 60255-5 test voltage 5kV	Yes/No	Yes	
1.13.6	Electromagnetic compatibility			
	1MHz Burst disturbance test, IEC 60255- severity class III	Yes/No	Yes	
	Electrostatic Discharge IEC 60255 severity class III	Yes/No	Yes	
	Radiated Electromagnetic Field Disturbance <u>IEC 60255-26</u> -severity class III Test method A, 27MHz through 500MHz	Yes/No	Yes	
	Electromagnetic Emissions <u>IEC 60255-26</u>	Yes/No	Yes	
	Fast Transient Disturbance <u>IEC 60255-26</u> -severity level IV	Yes/No	Yes	
1.13.7	Type test certificate provided	Yes/No	Yes	

aa) 400 kV OVERHEAD LINE EARTH CONDUCTOR			DATA	
			Required	Offered
1.0	Earth conductor and fittings			
1.1	Number of ACS earth conductors		1 no.	
1.2	International Standard No. applied		ASTM B416	
1.3	Material of earth conductor		Aluminium clad steel (ACS)	
1.4	Number and diameter of wires		7/3.26 No/mm	
1.5	Total area of earth conductor		58.6 mm ²	
1.6	Overall diameter of earth conductor		9.78 mm	
1.7	Mass of earth conductor		390 kg/km	
1.8	Ultimate strength of earth conductor		71,000 Newton	
1.9	Maximum tension of earth conductor in still air at "everyday" temperature		- Newton	
1.10	Assumed equivalent modulus of elasticity of earth conductor		162,000 N/mm ²	
1.11	Assumed equivalent coefficient of linear expansion of earth conductor		12.6 x 10 ⁻⁶ per deg.C	
1.12	Minimum bending radius		- mm	
1.13	Minimum length of earth conductor on drum		4 km	
1.14	Individual wires before stranding			
1.14.1	Standard for Aluminium-clad steel		ASTM B415	
	a. Grade of steel		20SA	
1.15	Vibration damping system for earth conductor			
1.15.1	Maximum span for			
	a. One vibration damper at each end of span (2 in the span)		- m	
	b. Two vibration dampers at each end of span (4 in the span)		- m	
	c. Three vibration dampers at each end of span (6 in the span)		- m	
2.0	OPGW and fittings			

aa) 400 kV OVERHEAD LINE EARTH CONDUCTOR		DATA	
		Required	Offered
2.1	Number of OPGW earth conductors	1 no.	
2.2	International Standard applied	IEEE 1138 IEC60794-4	
2.3	Material of OPGW conductors	Aluminium Alloy/ Aluminium clad steel	
2.4	Number and diameter of wires	- No/mm	
2.5	Total area of OPGW conductor	- mm ²	
2.7	Overall diameter of OPGW conductor	- mm	
2.8	Mass of OPGW conductor	< 850 kg/km	
2.9	Ultimate strength of OPGW conductor	>= 93,000 Newton	
2.10	Maximum tension of OPGW conductor in still air at “everyday” temperature 25 deg.C	> 18,500 Newton	
2.11	Assumed equivalent modulus of elasticity of OPGW conductor	>= 70,000 N/mm ²	
2.12	Assumed equivalent coefficient of linear expansion of OPGW conductor	<= 1.98 x 10 ⁻⁵ per deg.C	
2.13	Minimum bending radius	- mm	
2.14	Short circuit current rating	496 kA ² s	
2.15	Minimum length of OPGW conductor on drum	4 km	
2.16	Individual wires before stranding		
	• Aluminium alloy Standard applied	IEC 60104	
	- Minimum conductivity of aluminium wires at 20deg.C	52.5 % IACS	
	• Aluminium-clad steel Standard applied	IEC 60232	
	• Grade of Steel	20SA	
2.17	Vibration damping system of OPGW		
	Maximum span for		
	a. One vibration damper at each end of span (2 in the span)	- m	
	b. Two vibration dampers at each end of span (4 in the span)	- m	

aa) 400 kV OVERHEAD LINE EARTH CONDUCTOR		DATA	
		Required	Offered
	c. Three vibration dampers at each end of span (6 in the span)	- m	
3.0	Particulars of Fibre Optic Transmission System		
3.1	Type of Fibre optic data	Non-Zero Dispersion-Shifted Single-Mode as per ITU-T G.655	
3.2	Wavelength	1550/1625 nm	
3.3	Number of fibres	48 nos.	
3.4	Transmission attenuation		
	a. at 1550 nm	< 0.22 dB/km	
	b. at 1625 nm	< 0.24 dB/km	
3.5	Transmission bandwidth	> 10,000 MHz/km	
3.6	Fibre identification by	Colour code	
3.7	Chromatic dispersion		
	a. at 1550 nm	< 2 ps/nm.km	
	b. at 1625 nm	<12.4 ps/nm.km	
3.8	Splicing loss	< 0.1 dB	
3.9	Polarisation Mode Dispersion (PMD)	< 20 $\sqrt{\text{km}}$	
3.10	Minimum bending radius	- mm	

bb) 400KV OVERHEAD LINE CONDUCTOR		DATA	
		REQUIRED	OFFERED
1.0	Minimum factors of safety to be applied to assumed simultaneous maximum loadings		
1.1	Line and earth conductors, based on ultimate strength	2.5	
1.2	Line and earth conductors at everyday temperature, still air, based on ultimate strength	5.0	
1.3	Complete insulators and fittings	2.5	
1.4	Steel supports, foundation structures, based on elastic limit of members in tension and on crippling loads of compression members, or on tests on complete supports (but not tests on the foundations):		
1.4.1	Suspension supports		
	a. Normal conditions	2.0	

bb) 400KV OVERHEAD LINE CONDUCTOR		DATA	
		REQUIRED	OFFERED
	b. Unbalanced conditions (except cascade)	1.5	
	c. Cascade collapse condition	1.0	
1.4.2	Tension supports		
	a. Normal conditions	2.0	
	b. Unbalanced conditions	1.5	
1.4.3	Foundations		
	a. Normal conditions	2.5	
	b. Unbalanced conditions	1.75	
1.4.4	Maintenance and Erection		
2.0	Assumed Loading Conditions		
2.1	Minimum temperature of line and earth conductors	1°C	
2.2	“Everyday” temperature	25°C	
2.3	Maximum operating temperature of line conductor	80°C	
2.4	Basic Wind Speed - Wind pressure on projected area of insulators N/m ² - Wind pressure on projected area of conductors N/m ² - Wind pressure on projected area of earthwires N/m ² - Wind pressure on the projected area of members of one face of the towers N/m ²		
2.5	Site altitude above sea level (maximum)	2000 metres	
3.0	Particulars of spans		
3.1	Basic span	400 m	
3.2	Maximum sum of adjacent spans	880 m	
3.3	Maximum single span	600 m	
3.4	Tower design spans		
3.4.1	Wind span for tower design		
	a. Suspension towers	440 m	
	b. Tension towers	450 m	
3.4.2	Maximum weight spans		

bb) 400KV OVERHEAD LINE CONDUCTOR		DATA	
		REQUIRED	OFFERED
	a. Suspension towers	800 m	
	b. Tension towers	900 m	
3.4.3	Minimum weight spans (for design purposes)		
	a. Suspension towers	35% of sum of adjacent spans	
	b. Tension towers (uplift net)	- 450 m	
4.0	Line conductors and fittings		
4.1	Complete line conductor		
4.1.1	Nominal area per conductor	455 mm ²	
4.1.2	Numbers of conductors per phase	3 nos.	
4.1.3	Distance between conductor centres of one phase	400 mm	
4.1.4	Conductor code name	ACSR Condor	
4.1.5	Applicable standard	IEC 61089	
4.1.6	Applicable standard (Metric system, Condor)	ASTM B 232	
4.1.7	Material of conductor	Aluminum/ Galvanised steel	
4.1.8	Numbers and diameters of wires	Al 54/3.08 St 7/3.08 (No/mm)	
4.1.9	Overall diameter of stranded conductor	27.73 mm	
4.1.10	Resistance of conductor (dc) at 20deg.C	0.07173 ohm/km	
4.1.11	Mass of conductor (without grease)	1,522 kg/km	
4.1.12	Total mass of greased conductor (greased to Case 2 of IEC 61089)	- Kg/km	
4.1.13	Ultimate rated strength of conductor	127,800 Newton	
4.1.14	Maximum tension of conductor in still air at "everyday" temperature 25deg.C	25,560 Newton	
4.1.15	Assumed equivalent modulus of elasticity of conductor	68,650 N/mm ²	
4.1.16	Assumed equivalent coefficient of linear expansion of conductor	1.93 x 10 ⁻⁵ per deg.C	
4.1.17	Maximum length of conductor on drum	3 km	
4.2	Conductor grease		
4.2.1	Type		
4.2.2	Minimum drop-point temperature	120 deg.C	
4.2.3	Mass of grease per kilometre of conductor (all inner layers	- kg	

bb) 400KV OVERHEAD LINE CONDUCTOR		DATA	
		REQUIRED	OFFERED
	greased – Case 2 to IEC 61089)		
4.3	Vibration damping system		
4.3.1	Type of system (vibration damper + spacer or spacer damper)	Stockbridge type	
4.3.2	Type of vibration damper (if proposed and used)		
4.3.3	Standard applied	IEC 61897	
4.3.4	Conductor diameter range	- mm	
4.3.5	Mass of damper	- kg	
4.3.6	Maximum span length for		
	a. One vibration damper at each end of span (2 in the span)	- m	
	b. Two vibration dampers at each end of span (4 in the span)	- m	
	c. Three vibration dampers at each end of span (6 in the span)	- m	
4.3.7	Distances from clamp mouth to vibration damper attachment		
	a. First damper	- m	
	b. Second damper when required	- m	
	c. Third damper when required	- m	
4.4	Spacer or spacer damper		
4.4.1	Type of spacer or spacer damper		
4.4.2	Standard applied	IEC 61854	
4.4.3	Conductor diameter range	- mm	
4.4.4	Mass	- kg	
4.4.5	Symmetrical or asymmetrical in-span spacing		
4.4.6	Maximum sub-span length (distances between spacers)		