2.5. 220 KV TECHNICAL DATA SHEETS FOR BUSBARS AND CONNECTIONS

	BUSBARS AND CONNECTIONS	Unit	Required	Provided
1.1	Manufacturer			
1.2	Type (flexible or tubular)			
1.3	Material			
1.4	Short-circuit current rating / duration	kA/s	40/1	
1.5	Normal current rating			
	at 40°C	A	2000	
	at 50°C	A		
1.6	Maximum continuous current rating	A		
1.7	Flexible conductors			
	stranding			
	nominal cross-sectional area	mm^2		
	outer diameter	mm		
	no. of conductors per bundle			
	spacing between conductors	mm		
1.8	Tubular conductors			
	nominal cross-sectional area	mm^2		
	outer diameter	mm		
	inner diameter	mm		
1.9	Maximum stress at surface of flexible conductor	kV/mm		
1.10	Radio influence voltage level measured at 1.1 times Us/√3 at 1 MHz	µV		
1.11	Manufacturer quality system in accordance with ISO 9000	Yes/No	Yes	
	Date of issue		Latest	
	Validity			
	Certificate attached to the offer	Yes/No	Yes	

1.12	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted	Yes/No	Yes	
	Certificate to be attached to the offer	Yes/No	Yes	
	Report to be attached to the offer	Yes/No	Yes	

10.0 TECHNICAL DATA SHEETS FOR LOW VOLTAGE SWITCHGEAR

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.	LVAC SWITCHGEAR (415/240 V, 50 HZ)			
1.1	GENERAL			
1.1.1	Network configuration		TN-S	
1.1.2	Rated operating voltage	V	415	
1.1.3	Rated frequency	Hz	50	
1.2	LVAC SWITCHBOARD			
1.2.1	Manufacturer			
1.2.2	Type designation			
1.2.3	Type of switchboard		Metal-clad, withdrawable type, multi-tier	
1.2.4	Standards		IEC 61439	
1.2.5	Number of years equipment of identical design has been in service		5	
1.2.6	Rated current of busbar at 40□C ambient temperature	A	1200	
1.2.7	Busbar cross section	mm2		
1.2.8	Busbar insulation material			
1.2.9	Busbar insulation maximum working temperature	□C		
1.2.10	Temperature rise on continuous operation			
	at rated current			
	at 50□C			
1.2.11	Rated short-time withstand current (1 s),	kA	≥50	

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.2.12	Rated peak withstand current	kA	≥125	
1.2.13	Test voltage (1 min)	V	2500	
1.2.14	Rated insulation voltage	V	1000	
1.2.15.	Rated impulse withstand voltage	kVp		
1.2.16	Overvoltage category		IV	
1.2.17	Form of separation		3b	
1.2.18	Painting	RAL	7035	
1.2.19	Type of internal barriers, shutters, etc.		Metallic	
1.2.20	Degree of protection		IP51	
1.2.21	Overall dimensions per cubicle			
	Width	mm		
	Depth	mm		
	Height	mm	max 2250	
	Weight	kg		
1.2.22	Method of circuit breaker withdrawal		manual	
1.3	CIRCUIT BREAKER			
1.3.1	Manufacturer			
1.3.2	Type designation			
1.3.3	Type		Air, withdrawable	
1.3.4	Number of poles		3	
1.3.5	Standard		IEC 60947-2	

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.3.6	Rated current at 50□C	A		
1.3.7	Rated short-time withstand current (1 s)	kA		
1.3.8	Rated peak withstand current	kA		
1.3.9	Rated symmetrical breaking current	kA		
1.3.10	Rated making current	kA		
1.3.11	Breaking time	s		
1.3.12	Material of:			
	moving contacts			
	fixed contacts			
1.3.13	Design of:			
	moving contacts			
	fixed contacts			
1.3.14	Operating mechanism			
	Motor rated power	W		
	Motor operating voltage	V		
1.3.15	Weight of draw-out unit	kg		
1.3.16	Protection Module			
	Type			
	Phase protection functions		L,S,I	
	Neutral protection functions			
	Ground/Earth protection functions		G	

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.3.17	Remote Signalling		Yes	
1.3.18.	Type tests			
1.3.18.1	Temperature Rise Test			
	Have heating tests at continuous rated normal current been carried out?			
	report number			
	date			
1.3.18.2	Basic Impulse Voltage Type Test:			
	Has B.I.V test been completed?			
	circuit breaker			
	report number			
	date			
1.3.18.3	Life Test:			
	Has 2000 operating life test at no load (de-energised) been carried out?			
	report number			
	date			
1.4	MOULDED CASE CIRCUIT BREAKERS (MCCBs)			
1.4.1	Manufacturer			
1.4.2	Type designation			
1.4.3	Withdrawable MCCBs type		yes	
1.4.4	Number of poles		3	
1.4.5	Standards		IEC 60947-2	

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.4.6	Rated current at 50□C	A		
1.4.7	Rated short-time withstand current (1 s)	kA		
1.4.8	Rated peak withstand current	kA		
1.4.9	Rated breaking current	kA		
1.4.10	Remote signalling	Yes/No	Yes	
1.4.11	Operating mechanism			
1.4.12	Mass			
1.4.13	Protection Module			
	Type			
	Phase protection functions		L, I	
	Ground (Earth) protection function			
1.5	CURRENT TRANSFORMERS Note: CT data need to be confirmed by contractor's calculation			
1.5.1	Manufacturer			
1.5.2	Type			
1.5.3	Type of primary winding (e.g. bar, wound, etc.)			
1.5.4	Standards		IEC 61869	
1.5.5	Rated voltage	kV		
1.5.6	Rated lightning impulse withstand voltage phase to earth	kV		
1.5.7	Rated power frequency withstand voltage phase to earth	kV		
1.5.8	Partial discharge test voltage	kV		

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.5.9	Rated frequency	Hz	50	
1.5.10	Rated continuous thermal current at 50°C			
1.5.11	Rated short-time withstand current (1 s)	kA		
1.5.12	Rated dynamic current	kA		
1.5.13	Type designation			
1.5.14	Number of cores		3	
1.5.15	Rated extended primary current	%	120	
1.5.16	Ratio (TR = turns ratio)			
	I core	A	750/1	
	II core	A	750/1	
	III core	A	750/1	
1.5.17	Class			
	I core		5P20	
	II core		PX	
	III core		1.0 / FS:5	
1.5.18	Knee point voltage (EK)			
	I core	V		
	II core	V		
	III core	V		
1.5.19	Exciting current (IE) at EK			
	I core	A		

LV Services Equipment		UNIT	DATA	
			Required	Offered
	II core	A		
	III core	A		
1.5.20	Rated output (burden to be 25-100% rated burden			
	I core	VA	30	
	II core	VA	30	
	III core	VA	30	
1.5.21	Total mass of one current transformer complete	kg		
1.5.22	All Class PX CTs shall have a rated secondary current, ISN			
1.6	INSTRUMENTS			
1.6.1	Manufacturer			
1.6.2	Standards		IEC 60051	
1.6.3	Type designation			
	Ammeter			
	Voltmeter			
1.6.4	Total scale range			
	Ammeter			
	Voltmeter			
1.6.5	Dimensions	mm	96 x 96	
1.6.6	Accuracy		1.5	
1.6.7	Selector Switches			
	Ammeter			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Voltmeter			
1.7	PROTECTION			
1.7.1	Overcurrent & Earth Fault Protection (50/51/50N/51N) Relay			
1.7.1.1	Manufacturer			
1.7.1.2	Type reference			
1.7.1.3	Relay design (microprocessor-based, numerical)	Yes/No	Yes	
1.7.1.4	Auxiliary voltage range (Vn = 110Vdc)	Vdc	88□150	
1.7.1.5	Input frequency range (50Hz nominal)	Hz	47.5□52.5	
1.7.1.6	Number of phase CT inputs			
1.7.1.7	Number of earth fault CT inputs			
1.7.1.8	Characteristics curves conforming to IEC 60255, ANSI	Yes/No	Yes	
1.7.1.9	Number of overcurrent functions (e.g. No. lowset, high set, IDMTL)			
1.7.1.10	Number of earth fault functions			
1.7.1.11	Number of group settings			
1.7.1.12	Earth fault element suitable of high impedance REF (with external resistor)	Yes/No	Yes	
1.7.1.13	Other Requirements			
	Integral metering functions	Yes/No		
	Programmable logic	Yes/No	Yes	
	Binary Inputs			
	Number			
	Nominal voltage	Vdc	110	

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Maximum permissible voltage	Vdc		
	Binary Outputs			
	Number			
	CT analog inputs			
	Number			
	Rated current	A	1	
	Power consumption	VA		
	VT analog inputs			
	Number			
	Rated voltage	Vac	110	
	Power consumption	VA		
	Event and Fault recording functions	Yes/No	Yes	
	Self-monitoring and alarm facility	Yes/No	Yes	
	Integral LCD operator interface for local interrogation	Yes/No	Yes	
	PC based configuration software for HMI, settings, logic and data recorder.	Yes/No	Yes	
	Programme name			
	Program included in delivery	Yes/No	Yes	
	Type of interface at relay (e.g. RS232, Ethernet)			
1.7.1.14	Tripping contacts rating			
	Carry continuous	A	5	
	Make I (A) maximum for t (s)	A/s	30 / 0.5	

LV Services Equipment			UNIT	DATA	
				Required	Offered
	Break dc: W resistive/W inductive (L/R = 40ms)		W/W	40 / 25	
1.7.1.15	Communications				
	Control				
	Communication ports (Front/rear etc.)				
	Physical links (RS485/Fibre optic)			Fibre optic	
	Protocols supported				
	IEC 61850		Yes/No	Yes	
	Others (please state)				
1.7.1.16	Type Tests				
	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	
	Relative Humidity				
	Operation at 93%		Yes/No	Yes	
	Tested to IEC 60068-2-3 with severity class 56 days		Yes/No	Yes	
	Enclosure				
	IEC 60529			IP50	
	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	

LV Services Equipment		UNIT	DATA	
			Required	Offered
	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 60255-27– Series C of table 1	Yes/No	Yes	
	Impulse voltage IEC 60255-27test voltage 5kV	Yes/No	Yes	
	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 60255-26	Yes/No	Yes	
	Fast Transient Disturbance IEC 60255-26severity level IV	Yes/No	Yes	
	Type test certificate provided	Yes/No	Yes	
1.7.2	Restricted Earth Fault Protection Relay (87NLE)			
1.7.2.1	Manufacturer			
1.7.2.2	Type reference			
1.7.2.3	Relay design (microprocessor-based, numerical)	Yes/No	Yes	
1.7.2.4	Auxiliary voltage range (Vn = 110Vdc)	Vdc	88□150	
1.7.2.5	Input frequency range (50Hz nominal)	Hz	47.5□52.5	
1.7.2.6	Number of phase CT inputs			

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.7.2.7	Number of earth CT inputs			
1.7.2.8	Minimum fault setting (% of CT rating)	%		
1.7.2.9	Operating time at 5 x setting	ms		
1.7.2.10	State principle of operation, i.e. H - high impedance L - low impedance	H, L	H	
1.7.2.11	Current transformer requirements:			
	Required knee point voltage, Vk	V		
	CT maximum winding resistance	□		
	Magnetising current at Vk	A		
1.7.2.12	Other protection functions:			
	Overvoltage protection (59)	Yes/No	Yes	
	Undervoltage protection	Yes/No	Yes	
1.7.2.13	Other Requirements			
	Integral metering functions	Yes/No		
	Programmable logic	Yes/No	Yes	
	Binary Inputs			
	Number			
	Nominal voltage	Vdc	110	
	Maximum permissible voltage	Vdc		
	Binary Outputs			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Number			
	CT analog inputs			
	Number			
	Rated current	A	1	
	Power consumption	VA		
	VT analog inputs			
	Number			
	Rated voltage	Vac	110	
	Power consumption	VA		
	Event and Fault recording functions	Yes/No	Yes	
	Self-monitoring and alarm facility	Yes/No	Yes	
	Integral LCD operator interface for local interrogation	Yes/No	Yes	
	PC based configuration software for HMI, settings, logic and data recorder.	Yes/No	Yes	
	Programme name			
	Program included in delivery	Yes/No	Yes	
	Type of interface at relay (e.g. RS232, Ethernet)			
1.7.2.14	Tripping contacts rating			
	Carry continuous	A	5	
	Make I (A) maximum for t (s)	A/s	30 / 0.5	
	Break dc: W resistive/W inductive (L/R = 40ms)	W/W	40 / 25	
1.7.2.15	Communications			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Control			
	Communication ports (Front/rear etc.)			
	Physical links (RS485/Fibre optic)		Fibre optic	
	Protocols supported			
	IEC 61850	Yes/No	Yes	
	Others (please state)			
1.7.2.16	Type Tests			
	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	
	Relative Humidity			
	Operation at 93%	Yes/No	Yes	
	Tested to IEC 60068-2-3 with severity class 56 days	Yes/No	Yes	
	Enclosure			
	IEC 60529		IP50	
	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	
	Insulation			
	Rated insulation			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	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 60255-27 – Series C of table 1	Yes/No	Yes	
	Impulse voltage IEC 60255-27 test voltage 5kV	Yes/No	Yes	
	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 60255-26	Yes/No	Yes	
	Fast Transient Disturbance IEC 60255-26 severity level IV	Yes/No	Yes	
	Type test certificate provided	Yes/No	Yes	
1.7.3	Undervoltage Relay			
1.7.3.1.	Manufacturer			
1.7.3.2.	Type reference			
1.7.3.3.	Relay design (electromechanical, static)			
1.7.3.4.	Total scale range	V		
1.7.3.5.	Operate time at instantaneous voltage change	ms		
1.7.3.6.	Reset ratio	%		
1.8	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004	Yes/No	Yes	

LV Services Equipment		UNIT	DATA	
			Required	Offered
1.9	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate available	Yes/No	Yes	
2.	110 V D.C SYSTEM - SUBSTATION SERVICES SUPPLY			
2.1	110 V Battery Units			
2.1.1	Manufacturer			
2.1.2	Type designation			
2.1.3	Number of battery units		2 x 50%	
2.1.4	Type of cell		Nickel-Cadmium	
2.1.5	Operating voltage per cell	V	1.2	
2.1.6	Number of cells			
2.1.7	Standard		* IEEE 1115 for calculation * IEC 60623, 61204, 61439 for equipment	
2.1.8	Discharge capacity:			
	10 hour rate	Ah	min. 900 (to be confirmed by calculation)	
	5 hour rate	Ah		
	3 hour rate	Ah		
	1 hour rate	Ah		
	30 minute rate	Ah		
2.1.9	Final cell voltage after discharge:			
	10 hour rate	V	1.14	

LV Services Equipment		UNIT	DATA	
			Required	Offered
	5 hour rate	V		
	3 hour rate	V		
	1 hour rate	V		
	30 minute rate	V		
2.1.10	Ampere hour efficiency:			
	10 hour rate	%		
	5 hour rate	%		
	3 hour rate	%		
	1 hour rate	%		
2.1.11	Watt hour efficiency:			
	10 hour rate	%		
	5 hour rate	%		
	3 hour rate	%		
	1 hour rate	%		
	30 minute rate	%		
2.1.12	Maximum charging voltage per cell	V		
2.1.13	Normal charging rate range	A		
2.1.14	Maximum charging rate range	A		
2.1.15	Float charging rate	A		
2.1.16	Boost charging rate	A		
2.1.17	Normal voltage across battery on float charge	V		

LV Services Equipment		UNIT	DATA	
			Required	Offered
2.1.18	Voltage per cell on float charge	V		
2.1.19	Normal voltage across battery on boost charge	V		
2.1.20	Voltage per cell on boost charge	V		
2.1.21	Overall dimensions of one cell	mm		
2.1.22	Quantity of electrolyte per cell	Litres		
2.1.23	Overall dimensions of each stand	mm		
2.1.24	Number of stands			
2.1.25	Number of tiers			
2.1.26	Material and cross section of connections:			
	between cells	mm2		
	between tiers	mm2		
	between stands	mm2		
	to battery fuse box	mm2		
2.1.27	Method of treating copper connection against corrosion			
2.1.28	Method of protecting copper connections against accidental short circuiting			
2.1.29	Estimated short circuit current from fully charged battery	A		
2.1.30	Anticipated life of electrolyte under actual operating conditions	Years		
2.1.31	Anticipated life of electrolyte under actual operating conditions	Years		
2.1.32	Operating temperatures:			
	Normal operation maximum	□C		
	Normal operation minimum	□C		

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Emergency discharge maximum	□C		
	Emergency discharge minimum	□C		
2.2	110 V D.C Battery Chargers			
2.2.1	Manufacturer			
2.2.2	Type designation			
2.2.3	Panel			
	Degree of protection		IP 51	
	Painting	RAL	7035	
2.2.4	Number of chargers		2 x 100%	
2.2.5	Type		Thyristor Controlled	
2.2.6	Charging characteristic			
2.2.7	Input voltage and range	V	3 Phase, 415, ±25%	
2.2.8	Input frequency and range	Hz	50, ±5%	
2.2.9	Input power	kVA		
2.2.10	Minimum working power factor			
2.2.11	Rated output power	kW		
2.2.12	Output voltage range:			
	float charge	V		
	boost charge	V		
2.2.13	Continuous output current range:			
	float charge	A		

LV Services Equipment		UNIT	DATA	
			Required	Offered
	boost charge	A		
2.2.14	Accuracy of output voltage within a load range between 0 % and 100 % of the unit current	%		
2.2.15	Overload range	%		
2.2.16	Voltage ripple	%		
2.2.17	Ripple frequency	Hz		
2.2.18	Means of adjusting output			
2.2.19	Details of any forced cooling equipment for chargers			
2.2.20	Ambient temperature range	□C		
2.2.21	Ambient relative humidity range	%		
2.2.22	Mean time between failure (MTBF)	Years	25	
2.2.23	Overall dimensions (shall be a separate free-standing panel/cubicle)	mm		
2.2.24	Weight	kg		
2.2.25	Boost charge maximum permitted constant potential per cell	V		
2.2.26	Boost charge maximum permitted current as percentage of 5 hour capacity	%		
2.2.27	Time to be re-charge to 90% capacity at maximum permitted voltage and current	hrs		
2.3.	Battery Fuse Boxes			
2.3.1	Manufacturer			
2.3.2	Type designation			
2.3.3	Degree of protection		IP 51	
2.3.4	Fuse rated current at 50oC			
2.3.5	Remote signalling	Yes/No	Yes	

LV Services Equipment		UNIT	DATA	
			Required	Offered
2.3.6	Dimensions of box	mm		
2.4	110 V D.C. Switchboards			
2.4.1	Manufacturer			
2.4.2	Type designation			
2.4.3	Panels			
	Degree of protection		IP 51	
	Painting	RAL	7035	
	Form of separation		3b	
2.4.4	Standards		IEC 61439	
2.4.5	Rated operating voltage	V	110	
2.4.6	Rated current of busbars at 50oC ambient temperature	A		
2.4.7	Busbar cross section	mm2		
2.4.8	Busbar insulation material			
2.4.9	Number of circuits			
2.4.10	Main isolator rating	A		
2.4.11	Main fuse rating	A		
2.4.12	Single line diagram number			
2.4.13	Arrangement drawing number			
2.4.14	Details of Contactors:			
	Manufacturer			
	Type designation			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Type			
	Site current rating (at 50°C)	A		
	Rated breaking capacity	kA		
	Short time current (1 s)	kA		
	Maximum operating time opening	Msec		
	Maximum operating time closing	msec		
	Voltage / power coil rating	V/W		
	Typical circuit diagram number			
2.4.15	Details of Earth Fault Protection:			
	Manufacturer			
	Type Designation			
	Brochure number			
2.4.16	Details of Undervoltage / Overvoltage Protection:			
	Manufacturer			
	Type Designation			
	Brochure number			
2.4.17	Instruments			
	Manufacturer			
	Voltmeter (type)			
	Ammeter (type)			
	Instruments			

LV Services Equipment		UNIT	DATA	
			Required	Offered
2.4.18	Details of Moulded Case Circuit Breakers (MCCBs)			
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 50□C	A		
	Rated short-time withstand current (1 s)	kA		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
2.4.19	Details of Miniature Circuit Breakers (MCBs)			
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 50□C	A		
	Rated short-time withstand current (1 s)	kA		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
2.5	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004	Yes/No	Yes	
2.6	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate available	Yes/No	Yes	

LV Services Equipment		UNIT	DATA	
			Required	Offered
3.	48 V D.C SYSTEM - SUBSTATION SERVICES SUPPLY			
3.1	48 V Battery Units			
3.1.1	Manufacturer			
3.1.2	Type designation			
3.1.3	Number of battery units		2 x 50%	
3.1.4	Type of cell		Nickel-Cadmium	
3.1.5	Operating voltage per cell	V	1.2	
3.1.6	Number of cells			
3.1.7	Standard		* IEEE 1115 for calculation * IEC 60623, 61204, 61439 for equipment	
3.1.8	Discharge capacity:			
	12 hour rate	Ah	min. 200 (to be confirmed by calculation)	
	5 hour rate	Ah		
	3 hour rate	Ah		
	1 hour rate	Ah		
	30 minute rate	Ah		
3.1.9	Final cell voltage after discharge:			
	10 hour rate	V	1.14	
	5 hour rate	V		

LV Services Equipment		UNIT	DATA	
			Required	Offered
	3 hour rate	V		
	1 hour rate	V		
	30 minute rate	V		
3.1.10	Ampere hour efficiency:			
	10 hour rate	%		
	5 hour rate	%		
	3 hour rate	%		
	1 hour rate	%		
3.1.11	Watt hour efficiency:			
	10 hour rate	%		
	5 hour rate	%		
	3 hour rate	%		
	1 hour rate	%		
	30 minute rate	%		
3.1.12	Maximum charging voltage per cell	V		
3.1.13	Normal charging rate range	A		
3.1.14	Maximum charging rate range	A		
3.1.15	Float charging rate	A		
3.1.16	Boost charging rate	A		
3.1.17	Normal voltage across battery on float charge	V		
3.1.18	Voltage per cell on float charge	V		

LV Services Equipment		UNIT	DATA	
			Required	Offered
3.1.19	Normal voltage across battery on boost charge	V		
3.1.20	Voltage per cell on boost charge	V		
3.1.21	Overall dimensions of one cell	mm		
3.1.22	Quantity of electrolyte per cell	Litres		
3.1.23	Overall dimensions of each stand	mm		
3.1.24	Number of stands			
3.1.25	Number of tiers			
3.1.26	Material and cross section of connections:			
	between cells	mm2		
	between tiers	mm2		
	between stands	mm2		
	to battery fuse box	mm2		
3.1.27	Method of treating copper connection against corrosion			
3.1.28	Method of protecting copper connections against accidental short circuiting			
3.1.29	Estimated short circuit current from fully charged battery	A		
3.1.30	Anticipated life of electrolyte under actual operating conditions	Years		
3.1.31	Anticipated life of electrolyte under actual operating conditions	Years		
3.1.32	Operating temperatures:			
	Normal operation maximum	□C		
	Normal operation minimum	□C		
	Emergency discharge maximum	□C		

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Emergency discharge minimum	□C		
3.3	48 V D.C Battery Chargers			
3.3.1	Manufacturer			
3.3.2	Type designation			
3.3.3	Panel			
	Degree of protection		IP 51	
	Painting	RAL	7035	
3.3.4	Number of chargers		2 x 100%	
3.3.5	Type		Thyristor Controlled	
3.3.6	Charging characteristic			
3.3.7	Input voltage and range	V	3 Phase, 415, ±25%	
3.3.8	Input frequency and range	Hz	50, ±5%	
3.3.9	Input power	kVA		
3.3.10	Minimum working power factor			
3.3.11	Rated output power	kW		
3.3.12	Output voltage range:			
	float charge	V		
	boost charge	V		
3.3.13	Continuous output current range:			
	float charge	A		
	boost charge	A		

LV Services Equipment		UNIT	DATA	
			Required	Offered
3.3.14	Accuracy of output voltage within a load range between 0 % and 100 % of the unit current	%		
3.3.15	Overload range	%		
3.3.16	Voltage ripple	%		
3.3.17	Ripple frequency	Hz		
3.3.18	Means of adjusting output			
3.3.19	Details of any forced cooling equipment for chargers			
3.3.20	Ambient temperature range	□C		
3.3.21	Ambient relative humidity range	%		
3.3.22	Mean time between failure (MTBF)	Years	25	
3.3.23	Overall dimensions (shall be a separate free-standing panel/cubicle)	mm		
3.3.24	Weight	kg		
3.3.25	Boost charge maximum permitted constant potential per cell	V		
3.3.26	Boost charge maximum permitted current as percentage of 5 hour capacity	%		
3.3.27	Time to be re-charge to 90% capacity at maximum permitted voltage and current	hrs		
3.3.	Battery Fuse Boxes			
3.3.1	Manufacturer			
3.3.2	Type designation			
3.3.3	Degree of protection		IP 51	
3.3.4	Fuse rated current at 50oC			
3.3.5	Remote signalling	Yes/No	Yes	
3.3.6	Dimensions of box	mm		

LV Services Equipment		UNIT	DATA	
			Required	Offered
3.4	48 V D.C. Switchboards			
3.4.1	Manufacturer			
3.4.2	Type designation			
3.4.3	Panels			
	Degree of protection		IP 51	
	Painting	RAL	7035	
	Form of separation		3b	
3.4.4	Standards		IEC 61439	
3.4.5	Rated operating voltage	V	48	
3.4.6	Rated current of busbars at 50°C ambient temperature	A		
3.4.7	Busbar cross section	mm2		
3.4.8	Busbar insulation material			
3.4.9	Number of circuits			
3.4.10	Main isolator rating	A		
3.4.11	Main fuse rating	A		
3.4.12	Single line diagram number			
3.4.13	Arrangement drawing number			
3.4.14	Details of Contactors:			
	Manufacturer			
	Type designation			
	Type			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Site current rating (at 50°C)	A		
	Rated breaking capacity	kA		
	Short time current (1 s)	kA		
	Maximum operating time opening	msec		
	Maximum operating time closing	msec		
	Voltage / power coil rating	V/W		
	Typical circuit diagram number			
3.4.15	Details of Earth Fault Protection:			
	Manufacturer			
	Type Designation			
	Brochure number			
3.4.16	Details of Undervoltage / Overvoltage Protection:			
	Manufacturer			
	Type Designation			
	Brochure number			
3.4.17	Instruments			
	Manufacturer			
	Voltmeter (type)			
	Ammeter (type)			
	Instruments			
3.4.18	Details of Moulded Case Circuit Breakers (MCCBs)			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 50□C	A		
	Rated short-time withstand current (1 s)	kA		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
3.4.19	Details of Miniature Circuit Breakers (MCBs)			
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 50□C	A		
	Rated short-time withstand current (1 s)	kA		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
3.5	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004	Yes/No	Yes	
3.6	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate available	Yes/No	Yes	
4.	240 V AC UNINTERRUPTIBLE POWER SUPPLY			
4.1	GENERAL			

LV Services Equipment		UNIT	DATA	
			Required	Offered
4.1.1	The uninterruptible power supply (UPS) shall consist but not be limited to the following			
	two thyristor controlled 110 V DC / 415 V AC inverters	Yes/No	Yes	
	two static interrupters and transfer switches	Yes/No	Yes	
	one 240/240 V three phase isolating by-pass transformer	Yes/No	Yes	
	two manual by-pass switches	Yes/No	Yes	
	one UPS distribution board	Yes/No	Yes	
4.2	INVERTER			
4.2.1	Manufacturer			
4.2.2	Type designation			
4.2.3	Degree of protection/RAL code		IP51/RAL 7035	
4.2.4	Rated output power	VA	min 6000 (to be confirmed by calculation)	
4.2.5	Rated input voltage and range	V□%		
4.2.6	Rated input current	A		
4.2.7	Rated output voltage	V		
4.2.8	Steady state voltage variation	%		
4.2.9	Rated output current	A		
4.2.10	Rated output frequency	Hz		
4.2.11	Steady state frequency variation	%		
4.2.12	Total harmonic distortion	%		
4.2.13	Rated output power factor			

LV Services Equipment		UNIT	DATA	
			Required	Offered
4.2.14	Maximum harmonic distortion:			
	at any single frequency	%		
	at all frequencies	%		
4.2.15	Radio frequency interference (RFI) classification			
4.2.16	Output voltage rise time on turn-on	ms		
4.2.17	Output voltage decay time on turn-off	ms		
4.2.18	Maximum transient voltage variation after full load acceptance or rejection for:			
	1 cycle	%		
	0.1 s	%		
	1 s	%		
4.2.19	Method of cooling			
4.2.1	Ambient temperature range	□C		
4.2.20	Maximum temperature rise (inside)	□C		
4.2.21	Ambient relative humidity	%		
4.2.22	Method of protecting inverters against high intensity D.C voltage surges			
4.2.23	Mean time between failure (MTBF)	Years	25	
4.2.24	Dimensions	mm		
4.2.25	Weight	kg		
4.3	STATIC SWITCH			
4.3.1	Bidder shall fulfil the detailed description of offered static switch possibility with data and diagram			

LV Services Equipment		UNIT	DATA	
			Required	Offered
4.4	ISOLATION BY-PASS TRANSFORMER			
4.4.1	Manufacturer			
4.4.2	Standard applied			
4.4.3	Type designation			
4.4.4	Maximum continuous capacity	VA		
4.4.5	Number of phase	1		
4.4.6	Rated voltage under full load	V		
4.4.7	Protection class	IP		
4.4.8	Dimensions overall	mm		
4.4.9	Total weight	kg		
4.5	MANUAL BY-PASS SWITCH			
4.5.1	Manufacturer			
4.5.2	Type of designation			
4.5.3	Rated current at 50°C	A		
4.6	DISTRIBUTION BOARD			
4.6.1	Manufacturer			
4.6.2	Type designation			
4.6.3	Degree of protection/RAL code		IP 51/RAL 7035	
4.6.4	Busbar insulation material			
4.6.5	Number of circuits			
4.6.6	Details of Miniature Circuit Breakers (MCBs)			

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 40°C	A		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
4.6.7	Details of Moulded Case Circuit Breakers (MCCBs)			
	Manufacturer			
	Type designation			
	Number of poles			
	Standards			
	Rated current at 40°C	A		
	Rated breaking capacity	kA		
	Remote signalling	Yes/No	Yes	
4.7	Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004	Yes/No	Yes	
4.8	Type test certificate to be issued by independent laboratory or independently witnessed type test certificate available	Yes/No	Yes	
5.	AUXILIARY BCU			
	Hardware and software type same as BCUs specified in chapter "SUBSTATION CONTROL SYSTEM"	Yes/No	Yes	

LV Services Equipment		UNIT	DATA	
			Required	Offered
	Binary Inputs			
	Number			
	Nominal voltage	Vdc	110	
	Maximum permissible voltage	Vdc		
	Binary Outputs			
	Number			
	CT analog inputs			
	Number			
	Rated current	A	1	
	Power consumption	VA		
	VT analog inputs			
	Number			
	Rated voltage	Vac	110	
	Power consumption	VA		
	mA analog inputs			
	Number			
	Range	mA	4-20	