RAND WATER

ANNEXURE C3.2
SCOPE OF WORK

DESIGN, MANUFACTURE, SUPPLY, DELIVERY, INSTALLATION, COMMISSIONING AND PUTTING INTO SERVICE A 630kVA 11kV/400V MINI-SUBSTATION AT VEREENIGING PUMPING STATION.

SYSTEM SPECIFICATION, RETURNABLE SCHEDULE & BOQ

For

ELECTRICAL EQUIPMENT

1. Electrical Equipment

1.1. General requirements

The Contractor scope shall be for the provision of all the labour, materials and services and also be responsible for the design, supply, delivery, offloading, installation, testing, commissioning and putting into operation of the following electrical equipment as per the relevant standards and Rand Water specification:

a) A 630kVA, 11kV/400V, mini-substation complete with an LV side to feed the new Generator Room Changeover panel (500A), existing Silica Plant(500A) and two spare breakers (100A and 63A). The mini-substation should be located on the concrete plinth in the same position as the existing 315kVA Silica Plant mini substation.

b) Decommission of the existing 315kVA mini-sub and its plinth. Remove all rubbles from site and transport the mini-sub to the VG stores.

c) Complete MV and LV cabling and associated cable support systems, trenching, ducts, sleeves, sealing systems etc. to connect all electrical equipment.

d) Earthing and lightning protection system, inclusive of site survey and installation required.

e) The testing of all equipment, detailed site commissioning, the supply of all relevant test certificates and all documentation, including data sheets, QCPs, COCs and list of returnable schedules.

1.2. 630kVA Mini-substation:

1.2.1. Function: The 630kVA 11kV/400V mini-substation shall be utilised for distributing power to a diesel generator Changeover panel dedicated to chlorine plant 2, Silica Plant and spare breakers.

1.2.2. Specific requirements:

MINI-SUBSTATION	**REQUIREMENT**	**CONTRACTOR'S OFFER**
Description	Details	Details
CONSTRUCTION REQUIREMENTS		
Location	Outdoors	
Colour	Avocado green	
Rated maximum power of the minisub	630 kVA	
Service conditions		
Humidity	95% (non-condensing)	
Altitude (maMSL)	1800	
Wind Pressure	700 Pa	
Maximum air temperature	+ 40 degrees Celsius	

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
Minimum air temperature	- 10 degrees Celsius	
Lightning ground flash density (Flashes/km^2/year)	High	
Maximum solar radiation (W/m^2)	1000	
Ultraviolet radiation	High	
Pollution Level	Medium	
Pollution conditions inside minisub	Pollution Degree 3	
Miniature substation type	Type B	
Miniature substation design	Modular	
Base type	Steel	
Is a base with a removable section required?	Yes	
Enclosure material	3CR12	
Sheet metal thickness	6mm	
Are roof lifting lugs required?	Yes	
Method of sealing the cover	Bolted	
IP Rating	65	
APPLICABLE STANDARDS		
NRS 004 / SANS 1029, Mini-substations for rated A.C voltages up to and including 24 kV.		
NRS 012 / SANS 876, Cable terminations and live conductors within air-filled enclosures (insulation coordination) for rated a.c. voltages from 7,2 kV and up to and including 36 kV.		
NRS 053: Edition 2, Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33 kV)		
SANS 1019, Standard voltages, currents and insulation levels for electricity supply.		
SANS 1091, National colour standard.		
SANS 60529, Degrees of protection provided by enclosures (IP Code).		
SANS 60269-2:2007/IEC 60269-2:2006, Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Examples of standardized systems of fuses A to I.		

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
SANS 60815-1:2009, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles.		
SANS 60947-3:2009/IEC 60947-3:2008, Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units.		
SANS 61243-5, Live working – Voltage detectors – Part 5: Voltage detecting systems (VDS).		
SANS 61439-1, Low-voltage switchgear and controlgear assemblies – Part 1: General rules		
SANS 1195- Busbars and Busbar Connections		
SANS 1874- Metal-enclosed ring main units for rated a.c. voltages above 1 kV and up to and including 36 kV		
SANS 780- Distribution transformers		
SANS 60076-1- Power transformers Part 1		
SANS 60076-2- Power transformers Part 2: Temperature rise		
SANS 60076-3- Power transformers Part 3: Insulation levels, dielectric tests and external clearances in air		
SANS 60076-4- Lightning impulse and switching impulse		
SANS 60076-5- Power transformers Part 5: Ability to withstand short circuits		
SANS 60076-7, Power transformers – Part 7: Loading guide for oil-immersed power transformers.		
SANS 0292- Earthing of low-voltage (LV) distribution systems		
SANS 10200- Neutral earthing in medium voltage systems		
MV COMPARTMENT		
RMU REQUIREMENTS:		
Type of RMU	SF6-filled s/gear	

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
Configuration of RMU	2SD-SF	
Fused switch must be fitted with a shunt coil, and the coil must be connected to the contacts of the mini-sub thermometer	NO	
Rated voltage	12kV	
Operating voltage	11kV	
Rated frequency	50Hz	
Rated lightning impulse peak withstand voltage	95kV	
Rated short duration power frequency r.m.s withstand voltage	28kV	
Rated short time withstand r.m.s current for 3 seconds	20kA	
Rated peak withstand current	50kA	
Rated short-time current duration	3 seconds	
Fuse Rating (A)	To suit transformer rating	
Minimum IP rating	IP 65	
Voltage indicators required	YES	
Internal Arc Classification required	YES	
Circuit Ratings (A)	1000A	
Open Indication	Yes	
Closed Indication	Yes	
Interface to SCADA	Open and closed indication contacts to be wired to terminals	
Castell key interlock devices required	No	
Cable Type	XLPE SWA PVC	
Cable Size (mm2)	70 mm2, 3 core 6,35/11kV type A Cu cable	
Concrete plinth required	YES	
Earthing and lightning protection required	YES	
MV Earth Bar Required	YES	
TRANSFORMER		
Rating (kVA)	630	
Transformer Rated frequency	50Hz	
Primary Voltage (kV)	11	
Secondary Voltage (V)	400	
Power frequency withstand voltages (kV)	28	
Breakdown insulation level (kV)	95	
Impedance voltage	Standard	
Type	Sealed category 1	

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
Winding Conductors	Copper	
Winding Type	Double Wound	
Temperature Rise	Top Oil 60°C above 40°C ambient at full kVA loading	
Conservator	N/A	
Vector Group	Dyn11	
Loss Type	Low Loss	
Tappings	0%, +/-2,5%, +/-5%	
Winding in which tappings are installed	Primary	
Tap Selector	Manual Off Load with Padlocking Facility	
Cooling	ONAN	
Dehydrating breather	N/A	
Gas and oil actuated relay	N/A	
Indicating thermometer with trip and alarm relay	Yes	
Thermometer pocket	Yes	
Oil Level Sight Glass	Yes	
Pressure Relief Vent	Yes	
Drain Valve	Yes	
Earth Terminals	Yes, Two Off	
Bushings		
Power cables- Primary	70mm2, 3 core, Type A, XLPE 6.35/11kV	
Power cables- Secondary	Rated for a maximum current density of 2 A/mm2 at transformer full load	
Neutral Current Transformer for Backup earth fault protection	One off 200/1, 10VA, 5P20	
Neutral Connection	In separate terminal box with Backup CT	
Terminal Box for CT secondary signal	Yes, fitted with 2,5 mm2 terminals and wiring	
Current Transformers for Restricted Earth Fault Protection	Not Required	
Transformer Paint Colour	Avocado green	
Routine Tests as per SANS 780	Yes	
Oil Filling	Yes, Oil to SANS 555	
LV COMPARTMENT		

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
Common 400V distribution section required (see below) *	YES	
LV Busbar Rating	1,2 x Transformer Full Load Current	
LV Compartment and Component Short Circuit Rating	50kA for 3 seconds	
LV panel surge arrestors (Class 1 and 2)	3 phases and neutral	
Suitably rated incomer circuit breaker with 1000mA IDMT earth leakage connected to shunt trip coil, required	1000 A	
Neutral Circuit minimum Rating	450A	
Incomer Ammeter with selector switch	YES	
Incomer Voltmeter with selector switch	YES	
Suitably rated feeder circuit breakers required	YES	
kWh metering required per outgoing circuit	YES	
Adjustable IDMT earth leakage protection per outgoing feeder circuit (300 to 1000 mA)	YES	
Outgoing feeder circuits	YES	
Circuit 1- Chlorine Plant Changeover Panel - 3 phase and neutral	YES	
Circuit 2- Silica Plant - current limiting CB - 3 phase and neutral	YES	
Circuit 3- Spare - 100 A- 3 phase and neutral	YES	
Circuit 4- Spare- 63 A- 3 phase and neutral	YES	
Castell key interlock devices required	No	
Earthing and lightning protection required	YES	
LV Earth Bar	YES	
Bonding between LV and MV earth bars	35 mm2 copper conductor	
Custom concrete plinth for MV and LV cable access required	YES	
Miniature substation concrete plinth base preparation specification Excavate 400 mm below normal ground level. Rip and re-compact in-situ layer of material to a 150 mm layer to 90% MODAASHTO density.	YES	

MINI-SUBSTATION	REQUIREMENT	CONTRACTOR'S OFFER
Import G6 material to SANS 1200 and compact to a 150 mm layer to MODAASHTO 93% density.		
Signage:		
Transformer rating plate	YES	
Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	YES	
Electrical warning signs on all doors and barriers	YES	
Transformer phase labels below bushings	YES	
Colour-coded LV busbars	YES	
Labelling of MV and LV compartment doors	YES	
Primary voltage, secondary voltage and kVA rating stencilled on the front, centre	YES	
Mini-sub mass stencilled on side or rear	YES	
Form of Installation	Concrete plinth	

1.3. Cable racking

1.3.1. Function: Utilised for cable support

1.3.2. Specific requirements:

1.3.2.1. The Contractor shall be responsible for a cable racking system for structures and buildings including external concrete cable duct. The prices quoted in the bill of quantities shall include for the design, supply and delivery, as well as the erection of the required rack or tray system which shall include unistrut supports, straight lengths, bends, elbows, tees, reducers, fixing brackets, fixing materials and touch up cold galvanizing painting.

1.3.2.2. All cables shall be installed on a cable racking system. Cables installed in cable ducts or exiting cable sleeves or cable ducts, whether internal or external to a building, shall be installed on a cable racking system. No cable shall be installed directly into a cable duct.

1.3.2.3. When installing cable racking within cable ducts, a vertical installation mounted on the side wall of the cable duct, as opposed to a horizontal installation, is preferred.

1.3.2.4. The Contractor shall produce a detailed cable racking design detailing: racking types, layout, orientation, sizes, cable layout on the rack and routes, for approval, before purchasing any racking material.

1.4. Cable trenching

1.4.1. Function: Utilised for cable installation and cable protection.

1.4.2. Specific requirements: The Contractor shall be responsible for providing cable trenches in all soil conditions. This is not limited to the cable route between mini-sub and the changeover. Contractor to perform a cable detection along the new cable route.

1.5. Cable sleeves

1.5.1. Function: Utilised for cable installation and cable protection.

1.5.2. Specific requirements: The Contractor shall be responsible for providing heavy duty PVC sleeves as required. These sleeves shall be utilised for installing cables that cross the road from the mini-sub to the Generator. Contractor to make provision for cable duct/ sleeve to install cables that will feed the new Poly Plant.

1.6. Cabling

1.6.1. Function: To provide power to the Generator Change over panels.

1.6.2. Specific requirements: The Contractor shall be responsible for the supply, delivery, installation and commissioning of medium and low voltage power and control cabling, including earthing. All electrical equipment shall be earthed utilising black insulated copper wire or copper clad steel wire. **No bare copper earth wire will be accepted on both MV and LV**. The Contractor shall pay particular attention to the cabling interfaces between the various types of equipment and shall ensure that **ALL** cables have been included in the rates.

The work shall include terminations, joints, glands etc. The Contractor shall issue test certificates for the tests performed.

1.7. Earthing

1.7.1. Function: to provide adequate earthing for all equipment.

1.7.2. The Contractor shall ensure all electrical equipment e.g., mini-sub etc. are adequately earthed. All electrical equipment shall be earthed utilising black insulated copper wire or copper clad steel wire. No bare copper earth wire will be accepted.

1.8. Design philosophy and calculation document

a) The contractor shall ensure that all equipments are designed as per the Rand Water specification and National standards. This will include the submission of all calculation and document including operating & maintenance manuals, COCs, Test certificates and drawings (DWG-format).

2. BILL OF QUANTITY

PRICE SCHEDULE 1: DESIGN, SUPPLY, DELIVER, INSTALL, TEST AND COMMISSION OF ELECTRICAL EQUIPMENT

Item No	Description	Qty (A)	UOM	Rate (B)	Total
1.	**315kVA 11kV/400V Existing Mini-substation**				
1.1.	Disconnect and decommission the existing mini-sub and concrete plinth	1	Sum		
2.	**630kVA 11kV/400V Mini-substation complete with concrete plinth as per the System Spec**				
2.1.	Design, supply and Manufacture	1	Sum		
2.2.	Factory Test and Deliver	1	Sum		
2.3.	Install, test, Commission and Putting into Operation	1	Sum		
2.4.	Provide mini-substation earthing system (earth mat)	1	Sum		
3.	**Cables – Design, Supply, Deliver, Install, test and put into operation of**				
3.1.	70mm^2 3 core, 11kV SWA copper XLPE Cable	50	meter		
3.2.	70mm^2 3 core, 11kV SWA XLPE Cable Joints	1	No		
3.3.	70mm^2 3 core, 11kV SWA XLPE termination kits	2			
3.4.					
3.5.	LV Cables to feed the 400V f Changeover Panel from the mini-substation (2 x 150mm^2 4 Core PVC PVC SWA PVC)	300	Meter		
3.6.	Test insulation resistance after installation of all cables	1	Sum		
3.7.	Trench by hand in Hard Rock (Class 2) and prepare trench (800D x 500W x 200H)	130	Meter		
3.8.	Concrete cable markers with engraved plates	5	No		

Item No	Description	Qty (A)	UOM	Rate (B)	Total
3.9.	70mm^2, 1 core, black insulated copper earth wire	150	meter		
3.10	70mm^2, 1 core, black insulated copper earth wire terminations	2	No		
3.11					
4.	**DOCUMENTATION**				
4.1.	Supply of all documentation including all As Built (Supplied and generated) general arrangement and schematic drawings in electronic and hard copy formats, all test certificates and maintenance and operating instructions	1	Lot		
5.	**Administration, Preliminaries and General, Health and Safety, Environmental, Site Establishment and other related costs**				
5.1.	Administration, Preliminaries and General, site establishments and other site related facilities.	1	Sum		
5.2.	Compliance with all safety and environmental requirements as per SHE specifications	1	Sum		
5.3.					
6.	**Any Other Costs (**Others: Please state any other item that is not specifically listed, but may be required to complete the installation**)**				
6.1.					
6.2.					
6.3.					
Total Excluding VAT					

TOTAL AMOUNT (in words) *:

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* Should there be a variance between the numerical value and the worded amount; the worded amount shall prevail as correct.

Signature _____

Name _____

Capacity _____

Date _____