

ANNEXURE 1a

SCHEDULE OF REQUIREMENTS (Note: Equal or Similar approved to specified brands will be accepted.
For each MV switchgear, a withdrawable busbar VT to be allowed for in the allocated VT panel and a cable VT on other bus. The schedule of requirements indicates the requirement on a bus-section and VT panel, but this can be proposed such that there is a VT per bus and allowance of 1 withdrawable bus bar VT. Note the detail when pricing for diff protection. i.e. price for the replacement of relays upstream in the price for diff per respective panel)

CONTAINER ADMIN SUBSTATION (11kV)						
Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Panel Designation	E62- Incomer 1 E65- Incomer 2 E65a- Spare incomer	E63 –Transformer Feeder E64 – Transformer Feeder	BC8- Bus section BC8a - Busbar ES & VT	CAS – Stored Spare	
1.1	General					
	Type of panel	316 stainless steel	316 stainless steel	316 stainless steel	316 stainless steel	
	Number of switching devices	Three	Two	One	One	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Neutral Earthing: Unearthed: _____ Solidly Earthed: _____ Reactance Earthed: _____ Resonant Earthed: _____	Solidly Earthed				
	Arrangement drawing reference of the switchboard with details of each panel and its components and accessories	To be submitted by tenderer				
	Cable trench or basement layout to be agreed with the supplier (Yes/No)	No Existing Building				
1.2	Ratings of switchgear panels					
	Rated voltage kV	11 kV				
	Rated frequency 50 Hz	50 Hz				
	Busbars Rated normal current (amps) Type of Material: Copper..... Insulation	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	
	Rated insulation level kV	95kV				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Max. Three phase and earth fault current kA / 3 seconds	31.5				
	Internal Arc Classification (IAC) Rating	AFLR				
	Max Internal arc Fault rating kA / 1 second	31.5				
	Rated normal current for Circuits A	1250A	630A	1250A	630A	
	Anticondensation Heaters: Yes/No	Yes. In cable and CB compartment.				
	Switchboard Colour	TBA (Tenderer to be advised or as per spec)				
1.3	Enviromental conditions					
	a) altitude m	0 to 1800m				
	b) max. daily temperature °C	+45				
	c) min. daily temperature °C	-5				
	d) average daily temperature °C	+35				
	e) humidity %	96				
	f) exposure conditions	Salt laden and industrial atmosphere				
	g) Lightning Conditions	Severe: 11flashes/ km ² /annum				
1.4	Circuit-breakers					
	Circuit-breaker type required (Withdrawable)	Vacuum				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Closing mechanism if other than a stored energy type	Stored Energy, spring or Capacitor				
	Rating according to IEC 62271-100	E2, M2, C2				
	Closing Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Tripping Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Stored Energy Mechanism Type: Motor/Capacitor Voltage : _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Number of spare auxiliary contacts required on circuit-breakers					
	- “Normally open ” contacts	5	5	5	5	
	- “Normally Closed” contacts	5	5	5	5	
1.5	Safety earthing					

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Are earthing facilities required on main circuits? Yes/No	Yes	Yes		Yes	
	Are earthing facilities on busbars required? Yes/No			Yes one per busbar section 1 x ES in Bus Section or Bus Riser		
	Are these facilities to be rated for fault making? Yes/No	Yes	Yes	Yes	Yes	
	Interlock BB E/S capability required. (Yes/No)	Yes, via Key Type Interlock and SCADA automation		Yes, via Key Type Interlock and SCADA automation		
1.6	Cable Terminations					
	Type and size of cable	As per existing installation	As per existing installation		As per existing installation	
	Cable termination compartments	Yes	Yes		Yes	
	Type of cable boxes required	Air Insulated, EN50181, inner-cone, pluggable	Air Insulated. EN50181, inner-cone, pluggable		Air Insulated. EN50181, inner-cone, pluggable	
	Type of filling required: XLPE Air insulated Cables.	EN50181, pluggable Termination kits to be provided.	EN50181, pluggable Termination kits to be provided.		EN50181, pluggable Termination kits to be provided.	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Are gland plates or arrangement for clamping required? Yes/No	Yes, as per design for the pluggable termination.	Yes, as per design for the pluggable termination.		Yes, as per design for the pluggable termination.	.
	Cable trifurcation for three-core cable to single cores ? Yes/No	Yes	Yes		Yes	
1.7	Current transformers (CTs)					
	Current transformer specification applicable.	Yes	Yes	Yes	Yes	
	a) Class type: Protection per panel:	1	1	1	1	
	- quantity	3	6	6	42	
	Class X	Yes 630/1 0.03 A RCT < 2.8Ohm	Nil	Nil	Nil	
	- ratios	630/1	100/1	630/1	100/1	
		5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	
	b) Metering CTs					
	Where required?	Incomer				
	Class type (per panel):	1	1		1	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	- quantity	3	3		3	
	- ratio (Multi ratio)	630/1	100/1		100/1	
	- accuracy %	Cl 0.5 - 7.5VA	Cl 0.5 - 7.5VA		Cl 0.5 - 7.5VA	
	c) Differential protection					
	Where required?	Incomers	N/A	N/A	N/A	N/A
	- quantity	2 (Bidder to price for a duplicate for substations feeding the proposed sub)				
	Test Blocks Yes/No	Yes RXTP type On LV Door				
1.8	Voltage Transformers (VTs)					
	Panel to which VTs are to be fitted			Bus section, Busbar riser / BB VT Panel.		
	VT requirements					
	Connected to			Busbar		
	Quantity			3 x Single Phase		
	a) Class type / VA: Indicating Instruments / Meters			Class 0.5 / 50VA		
	b) Class type / VA: Protection			6P / 150VA		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	- quantity			1 per busbar section		
	- ratios			11000v3/110v3/110/3 Volts		
	VT Protection device			Loading resistor or VT guard.		
	Connection of VT primary to: Busbar side/circuit side			Busbar Side, Withdrawable/fixed		
	Are HV fuse-links required? Yes/No			Yes		
1.9	Live circuit indication					
	According to IEC 61243-5	Yes	Yes	Yes	Yes	
	Is live circuit indication required Yes/No	Yes	Yes	Yes	Yes	
	If Yes, on which panels?	Incomer	Feeders	Bus section	Feeders	
1.10	Control, protection and alarm circuitry					
	Drawing number, if applicable, for all panels	To be submitted by Manufacturer				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Are control wires to be terminated with crimped lugs? Yes/No	Yes				
	Colour of auxiliary wires, if not grey	As per specification.				
	Requirements for alarm circuits					
	Protection of d.c. circuits Fuses/MCCBs	MCB's				
	Are Ammeter required? Yes/No	Yes via IED				
	Are Voltmeters required? Yes/No	Yes via IED				
C.11	Battery, battery charger and d.c. supplies					
	Are a battery and battery charger to be supplied? Yes/No	Yes				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	If Yes, details of the battery V A.h capacity suitable for 8hour standby	110 Volt (gel type, maintenance free batteries) Manufacturer to calculate the Ah capacity required				
	Auxiliary supply	Yes 380/220V Local AC DB existing				
1.12	Protection Relays Overcurrent and Earth Fault Relays (All IEC-61850 compliant): Overcurrent: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time Earth Fault: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Auto-reclosing	No	No	No	No	
	Cable Differential Protection	Yes	No	No	No	
	Power Factor Protection	No	No	No	No	
	Busbar Blocking	Yes	Yes	Yes	Yes	
	Details of indication functions required					
	Current Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Voltage Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Energy Metering	Yes in IED	Yes in IED	NA	Yes in IED	
	Specify	P, Q, Pf	P, Q, Pf	NA	P, Q, Pf	
	Binary Inputs	16 Inputs	16 Inputs	16 Inputs	16 Inputs	
	Binary Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	
	Communications	Ethernet RJ45/multi-mode				
	Communications Protocol	IEC 61850				
	Type of IED	Equal or similar approved to ABB RED615 HBDCACADN HA1BNN1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Pilot wire Modem required Yes/No	Yes, equal, or similar to RPW600AMF or as applicable to the installation.	No	No	No	
	Arc Protection	Ultra-Fast Earthing System including sensors per bay as required				
	Arc Protection system	Tripping the source of the fault current				
	Gas monitoring system Alarm/Trip,		Yes in IED		Yes in IED	
	Winding Temp Alarm/Trip		Yes in IED		Yes in IED	
	Oil Temp/Trip		Yes in IED		Yes in IED	
1.13	Electrical Interstrip	Remote Cable Differential Signal	No	No	No	
	Driving unit: Breaker No. Follower unit: Breaker No	Cable Differential Trip Signal				
	Where are VT fuses or links located?			On VT		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
1.14	Remote Switching	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	
1.15	Tests					
	Routine test and type test of metering CTs required	Yes according to IEC 60044-1				
	Routine test and type test of protection CTs required	Yes according to IEC 60044-1				
	Routine Test and Type test of VTs required			Yes according to IEC 60044-2		
	Number of copies of routine test certificates required	Three				
1.16	Marking/labeling/documentation					
	Are main circuit labels to be engraved? Yes/No	Yes				
	Documentation to be provided with the offer.	General Arrangement and details of equipment offered				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	
	Quantity of Operational and Maintenance manuals required:	Three copies				
1.17	Accessories					
	Supply of cabinet required Switchgear Operating Tools Wall Mounted tool cabinet CB service trolley	Yes Yes Yes				
	Number of as-built drawings and Operating and Maintenance manuals required.	Three				
	Spares					
	Period required for routine maintenance spares	5 years				
	Minimum availability of spares from date of supply	10 years				
	Delivery					
	Delivery period EXW in Weeks	Tenderer to advise as part of tender returnable				
	Delivery period installation in weeks	Winning tenderer/contractor to advise				
	Delivery period for commissioning in weeks	Winning tenderer/contractor to advise				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E62, E65 & E65a	E63 & E64	BC8 & BC8a	CAS	

ANNEXURE 1a
SCHEDULE OF REQUIREMENTS

ROAD RAIL SUBSTATION (11kV)						
Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Panel Designation	E44- Incomer 1 E47- Incomer 2 E47a- Spare incomer	E45 – Transformer Feeder E46 – Transformer Feeder E48 – Transformer Feeder E49 – Transformer Feeder	BC5 - Bus section BC5a - Busbar ES & VT	E50 – Mini Sub 1 E50a – Spare feeder	
1.1	General					
	Type of panel	316 stainless steel	316 stainless steel	316 stainless steel	316 stainless steel	
	Number of switching devices	Three	Four	One	Two	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Neutral Earthing: Unearthed: _____ Solidly Earthed: _____ Reactance Earthed: _____ Resonant Earthed: _____	Solidly Earthed				
	Arrangement drawing reference of the switchboard with details of each panel and its components and accessories	To be submitted by tenderer				
	Cable trench or basement layout to be agreed with the supplier (Yes/No)	No Existing Building				
1.2	Ratings of switchgear panels					
	Rated voltage kV	11 kV				
	Rated frequency 50 Hz	50 Hz				
	Busbars Rated normal current (amps) Type of Material: Copper..... Insulation	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	
	Rated insulation level kV	95kV				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Max. Three phase and earth fault current kA / 3 seconds	31.5				
	Internal Arc Classification (IAC) Rating	AFLR				
	Max Internal arc Fault rating kA / 1 second	31.5				
	Rated normal current for Circuits A	1250A	630A	1250A	630A	
	Anticondensation Heaters: Yes/No	Yes. In cable and CB compartment.				
	Switchboard Colour	TBA (Tenderer to be advised or as per spec)				
1.3	Enviromental conditions					
	a) altitude m	0 to 1800m				
	b) max. daily temperature °C	+45				
	c) min. daily temperature °C	-5				
	d) average daily temperature °C	+35				
	e) humidity %	96				
	f) exposure conditions	Salt laden and industrial atmosphere				
	g) Lightning Conditions	Severe: 11flashes/ km ² /annum				
1.4	Circuit-breakers					
	Circuit-breaker type required (Withdrawable)	Vacuum				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Closing mechanism if other than a stored energy type	Stored Energy, spring or Capacitor				
	Rating according to IEC 62271-100	E2, M2, C2				
	Closing Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Tripping Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Stored Energy Mechanism Type: Motor/Capacitor Voltage : _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Number of spare auxiliary contacts required on circuit-breakers					
	- “Normally open ” contacts	5	5	5	5	
	- “Normally Closed” contacts	5	5	5	5	
1.5	Safety earthing					

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Are earthing facilities required on main circuits? Yes/No	Yes	Yes		Yes	
	Are earthing facilities on busbars required? Yes/No			Yes one per busbar section 1 x ES in Bus Section or Bus Riser		
	Are these facilities to be rated for fault making? Yes/No	Yes	Yes	Yes	Yes	
	Interlock BB E/S capability required. (Yes/No)	Yes, via Key Type Interlock and SCADA automation		Yes, via Key Type Interlock and SCADA automation		
1.6	Cable Terminations					
	Type and size of cable	As per existing installation	As per existing installation		As per existing installation	
	Cable termination compartments	Yes	Yes		Yes	
	Type of cable boxes required	Air Insulated, EN50181, inner-cone, pluggable	Air Insulated. EN50181, inner-cone, pluggable		Air Insulated. EN50181, inner-cone, pluggable	
	Type of filling required: XLPE Air insulated Cables.	EN50181, pluggable Termination kits to be provided.	EN50181, pluggable Termination kits to be provided.		EN50181, pluggable Termination kits to be provided.	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Are gland plates or arrangement for clamping required? Yes/No	Yes, as per design for the pluggable termination.	Yes, as per design for the pluggable termination.		Yes, as per design for the pluggable termination.	.
	Cable trifurcation for three-core cable to single cores ? Yes/No	Yes	Yes		Yes	
1.7	Current transformers (CTs)					
	Current transformer specification applicable.	Yes	Yes	Yes	Yes	
	a) Class type: Protection per panel:	1	1	1	1	
	- quantity	3	6	6	42	
	Class X	Yes 630/1 0.03 A RCT < 2.8Ohm	Nil	Nil	Nil	
	- ratios	630/1	100/1	630/1	100/1	
		5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	
	b) Metering CTs					
	Where required?	Incomer				
	Class type (per panel):	1	1		1	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	- quantity	3	3		3	
	- ratio (Multi ratio)	630/1	100/1		100/1	
	- accuracy %	Cl 0.5 - 7.5VA	Cl 0.5 - 7.5VA		Cl 0.5 - 7.5VA	
	c) Differential protection					
	Where required?	Incomers	N/A	N/A	N/A	N/A
	- quantity	2 (Bidder to price for a duplicate for substations feeding the proposed sub)				
	Test Blocks Yes/No	Yes RXTP type On LV Door				
1.8	Voltage Transformers (VTs)					
	Panel to which VTs are to be fitted			Bus section, Busbar riser / BB VT Panel.		
	VT requirements					
	Connected to			Busbar		
	Quantity			3 x Single Phase		
	a) Class type / VA: Indicating Instruments / Meters			Class 0.5 / 50VA		
	b) Class type / VA: Protection			6P / 150VA		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	- quantity			1 per busbar section		
	- ratios			11000v3/110v3/110/3 Volts		
	VT Protection device			Loading resistor or VT guard.		
	Connection of VT primary to: Busbar side/circuit side			Busbar Side, Withdrawable/fixed		
	Are HV fuse-links required? Yes/No			Yes		
1.9	Live circuit indication					
	According to IEC 61243-5	Yes	Yes	Yes	Yes	
	Is live circuit indication required Yes/No	Yes	Yes	Yes	Yes	
	If Yes, on which panels?	Incomer	Feeders	Bus section	Feeders	
1.10	Control, protection and alarm circuitry					
	Drawing number, if applicable, for all panels	To be submitted by Manufacturer				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Are control wires to be terminated with crimped lugs? Yes/No	Yes				
	Colour of auxiliary wires, if not grey	As per specification.				
	Requirements for alarm circuits					
	Protection of d.c. circuits Fuses/MCCBs	MCB's				
	Are Ammeter required? Yes/No	Yes via IED				
	Are Voltmeters required? Yes/No	Yes via IED				
C.11	Battery, battery charger and d.c. supplies					
	Are a battery and battery charger to be supplied? Yes/No	Yes				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	If Yes, details of the battery V A.h capacity suitable for 8hour standby	110 Volt (gel type, maintenance free batteries) Manufacturer to calculate the Ah capacity required				
	Auxiliary supply	Yes 380/220V Local AC DB existing				
1.12	Protection Relays Overcurrent and Earth Fault Relays (All IEC-61850 compliant): Overcurrent: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time Earth Fault: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Auto-reclosing	No	No	No	No	
	Cable Differential Protection	Yes	No	No	No	
	Power Factor Protection	No	No	No	No	
	Busbar Blocking	Yes	Yes	Yes	Yes	
	Details of indication functions required					
	Current Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Voltage Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Energy Metering	Yes in IED	Yes in IED	NA	Yes in IED	
	Specify	P, Q, Pf	P, Q, Pf	NA	P, Q, Pf	
	Binary Inputs	16 Inputs	16 Inputs	16 Inputs	16 Inputs	
	Binary Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	
	Communications	Ethernet RJ45/multi-mode				
	Communications Protocol	IEC 61850				
	Type of IED	Equal or similar approved to ABB RED615 HBDCACADN HA1BNN1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Pilot wire Modem required Yes/No	Yes, equal, or similar to RPW600AMF or as applicable to the installation.	No	No	No	
	Arc Protection	Ultra-Fast Earthing System including sensors per bay as required				
	Arc Protection system	Tripping the source of the fault current				
	Gas monitoring system Alarm/Trip,		Yes in IED		Yes in IED	
	Winding Temp Alarm/Trip		Yes in IED		Yes in IED	
	Oil Temp/Trip		Yes in IED		Yes in IED	
1.13	Electrical Interstrip	Remote Cable Differential Signal	No	No	No	
	Driving unit: Breaker No. Follower unit: Breaker No	Cable Differential Trip Signal				
	Where are VT fuses or links located?			On VT		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
1.14	Remote Switching	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	
1.15	Tests					
	Routine test and type test of metering CTs required	Yes according to IEC 60044-1				
	Routine test and type test of protection CTs required	Yes according to IEC 60044-1				
	Routine Test and Type test of VTs required			Yes according to IEC 60044-2		
	Number of copies of routine test certificates required	Three				
1.16	Marking/labeling/documentation					
	Are main circuit labels to be engraved? Yes/No	Yes				
	Documentation to be provided with the offer.	General Arrangement and details of equipment offered				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	
	Quantity of Operational and Maintenance manuals required:	Three copies				
1.17	Accessories					
	Supply of cabinet required Switchgear Operating Tools Wall Mounted tool cabinet CB service trolley	Yes Yes Yes				
	Number of as-built drawings and Operating and Maintenance manuals required.	Three				
	Spares					
	Period required for routine maintenance spares	5 years				
	Minimum availability of spares from date of supply	10 years				
	Delivery					
	Delivery period EXW in Weeks	Tenderer to advise as part of tender returnable				
	Delivery period installation in weeks	Winning tenderer/contractor to advise				
	Delivery period for commissioning in weeks	Winning tenderer/contractor to advise				

Technical Specification
Specification No. TPD: 007-MVSWITCHSPEC

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E44, E47 & E47a	E45, E46, E48 & E49	BC5	E50 & E50a	

ANNEXURE 1a
SCHEDULE OF REQUIREMENTS

REFRIGERATION SUBSTATION (11kV)						
Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Panel Designation	E27- Incomer 1 E34- Incomer 2 E34a- Spare incomer	E30 – Transformer Feeder E31 – Transformer Feeder	BC3 - Bus section BC3a - Busbar ES & VT	E28 – Island Mini Sub E29 – Mini Sub 1 E32 – Mini Sub 3 E33 – Equipped Spare E33a – Spare feeder	
1.1	General					
	Type of panel	316 stainless steel	316 stainless steel	316 stainless steel	316 stainless steel	
	Number of switching devices	Three	Two	One	Five	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Neutral Earthing: Unearthed: _____ Solidly Earthed: _____ Reactance Earthed: _____ Resonant Earthed: _____	Solidly Earthed				
	Arrangement drawing reference of the switchboard with details of each panel and its components and accessories	To be submitted by tenderer				
	Cable trench or basement layout to be agreed with the supplier (Yes/No)	No Existing Building				
1.2	Ratings of switchgear panels					
	Rated voltage kV	11 kV				
	Rated frequency 50 Hz	50 Hz				
	Busbars Rated normal current (amps) Type of Material: Copper..... Insulation	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	
	Rated insulation level kV	95kV				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Max. Three phase and earth fault current kA / 3 seconds	31.5				
	Internal Arc Classification (IAC) Rating	AFLR				
	Max Internal arc Fault rating kA / 1 second	31.5				
	Rated normal current for Circuits A	1250A	630A	1250A	630A	
	Anticondensation Heaters: Yes/No	Yes. In cable and CB compartment.				
	Switchboard Colour	TBA (Tenderer to be advised or as per spec)				
1.3	Enviromental conditions					
	a) altitude m	0 to 1800m				
	b) max. daily temperature °C	+45				
	c) min. daily temperature °C	-5				
	d) average daily temperature °C	+35				
	e) humidity %	96				
	f) exposure conditions	Salt laden and industrial atmosphere				
	g) Lightning Conditions	Severe: 11flashes/ km ² /annum				
1.4	Circuit-breakers					
	Circuit-breaker type required (Withdrawable)	Vacuum				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Closing mechanism if other than a stored energy type	Stored Energy, spring or Capacitor				
	Rating according to IEC 62271-100	E2, M2, C2				
	Closing Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Tripping Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Stored Energy Mechanism Type: Motor/Capacitor Voltage : _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Number of spare auxiliary contacts required on circuit-breakers					
	- “Normally open ” contacts	5	5	5	5	
	- “Normally Closed” contacts	5	5	5	5	
1.5	Safety earthing					

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Are earthing facilities required on main circuits? Yes/No	Yes	Yes		Yes	
	Are earthing facilities on busbars required? Yes/No			Yes one per busbar section 1 x ES in Bus Section or Bus Riser		
	Are these facilities to be rated for fault making? Yes/No	Yes	Yes	Yes	Yes	
	Interlock BB E/S capability required. (Yes/No)	Yes, via Key Type Interlock and SCADA automation		Yes, via Key Type Interlock and SCADA automation		
1.6	Cable Terminations					
	Type and size of cable	As per existing installation	As per existing installation		As per existing installation	
	Cable termination compartments	Yes	Yes		Yes	
	Type of cable boxes required	Air Insulated, EN50181, inner-cone, pluggable	Air Insulated. EN50181, inner-cone, pluggable		Air Insulated. EN50181, inner-cone, pluggable	
	Type of filling required: XLPE Air insulated Cables.	EN50181, pluggable Termination kits to be provided.	EN50181, pluggable Termination kits to be provided.		EN50181, pluggable Termination kits to be provided.	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Are gland plates or arrangement for clamping required? Yes/No	Yes, as per design for the pluggable termination.	Yes, as per design for the pluggable termination.		Yes, as per design for the pluggable termination.	.
	Cable trifurcation for three-core cable to single cores ? Yes/No	Yes	Yes		Yes	
1.7	Current transformers (CTs)					
	Current transformer specification applicable.	Yes	Yes	Yes	Yes	
	a) Class type: Protection per panel:	1	1	1	1	
	- quantity	3	6	6	42	
	Class X	Yes 630/1 0.03 A RCT < 2.8Ohm	Nil	Nil	Nil	
	- ratios	630/1	100/1	630/1	100/1	
		5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	
	b) Metering CTs					
	Where required?	Incomer				
	Class type (per panel):	1	1		1	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	- quantity	3	3		3	
	- ratio (Multi ratio)	630/1	100/1		100/1	
	- accuracy %	Cl 0.5 - 7.5VA	Cl 0.5 - 7.5VA		Cl 0.5 - 7.5VA	
	c) Differential protection					
	Where required?	Incomers	N/A	N/A	N/A	N/A
	- quantity	2 (Bidder to price for a duplicate for substations feeding the proposed sub)				
	Test Blocks Yes/No	Yes RXTP type On LV Door				
1.8	Voltage Transformers (VTs)					
	Panel to which VTs are to be fitted			Bus section, Busbar riser / BB VT Panel.		
	VT requirements					
	Connected to			Busbar		
	Quantity			3 x Single Phase		
	a) Class type / VA: Indicating Instruments / Meters			Class 0.5 / 50VA		
	b) Class type / VA: Protection			6P / 150VA		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	- quantity			1 per busbar section		
	- ratios			11000v3/110v3/110/3 Volts		
	VT Protection device			Loading resistor or VT guard.		
	Connection of VT primary to: Busbar side/circuit side			Busbar Side, Withdrawable/fixed		
	Are HV fuse-links required? Yes/No			Yes		
1.9	Live circuit indication					
	According to IEC 61243-5	Yes	Yes	Yes	Yes	
	Is live circuit indication required Yes/No	Yes	Yes	Yes	Yes	
	If Yes, on which panels?	Incomer	Feeders	Bus section	Feeders	
1.10	Control, protection and alarm circuitry					
	Drawing number, if applicable, for all panels	To be submitted by Manufacturer				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Are control wires to be terminated with crimped lugs? Yes/No	Yes				
	Colour of auxiliary wires, if not grey	As per specification.				
	Requirements for alarm circuits					
	Protection of d.c. circuits Fuses/MCCBs	MCB's				
	Are Ammeter required? Yes/No	Yes via IED				
	Are Voltmeters required? Yes/No	Yes via IED				
C.11	Battery, battery charger and d.c. supplies					
	Are a battery and battery charger to be supplied? Yes/No	Yes				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	If Yes, details of the battery V A.h capacity suitable for 8hour standby	110 Volt (gel type, maintenance free batteries) Manufacturer to calculate the Ah capacity required				
	Auxiliary supply	Yes 380/220V Local AC DB existing				
1.12	Protection Relays Overcurrent and Earth Fault Relays (All IEC-61850 compliant): Overcurrent: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time Earth Fault: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Auto-reclosing	No	No	No	No	
	Cable Differential Protection	Yes	No	No	No	
	Power Factor Protection	No	No	No	No	
	Busbar Blocking	Yes	Yes	Yes	Yes	
	Details of indication functions required					
	Current Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Voltage Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Energy Metering	Yes in IED	Yes in IED	NA	Yes in IED	
	Specify	P, Q, Pf	P, Q, Pf	NA	P, Q, Pf	
	Binary Inputs	16 Inputs	16 Inputs	16 Inputs	16 Inputs	
	Binary Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	
	Communications	Ethernet RJ45/multi-mode				
	Communications Protocol	IEC 61850				
	Type of IED	Equal or similar approved to ABB RED615 HBDCACADN HA1BNN1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Pilot wire Modem required Yes/No	Yes, equal, or similar to RPW600AMF or as applicable to the installation.	No	No	No	
	Arc Protection	Ultra-Fast Earthing System including sensors per bay as required				
	Arc Protection system	Tripping the source of the fault current				
	Gas monitoring system Alarm/Trip,		Yes in IED		Yes in IED	
	Winding Temp Alarm/Trip		Yes in IED		Yes in IED	
	Oil Temp/Trip		Yes in IED		Yes in IED	
1.13	Electrical Interstrip	Remote Cable Differential Signal	No	No	No	
	Driving unit: Breaker No. Follower unit: Breaker No	Cable Differential Trip Signal				
	Where are VT fuses or links located?			On VT		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
1.14	Remote Switching	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	
1.15	Tests					
	Routine test and type test of metering CTs required	Yes according to IEC 60044-1				
	Routine test and type test of protection CTs required	Yes according to IEC 60044-1				
	Routine Test and Type test of VTs required			Yes according to IEC 60044-2		
	Number of copies of routine test certificates required	Three				
1.16	Marking/labeling/documentation					
	Are main circuit labels to be engraved? Yes/No	Yes				
	Documentation to be provided with the offer.	General Arrangement and details of equipment offered				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	
	Quantity of Operational and Maintenance manuals required:	Three copies				
1.17	Accessories					
	Supply of cabinet required Switchgear Operating Tools Wall Mounted tool cabinet CB service trolley	Yes Yes Yes				
	Number of as-built drawings and Operating and Maintenance manuals required.	Three				
	Spares					
	Period required for routine maintenance spares	5 years				
	Minimum availability of spares from date of supply	10 years				
	Delivery					
	Delivery period EXW in Weeks	Tenderer to advise as part of tender returnable				
	Delivery period installation in weeks	Winning tenderer/contractor to advise				
	Delivery period for commissioning in weeks	Winning tenderer/contractor to advise				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E27, E34 & E34a	E30 & E31	BC3	E28, E29, E32, E33 & E33a	

ANNEXURE 1a
SCHEDULE OF REQUIREMENTS

CAE SUBSTATION (11kV)						
Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Panel Designation	E67- Incomer 1 E70- Incomer 2 E70a- Spare incomer	E68 – Transformer Feeder E69 – Transformer Feeder	BC9 - Bus section BC9a - Busbar ES & VT	E50 – Mini Sub 7 E50a – Spare feeder	
1.1	General					
	Type of panel	316 stainless steel	316 stainless steel	316 stainless steel	316 stainless steel	
	Number of switching devices	Three	Two	One	Two	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Neutral Earthing: Unearthed: _____ Solidly Earthed: _____ Reactance Earthed: _____ Resonant Earthed: _____	Solidly Earthed				
	Arrangement drawing reference of the switchboard with details of each panel and its components and accessories	To be submitted by tenderer				
	Cable trench or basement layout to be agreed with the supplier (Yes/No)	No Existing Building				
1.2	Ratings of switchgear panels					
	Rated voltage kV	11 kV				
	Rated frequency 50 Hz	50 Hz				
	Busbars Rated normal current (amps) Type of Material: Copper..... Insulation	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	
	Rated insulation level kV	95kV				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Max. Three phase and earth fault current kA / 3 seconds	31.5				
	Internal Arc Classification (IAC) Rating	AFLR				
	Max Internal arc Fault rating kA / 1 second	31.5				
	Rated normal current for Circuits A	1250A	630A	1250A	630A	
	Anticondensation Heaters: Yes/No	Yes. In cable and CB compartment.				
	Switchboard Colour	TBA (Tenderer to be advised or as per spec)				
1.3	Enviromental conditions					
	a) altitude m	0 to 1800m				
	b) max. daily temperature °C	+45				
	c) min. daily temperature °C	-5				
	d) average daily temperature °C	+35				
	e) humidity %	96				
	f) exposure conditions	Salt laden and industrial atmosphere				
	g) Lightning Conditions	Severe: 11flashes/ km ² /annum				
1.4	Circuit-breakers					
	Circuit-breaker type required (Withdrawable)	Vacuum				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Closing mechanism if other than a stored energy type	Stored Energy, spring or Capacitor				
	Rating according to IEC 62271-100	E2, M2, C2				
	Closing Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Tripping Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Stored Energy Mechanism Type: Motor/Capacitor Voltage : _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Number of spare auxiliary contacts required on circuit-breakers					
	- “Normally open ” contacts	5	5	5	5	
	- “Normally Closed” contacts	5	5	5	5	
1.5	Safety earthing					

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Are earthing facilities required on main circuits? Yes/No	Yes	Yes		Yes	
	Are earthing facilities on busbars required? Yes/No			Yes one per busbar section 1 x ES in Bus Section or Bus Riser		
	Are these facilities to be rated for fault making? Yes/No	Yes	Yes	Yes	Yes	
	Interlock BB E/S capability required. (Yes/No)	Yes, via Key Type Interlock and SCADA automation		Yes, via Key Type Interlock and SCADA automation		
1.6	Cable Terminations					
	Type and size of cable	As per existing installation	As per existing installation		As per existing installation	
	Cable termination compartments	Yes	Yes		Yes	
	Type of cable boxes required	Air Insulated, EN50181, inner-cone, pluggable	Air Insulated. EN50181, inner-cone, pluggable		Air Insulated. EN50181, inner-cone, pluggable	
	Type of filling required: XLPE Air insulated Cables.	EN50181, pluggable Termination kits to be provided.	EN50181, pluggable Termination kits to be provided.		EN50181, pluggable Termination kits to be provided.	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Are gland plates or arrangement for clamping required? Yes/No	Yes, as per design for the pluggable termination.	Yes, as per design for the pluggable termination.		Yes, as per design for the pluggable termination.	.
	Cable trifurcation for three-core cable to single cores ? Yes/No	Yes	Yes		Yes	
1.7	Current transformers (CTs)					
	Current transformer specification applicable.	Yes	Yes	Yes	Yes	
	a) Class type: Protection per panel:	1	1	1	1	
	- quantity	3	6	6	42	
	Class X	Yes 630/1 0.03 A RCT < 2.8Ohm	Nil	Nil	Nil	
	- ratios	630/1	100/1	630/1	100/1	
		5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	
	b) Metering CTs					
	Where required?	Incomer				
	Class type (per panel):	1	1		1	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	- quantity	3	3		3	
	- ratio (Multi ratio)	630/1	100/1		100/1	
	- accuracy %	Cl 0.5 - 7.5VA	Cl 0.5 - 7.5VA		Cl 0.5 - 7.5VA	
	c) Differential protection					
	Where required?	Incomers	N/A	N/A	N/A	N/A
	- quantity	2 (Bidder to price for a duplicate for substations feeding the proposed sub)				
	Test Blocks Yes/No	Yes RXTP type On LV Door				
1.8	Voltage Transformers (VTs)					
	Panel to which VTs are to be fitted			Bus section, Busbar riser / BB VT Panel.		
	VT requirements					
	Connected to			Busbar		
	Quantity			3 x Single Phase		
	a) Class type / VA: Indicating Instruments / Meters			Class 0.5 / 50VA		
	b) Class type / VA: Protection			6P / 150VA		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	- quantity			1 per busbar section		
	- ratios			11000v3/110v3/110/3 Volts		
	VT Protection device			Loading resistor or VT guard.		
	Connection of VT primary to: Busbar side/circuit side			Busbar Side, Withdrawable/fixed		
	Are HV fuse-links required? Yes/No			Yes		
1.9	Live circuit indication					
	According to IEC 61243-5	Yes	Yes	Yes	Yes	
	Is live circuit indication required Yes/No	Yes	Yes	Yes	Yes	
	If Yes, on which panels?	Incomer	Feeders	Bus section	Feeders	
1.10	Control, protection and alarm circuitry					
	Drawing number, if applicable, for all panels	To be submitted by Manufacturer				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Are control wires to be terminated with crimped lugs? Yes/No	Yes				
	Colour of auxiliary wires, if not grey	As per specification.				
	Requirements for alarm circuits					
	Protection of d.c. circuits Fuses/MCCBs	MCB's				
	Are Ammeter required? Yes/No	Yes via IED				
	Are Voltmeters required? Yes/No	Yes via IED				
C.11	Battery, battery charger and d.c. supplies					
	Are a battery and battery charger to be supplied? Yes/No	Yes				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	If Yes, details of the battery V A.h capacity suitable for 8hour standby	110 Volt (gel type, maintenance free batteries) Manufacturer to calculate the Ah capacity required				
	Auxiliary supply	Yes 380/220V Local AC DB existing				
1.12	Protection Relays Overcurrent and Earth Fault Relays (All IEC-61850 compliant): Overcurrent: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time Earth Fault: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Auto-reclosing	No	No	No	No	
	Cable Differential Protection	Yes	No	No	No	
	Power Factor Protection	No	No	No	No	
	Busbar Blocking	Yes	Yes	Yes	Yes	
	Details of indication functions required					
	Current Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Voltage Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Energy Metering	Yes in IED	Yes in IED	NA	Yes in IED	
	Specify	P, Q, Pf	P, Q, Pf	NA	P, Q, Pf	
	Binary Inputs	16 Inputs	16 Inputs	16 Inputs	16 Inputs	
	Binary Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	
	Communications	Ethernet RJ45/multi-mode				
	Communications Protocol	IEC 61850				
	Type of IED	Equal or similar approved to ABB RED615 HBDCACADN HA1BNN1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Pilot wire Modem required Yes/No	Yes, equal, or similar to RPW600AMF or as applicable to the installation.	No	No	No	
	Arc Protection	Ultra-Fast Earthing System including sensors per bay as required				
	Arc Protection system	Tripping the source of the fault current				
	Gas monitoring system Alarm/Trip,		Yes in IED		Yes in IED	
	Winding Temp Alarm/Trip		Yes in IED		Yes in IED	
	Oil Temp/Trip		Yes in IED		Yes in IED	
1.13	Electrical Interstrip	Remote Cable Differential Signal	No	No	No	
	Driving unit: Breaker No. Follower unit: Breaker No	Cable Differential Trip Signal				
	Where are VT fuses or links located?			On VT		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
1.14	Remote Switching	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	
1.15	Tests					
	Routine test and type test of metering CTs required	Yes according to IEC 60044-1				
	Routine test and type test of protection CTs required	Yes according to IEC 60044-1				
	Routine Test and Type test of VTs required			Yes according to IEC 60044-2		
	Number of copies of routine test certificates required	Three				
1.16	Marking/labeling/documentation					
	Are main circuit labels to be engraved? Yes/No	Yes				
	Documentation to be provided with the offer.	General Arrangement and details of equipment offered				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	
	Quantity of Operational and Maintenance manuals required:	Three copies				
1.17	Accessories					
	Supply of cabinet required Switchgear Operating Tools Wall Mounted tool cabinet CB service trolley	Yes Yes Yes				
	Number of as-built drawings and Operating and Maintenance manuals required.	Three				
	Spares					
	Period required for routine maintenance spares	5 years				
	Minimum availability of spares from date of supply	10 years				
	Delivery					
	Delivery period EXW in Weeks	Tenderer to advise as part of tender returnable				
	Delivery period installation in weeks	Winning tenderer/contractor to advise				
	Delivery period for commissioning in weeks	Winning tenderer/contractor to advise				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E67, E70 & E70a	E68 & E69	BC9	E71 & E71a	

ANNEXURE 1a
SCHEDULE OF REQUIREMENTS

COASTER BERTH SUBSTATION (11kV)						
Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Panel Designation	E72- Incomer 1 E75- Incomer 2 E75a- Spare incomer	E73 – Transformer Feeder E74 – Transformer Feeder E76 – Transformer Feeder E77 – Transformer Feeder	BC1 - Bus section BC1a - Busbar ES & VT	E77a – Spare feeder	
1.1	General					
	Type of panel	316 stainless steel	316 stainless steel	316 stainless steel	316 stainless steel	
	Number of switching devices	Three	Four	One	One	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Neutral Earthing: Unearthed: _____ Solidly Earthed: _____ Reactance Earthed: _____ Resonant Earthed: _____	Solidly Earthed				
	Arrangement drawing reference of the switchboard with details of each panel and its components and accessories	To be submitted by tenderer				
	Cable trench or basement layout to be agreed with the supplier (Yes/No)	No Existing Building				
1.2	Ratings of switchgear panels					
	Rated voltage kV	11 kV				
	Rated frequency 50 Hz	50 Hz				
	Busbars Rated normal current (amps) Type of Material: Copper..... Insulation	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	1250A Copper Air Insulated	
	Rated insulation level kV	95kV				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Max. Three phase and earth fault current kA / 3 seconds	31.5				
	Internal Arc Classification (IAC) Rating	AFLR				
	Max Internal arc Fault rating kA / 1 second	31.5				
	Rated normal current for Circuits A	1250A	630A	1250A	630A	
	Anticondensation Heaters: Yes/No	Yes. In cable and CB compartment.				
	Switchboard Colour	TBA (Tenderer to be advised or as per spec)				
1.3	Enviromental conditions					
	a) altitude m	0 to 1800m				
	b) max. daily temperature °C	+45				
	c) min. daily temperature °C	-5				
	d) average daily temperature °C	+35				
	e) humidity %	96				
	f) exposure conditions	Salt laden and industrial atmosphere				
	g) Lightning Conditions	Severe: 11flashes/ km ² /annum				
1.4	Circuit-breakers					
	Circuit-breaker type required (Withdrawable)	Vacuum				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Closing mechanism if other than a stored energy type	Stored Energy, spring or Capacitor				
	Rating according to IEC 62271-100	E2, M2, C2				
	Closing Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Tripping Supply: Rated Voltage: _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Stored Energy Mechanism Type: Motor/Capacitor Voltage : _____ Peak Power: _____	110 Volts, Battery Peak Power 750W				
	Number of spare auxiliary contacts required on circuit-breakers					
	- “Normally open ” contacts	5	5	5	5	
	- “Normally Closed” contacts	5	5	5	5	
1.5	Safety earthing					

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Are earthing facilities required on main circuits? Yes/No	Yes	Yes		Yes	
	Are earthing facilities on busbars required? Yes/No			Yes one per busbar section 1 x ES in Bus Section or Bus Riser		
	Are these facilities to be rated for fault making? Yes/No	Yes	Yes	Yes	Yes	
	Interlock BB E/S capability required. (Yes/No)	Yes, via Key Type Interlock and SCADA automation		Yes, via Key Type Interlock and SCADA automation		
1.6	Cable Terminations					
	Type and size of cable	As per existing installation	As per existing installation		As per existing installation	
	Cable termination compartments	Yes	Yes		Yes	
	Type of cable boxes required	Air Insulated, EN50181, inner-cone, pluggable	Air Insulated. EN50181, inner-cone, pluggable		Air Insulated. EN50181, inner-cone, pluggable	
	Type of filling required: XLPE Air insulated Cables.	EN50181, pluggable Termination kits to be provided.	EN50181, pluggable Termination kits to be provided.		EN50181, pluggable Termination kits to be provided.	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Are gland plates or arrangement for clamping required? Yes/No	Yes, as per design for the pluggable termination.	Yes, as per design for the pluggable termination.		Yes, as per design for the pluggable termination.	.
	Cable trifurcation for three-core cable to single cores ? Yes/No	Yes	Yes		Yes	
1.7	Current transformers (CTs)					
	Current transformer specification applicable.	Yes	Yes	Yes	Yes	
	a) Class type: Protection per panel:	1	1	1	1	
	- quantity	3	6	6	42	
	Class X	Yes 630/1 0.03 A RCT < 2.8Ohm	Nil	Nil	Nil	
	- ratios	630/1	100/1	630/1	100/1	
		5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	5P20 7.5VA RCT < 6.4 Ohm	5P20 2.5VA RCT < 1 Ohm	
	b) Metering CTs					
	Where required?	Incomer				
	Class type (per panel):	1	1		1	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	- quantity	3	3		3	
	- ratio (Multi ratio)	630/1	100/1		100/1	
	- accuracy %	Cl 0.5 - 7.5VA	Cl 0.5 - 7.5VA		Cl 0.5 - 7.5VA	
	c) Differential protection					
	Where required?	Incomers	N/A	N/A	N/A	N/A
	- quantity	2 (Bidder to price for a duplicate for substations feeding the proposed sub)				
	Test Blocks Yes/No	Yes RXTP type On LV Door				
1.8	Voltage Transformers (VTs)					
	Panel to which VTs are to be fitted			Bus section, Busbar riser / BB VT Panel.		
	VT requirements					
	Connected to			Busbar		
	Quantity			3 x Single Phase		
	a) Class type / VA: Indicating Instruments / Meters			Class 0.5 / 50VA		
	b) Class type / VA: Protection			6P / 150VA		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	- quantity			1 per busbar section		
	- ratios			11000v3/110v3/110/3 Volts		
	VT Protection device			Loading resistor or VT guard.		
	Connection of VT primary to: Busbar side/circuit side			Busbar Side, Withdrawable/fixed		
	Are HV fuse-links required? Yes/No			Yes		
1.9	Live circuit indication					
	According to IEC 61243-5	Yes	Yes	Yes	Yes	
	Is live circuit indication required Yes/No	Yes	Yes	Yes	Yes	
	If Yes, on which panels?	Incomer	Feeders	Bus section	Feeders	
1.10	Control, protection and alarm circuitry					
	Drawing number, if applicable, for all panels	To be submitted by Manufacturer				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Are control wires to be terminated with crimped lugs? Yes/No	Yes				
	Colour of auxiliary wires, if not grey	As per specification.				
	Requirements for alarm circuits					
	Protection of d.c. circuits Fuses/MCCBs	MCB's				
	Are Ammeter required? Yes/No	Yes via IED				
	Are Voltmeters required? Yes/No	Yes via IED				
C.11	Battery, battery charger and d.c. supplies					
	Are a battery and battery charger to be supplied? Yes/No	Yes				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	If Yes, details of the battery V A.h capacity suitable for 8hour standby	110 Volt (gel type, maintenance free batteries) Manufacturer to calculate the Ah capacity required				
	Auxiliary supply	Yes 380/220V Local AC DB existing				
1.12	Protection Relays Overcurrent and Earth Fault Relays (All IEC-61850 compliant): Overcurrent: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time Earth Fault: Number of elements IDMT Inverse IDMT Extremely Inverse High Set Instantaneous Instantaneous Definite Time	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes	Yes Three Yes Yes Yes Yes Yes Three Yes One Yes

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Auto-reclosing	No	No	No	No	
	Cable Differential Protection	Yes	No	No	No	
	Power Factor Protection	No	No	No	No	
	Busbar Blocking	Yes	Yes	Yes	Yes	
	Details of indication functions required					
	Current Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Voltage Indication	Yes in IED	Yes in IED	Yes in IED	Yes in IED	
	Energy Metering	Yes in IED	Yes in IED	NA	Yes in IED	
	Specify	P, Q, Pf	P, Q, Pf	NA	P, Q, Pf	
	Binary Inputs	16 Inputs	16 Inputs	16 Inputs	16 Inputs	
	Binary Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	6 Normal + 4 Power Outputs	
	Communications	Ethernet RJ45/multi-mode				
	Communications Protocol	IEC 61850				
	Type of IED	Equal or similar approved to ABB RED615 HBDCACADN HA1BNN1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	Equal or similar approved to ABB REF615 HBFEAEAGNBA1BNA1XD (Most recent model to be considered)	

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Pilot wire Modem required Yes/No	Yes, equal, or similar to RPW600AMF or as applicable to the installation.	No	No	No	
	Arc Protection	Ultra-Fast Earthing System including sensors per bay as required				
	Arc Protection system	Tripping the source of the fault current				
	Gas monitoring system Alarm/Trip,		Yes in IED		Yes in IED	
	Winding Temp Alarm/Trip		Yes in IED		Yes in IED	
	Oil Temp/Trip		Yes in IED		Yes in IED	
1.13	Electrical Interstrip	Remote Cable Differential Signal	No	No	No	
	Driving unit: Breaker No. Follower unit: Breaker No	Cable Differential Trip Signal				
	Where are VT fuses or links located?			On VT		

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
1.14	Remote Switching	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	Yes, via socket on panel face and local control LV panel	
1.15	Tests					
	Routine test and type test of metering CTs required	Yes according to IEC 60044-1				
	Routine test and type test of protection CTs required	Yes according to IEC 60044-1				
	Routine Test and Type test of VTs required			Yes according to IEC 60044-2		
	Number of copies of routine test certificates required	Three				
1.16	Marking/labeling/documentation					
	Are main circuit labels to be engraved? Yes/No	Yes				
	Documentation to be provided with the offer.	General Arrangement and details of equipment offered				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	
	Quantity of Operational and Maintenance manuals required:	Three copies				
1.17	Accessories					
	Supply of cabinet required Switchgear Operating Tools Wall Mounted tool cabinet CB service trolley	Yes Yes Yes				
	Number of as-built drawings and Operating and Maintenance manuals required.	Three				
	Spares					
	Period required for routine maintenance spares	5 years				
	Minimum availability of spares from date of supply	10 years				
	Delivery					
	Delivery period EXW in Weeks	Tenderer to advise as part of tender returnable				
	Delivery period installation in weeks	Winning tenderer/contractor to advise				
	Delivery period for commissioning in weeks	Winning tenderer/contractor to advise				

Item	Description	Incomers	11kV Transformer Feeders	Bus Section, VTs & Riser	11kV Feeders	
	Panel No	E72, E75 & E75a	E73, E74, E76 & E77	BC1	E77a	

ANNEXURE 1b

TECHNICAL DATA SHEET
To be completed by the Tenderer

SUBSTATIONS (11kV) Submissions for separate switchgear						
Item	Description					
	Panel No.					
1.1	General					
	Details of provisions for lifting/slinging					
	Type of transporting device if not an integral device					
1.2	Circuit-breakers					
	Circuit-breaker type offered					
	Rating of the closing device					
	a) rated control voltage V					
	b) rated current A					
	c) rated power kW					
	d) time lag fuses or MCCBs?					

Item	Description					
	Panel No.					
	e) alternative methods of tripping if any					
	Number of spare auxiliary contacts offered on circuit-breakers					
1.3	Safety Earthing					
	Details of earthing facilities offered					
	Details of earthing busbars in bus-section and/or bus-coupler panels					
1.4	Cable termination compartments					
	Type of compartment offered					
1.5	Current transformers (CTs)					
	Current transformer specification offered					
	Type of CT offered					
	Are separate CTs used for indications?					

Item	Description					
	Panel No.					
	Is approval for connection of protection or indicating instruments to metering CTs required? Yes/No					
1.6	Voltage transformers (VTs)					
	Type of VTs offered					
1.7	Live circuit indication					
	Type of indication offered					
	Voltage divider bushing details					
	- manufacturer					
	- type					
	- dielectric					
	- rating					
1.8	Battery, Battery Charger, and dc supplies					
	Type of battery offered					
	Type of battery charger offered					
	Battery load					
	Peak current from all switchgear A					

Item	Description					
	Panel No.					
	Standby current A					
1.9	Protection relays and instruments					
	Details of protection equipment offered					
1.10	Terminals for auxiliary circuits					
	Type of test block offered					
1.11	Painting/Coating					
	Paint/coating system offered					
1.12	Tests					
	Summary of type test certificates available					
	Test authority for type certificates					
	Are any test certificates overseas products?					
	If Yes, is the South African product identical?					

Item	Description					
	Panel No.					
	How many units installed in South Africa?					
1.13	Accessories					
	Details of the accessories supplied					
1.14	Spares					
	Is a complete range of spares held in stock by the local representative?					
	Yes/No					

Applicable Standards for Relays

	Requirement description	Fulfill the requirement [yes/no]	Comments
	General		
1.	Type test according IEC 61850-3		
	Climatic Requirements		
2.	Ambient temperature operation (according IEC 60068-2-1, Test A and IEC 60068-2-2, Test B) -10 °C to +55 °C		
3.	Ambient temperature transport and storage (according IEC 60068-2-1, Test Aa and IEC 60068-2-2, Test Ba) -40 °C to +80 °C		

	Requirement description	Fulfill the requirement [yes/no]	Comments
4.	Relative humidity (RH) 93 %		
	Mechanical Requirements IEC 60870-2-2, class BM:		
5.	Bump acc. IEC 60068-2-29 Acceleration 10 g, pulse duration 16 ms Number of directions: 6 Test duration 600 shocks (100 shocks per direction)		
6.	Shock acc. IEC 60068-2-27 Acceleration 10 g, pulse duration 11 ms Number of directions: 6 Test duration 18 shocks (3 shocks per direction)		

	Requirement description	Fulfill the requirement [yes/no]	Comments
7.	Vibration acc. IEC 60068-2-6 Number of axes: 3 Test duration 10h (20 cycles per axis), 2 - 500 Hz		
	EMC Interference Immunity		
8.	EN 61000-4-2		
9.	EN 61000-4-3		
10.	EN 61000-4-8		
11.	EN 61000-4-4		
12.	EN 61000-4-5		
13.	EN 61000-4-6		
14.	EN 61000-4-11		
15.	ANSI C37.90.1 / IEC 61000-4-12		

	Requirement description	Fulfill the requirement [yes/no]	Comments
16.	ANSI C37.90.1 / CFE		
17.	ANSI C37.90.2		
18.	ANSI C37.90.3 / CFE		
19.	IEC 60255-5		
	EMC Electromagnetic Emission		
20.	IEC CISPR 16-2-3		
21.	EN 61000-3-2		
22.	EN 61000-3-3		
23.	EN 61000-3-11/12		
24.	IEC CISPR 16-2-1		
25.	IEC CISPR 22		
26.	FCC Part 15/18		

	Requirement description	Fulfill the requirement [yes/no]	Comments
27.	EM 61000-2-3		
28.	CFE / IEC 60255-11 IEC 61000-4-11 IEC 61000-4-29		

Requirements / standards for IEDs (Separate submissions to be provided for 11kV and 3.3kV switchgear)

The following table is the summary of the requirements described.

Functional Requirements:

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Hardware		
29.	Numeric keypad shall be possible		
30.	9 function keys shall be possible		
31.	16 LEDs with two different colours shall be possible.		
32.	Flush-mounting and surface mounting devices shall be possible.		
33.	The complete device should be equipped with pluggable terminal blocks which guarantee easy connection, pre wiring and safe exchange of the device or modules.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
34.	Current inputs thermal rating: 20 A continuously 150 A for 10 s 500 A for 1s 1250 A for 10 ms		
35.	There should be the option of device trip relays, which can be wired directly to the CB trip coils without any interposing relay. For this purpose these device contacts should have the switching capacity of on/off 1000 W/VA		
36.	Voltage thresholds for the binary inputs of the device shall be settable on site by SW without opening the device or changing jumpers.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
37.	Binary inputs shall have three different thresholds: $V_{low} \leq \text{DC } 10 \text{ V}$, $V_{high} \geq \text{DC } 19 \text{ V}$ $V_{low} \leq \text{DC } 44 \text{ V}$, $V_{high} \geq \text{DC } 88 \text{ V}$ $V_{low} \leq \text{DC } 88 \text{ V}$, $V_{high} \geq \text{DC } 176 \text{ V}$		
38.	Secondary rated current (1 A, 5 A) shall be settable on site by SW without opening the device or changing jumpers. For special application the full scale dynamic range shall be settable. (20 Irated or 100 Irated)		
39.	It should be no need to open the devices and expansion modules at any time.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Communication general		
40.	The device shall have protocol independent communication modules for increasing the flexibility and availability.		
41.	The device shall have built in switches for Ethernet communication to support ring and star communication structures		
42.	Multiple protocols like IEC 60870-5-103 / DNP3 / DNP3 IP / IEC 61850 TCP shall be made available in the device		
43.	The device architecture shall be open for further protocols.		
44.	Compliance to cyber security regulations - NERC CIP, BDEW Whitepapers – enabling to make the Ethernet networks safe and secured		

	Requirement description	Fulfill the requirement [yes/no]	Comments
45.	The manufacturer shall supply a security blue print with the device delivery.		
	Communication IEC 61850		
46.	The user shall be able to create user specific IEC 61850 structures on his own without the vendor support (Flexible Engineering).		
47.	Internal data structure of the device shall be designed according IEC 61850		
48.	Logical Device (LD) names and prefix und suffix of all Logical Nodes (LN) shall be changeable.		
49.	User defined signals shall be assigned to any Logical Node		

	Requirement description	Fulfill the requirement [yes/no]	Comments
50.	Logical nodes shall be editable (copied/deleted/moved) in the IEC 61850 structure.		
51.	New and user defined Logical Nodes shall be supplied from a library		
52.	Device settings shall be changeable by IEC 61850 protocol		
53.	The device shall be IEC 61850 Edition 1 and 2 compatible.		
54.	The engineering tool shall be able to handle IEC 61850 Edition 1 and Edition 2 devices		
55.	Open interfaces according to IEC61850 have to guarantee user independent system configuration (ICD, IID, CID, SCD, MICS ...)		

	Requirement description	Fulfill the requirement [yes/no]	Comments
56.	The tool shall represent the rooting to BI, BO, LED and communication in a matrix form.		
57.	The engineering tool shall connect via USB or Ethernet to the device.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
58.	Open and scalable architecture should allow the user to add-on new hardware and software functions to accommodate emerging technologies like PMU, grid monitoring etc		

	Requirement description	Fulfill the requirement [yes/no]	Comments
59.	The device should be suitable for an intelligent, green and smart grid with high sampling rate integrating protection, control, automation, monitoring, auto testing with the test suite and communication.		
60.	The device should guarantee necessary functions to establish network stability using state of the art techniques like grid monitoring using synchro phasors, powerful algorithms for power swing etc.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
61.	The manufacturer should support equipment/condition monitoring to improve the network stability, availability and reliability.		
62.	Intelligent functionalities for grid operation analyzing faults as per standards		
63.	The device should have a integrated CFC with a graphical editor.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
64.	The device should provide several operational logs: - Operational log for 2000 indications - Log for up to 128 faults with 1000 indications each - Ground-fault log for up to 10 ground faults and 100 indications per fault - Inerasable log for recording of all parameter changes and configuration downloads with 200 indications - Recording of successful and unsuccessful access attempts to areas of the device with restricted access rights in a security log. (500 indications) - Recording and display of concrete instructions for action in case of necessary maintenance (e.g. battery monitoring), detected hardware defects or compatibility problems in a dedicated diagnostic log.		

	Requirement description	Fulfill the requirement [yes/no]	Comments
65.	Easily interchangeable CT inputs with different accuracies at site. Processing via the protection-input transformer: • $I \leq \text{Cl. } 0.5$ (0.5 % accuracy) • $P, Q \leq \text{Cl. } 1$ (1 % accuracy) Processing via the measuring-input transformer: • $I \leq \text{Cl. } 0.2$ (0.2 % accuracy) • $P, Q \leq \text{Cl. } 0.5$ (0.5 % accuracy)		

Standards:

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Climatic Requirements		
66.	Ambient temperature operation (in compliance with IEC 60068-2-1 and IEC 60068-2-2, test bd for 16 h) -25 °C to +85 °C		
67.	Ambient temperature transport and storage -25 °C to +70 °C		
68.	Relative humidity (RH) 93 %		

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Mechanical Requirements: Vibration and Shock Stress in Stationary Use		
69.	Oscillation IEC 60255-21-1, class 2 and IEC 60068-2-6		
70.	Shock IEC 60255-21-2, class 1		
71.	Oscillation in an earthquake IEC 60255-21-3, class 2 and IEC 60068-3-3		

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Mechanical Requirements: Vibration and Shock Stress During Transport		
72.	Oscillation IEC 60255-21-1, class 2 and IEC 60068-2-6		
73.	Shock IEC 60255-21-2, class 1 and IEC 60068-2-27		
74.	Continuous shock IEC 60255-21-2, class 1 and IEC 60068-2-29		

	Requirement description	Fulfill the requirement [yes/no]	Comments
	Insulation Test according IEC 60255-27 and IEC 60870-2-1		
75.	Voltage test (component testing), current-measuring inputs, voltage - measuring inputs, relay outputs AC 2.5 kV, 50 Hz		
76.	Voltage test (component testing), Auxiliary voltage, binary inputs DC 3.5 kV		
77.	Voltage test (component testing), AC 500 V/50 Hz or DC 700 V		

	Requirement description	Fulfill the requirement [yes/no]	Comments
78.	Surge immunity test, BI and BO 5 kV (peak value) 1.2 μ s/50 μ s 0.5 J 3 positive and 3 negative impulses at intervals of 1 s		
	EMC Interference Immunity		
79.	Electrical disturbance tests – 1 MHz burst immunity tests, IEC 60255-22-1, class III		
80.	Electrostatic discharge tests IEC 60255-22-2, class IV IEC 61000-4-2, class IV		

	Requirement description	Fulfill the requirement [yes/no]	Comments
81.	Radiated electromagnetic field immunity IEC 60255-22-3, class III IEC 61000-4-3, class III		
82.	Radiated electromagnetic field immunity Spot frequencies IEC 60255-22-3 IEC 61000-4-3, class III		
83.	Electrical fast transient/burst immunity IEC 60255-22-4, class A IEC 61000-4-4, class IV		
84.	Surge immunity test class III IEC 60255-22-5, IEC 61000-4-5		

	Requirement description	Fulfill the requirement [yes/no]	Comments
85.	Immunity to conducted disturbances induced by radio frequency fields, class III IEC 60255-22-6, IEC 61000-4-6		
86.	Power frequency magnetic field immunity test IEC 60255-1 IEC 61000-4-8, Class IV		
87.	Standard for Surge Withstand Capability (SWC) IEEE Std C37.90.1		

	Requirement description	Fulfill the requirement [yes/no]	Comments
88.	Standard for Fast Transient Surge Withstand Capability IEEE Std C37.90.1		
89.	Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers (Keying test) IEEE Std C37.90.2		
90.	Damped oscillatory wave immunity test IEC 61000-4-18		

	Requirement description	Fulfill the requirement [yes/no]	Comments
	EMC Electromagnetic Emission		
91.	Radio noise voltage to lines, only auxiliary voltage IEC-CISPR 11, class A		
92.	Interference field strength IEC-CISPR 11, class A		
	Degree of Protection According to IEC 60529		
93.	For the equipment front and rear IP50		
94.	For the front in case of flush mounting IP51		
95.	For operator protection IP2X for current terminals IP1X for voltage terminals		

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Technical Specification
Specification No. TPD: 007-MVSWITCHSPEC

	Requirement description	Fulfill the requirement [yes/no]	Comments
96.	Degree of pollution, IEC 60255-27: 2		
	Supply voltage		
97.	Stored-energy time on outage or short circuit of the auxiliary voltage: At least 50 ms		

Contractor:.....

Date:

Witness 1:

Witness 2: