RAND WATER

DETAILED SCOPE OF WORK

DESIGN, MANUFACTURE, SUPPLY, DELIVERY, INSTALLATION, COMMISSIONING AND PUTTING INTO SERVICE OF A 315kVA EMERGENCY DIESEL GENERATOR AT VEREENIGING PUMPING STATION.

SYSTEM SPECIFICATION, RETURNABLE SCHEDULE & BOQ

For

ELECTRICAL EQUIPMENT

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1 Electrical Equipment

1.1 General requirements

The Contractor scope shall be responsible for the provision of all the labour, materials and services and 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 standby diesel generator in the new generator room to feed 120A Poly Plant and the Chlorine plant (400A), complete with changeover panel with a 4-pole breaker to feed each area.

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

c) Earthing and lightning protections systems, inclusive of site surveys and installations required on site.

d) 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 Emergency Standby Diesel Generator

1.2.1 Function: The emergency standby diesel generator shall be utilized for distributing power to the Changeover panel which supplies emergency and normal power to electrical equipment situated in two different locations.

1.2.2 Specific requirements:

1.2.2.1 The emergency standby diesel generator shall be installed in the change-over panel kiosk and shall supply power through a changeover distribution boards to the 400V MCCs located in the new Chlorine plant and the polyelectrolyte plant. The panel should also comprise of a spare feeder for future purposes.

1.2.2.2 The Contractor shall be responsible for the design, supply, delivery, offloading, installation, testing and commissioning of an emergency standby diesel generator complete with an automatic changeover panel to feed the Chlorine Plant (400A) and Poly Plant (120A). The designs should include the construction of foundations (including earthworks), a bund wall, and shelter structure.

1.2.2.3 The Contractor shall ensure that the power supplies to all associated buildings, structures and equipment have been included.

1.2.2.4 The generator controller unit shall have a Modbus TCP/IP communications port and

software to allow for connection to a PLC and SCADA system. The generator unit status, alarms and metering values shall be communicated to the PLC via this communications link.

No	DESCRIPTION	REQUIRED	CONTRACTOR'S OFFER
1	GENERAL DATA		
	Continuous Rated Output Power At Sea Level (kW)	250 kW	
	Continuous Rated Output Power At Sea Level (kVA)		
	Percentage De-Rating for Site Conditions, In Accordance With BS 551.4: For Altitude For Temperature For Humidity Total De-Rating		
	Continuous Rated Output Power At site (kW at 0.8 Power Factor)		
	Continuous Rated Output Power At site (kVA)	315kVA	
	Power Factor	0.8	
	Efficiency	Min. 90% @ 75% Load	
	AC Voltage	380Vac/400Vac/230Vac	
	Frequency	50 Hz	
	Number Of Phases	3-Phase with Neutral	
	Connection Method	Star	
	Duty Type	Heavy Duty	
	Canopy Material (Outdoor Installation)	3CR12 and Powder Coated	
	Canopy Internal Material	Flameproof	
	Continuous Running Time @ Full Load	Min. 12 Hours	
	Insulating And Dielectric Materials	Fireproof, Non-Toxic And Environmental Friendly	
	Applicable Standards/Specification	European And South African	
	Type Of Technology	ATS & AMF	
	OTHERS		
2	**OPERATION MODE**		
	Start/Shutdown Method	Auto Start (AMF&ATS) And Auto Shutdown	

	Operation Condition (Load Application)	Withstand Sudden Load Change And Maintain Stable Operation	
	Negative Phase Sequence Current	Up To 10%	
	Load Acceptance	As Soon As Reaching Rated Speed and Voltage	
	Effects Of Sudden Load Change	Insignificantly Small	
	Intervention Running At Less Than 60% Load		
	Overload Capability	10% for 1 hour	
3	**NOISE LEVEL (dBA) SABS 0103**		
	Canopy (outdoor Installation)	Not Greater Than 65 dBA	
4	**ENGINE DATA (BS 5514 AND SANS 60034)**		
	DC Voltage	12Vdc/24Vdc	
	Exhaust System Material	3CR12 Corrosion-Resistant Steel	
	Exhaust Cladding Material	Galvanized Mild Steel	
	Fuel Type	Diesel	
	Lubrication Oil Type	As per Engine Manufacturer Preference	
	AVR	Constant Voltage	
	Mounting	Heavy Duty Anti-Vibration	
	Type of base and Base Orientation		
	OTHERS	Engines to be supplied with replaceable elements for oil, fuel, air filter assemblies	
5	**ALTERNATOR DATE (BS 5000 Part 99 and BS 4999 Parts 20 and 32)**		
	Manufacturer's Name, Type Number (Model) and Year of Manufacturer		
	Terminal Voltage and Frequency	380Vac/400Vac/230Vac @ 50Hz	
	Guaranteed Voltage Regulation From No-Load To Full-Load @ 0.8 PF	Within 1% of steady state in less than 300 ms	
	Transient Voltage Dip on Load Application	- 10% of rated voltage	
	Insulation Class	H	
	IP Protection	Minimum 22	
6	**STARTING BATTERY (SANS 8528-4)**		
	Manufacturer's Name		

	Battery Type (Heavy Duty)	Lead-Acid Low Maintenance Type	
	Battery Voltage	12Vdc/24Vdc	
	Battery Quantity	1	
	Battery Capacity (Ah)	100	
	Battery Starting Capacity	Six 10 Second Start Attempts	
	Boost Charge When The Battery Voltage Drops	Less Than 20% Of Battery Capacity	
	Battery Life Span	5 years	
	OTHERS	Supply Battery Tray and Leads	
7	**CONTROL PANEL**		
	Control Type/Technology	Microprocessor	
	Alarm and Fault Indication	Code and Description	
	Communication Protocol	Open Communication (Modbus TCP IP)	
	Ambient Temperature	40°C	
	IP Protection	65	
	OTHERS		
8	**PROTECTION**		
	Engine Oil Pressure	Remote Alarm & Shutdown	
	High Engine/Oil Temperature	Remote Alarm & Shutdown	
	High Water Temperature	Remote Alarm & Shutdown	
	Low Water Level	Remote Alarm & Shutdown	
	Battery Voltage	Remote Alarm	
	Under/Over Frequency Protection	Remote Alarm & Shutdown	
	Under/Over Voltage Protection	Remote Alarm & Shutdown	
	Overload Protection	Remote Alarm & Shutdown	
	Start Fault	Remote Alarm & Shutdown	
	Emergency Stop	Remote Alarm & Shutdown	
	Battery Charger Fault	Remote Alarm	
	Low Fuel Level (30%)	Remote Alarm	
	Loss Of Speed Signal	Remote Alarm & Shutdown	

	Under/Over Speed Protection	Remote Alarm & Shutdown	
	Electrical Phase Sequence	Remote Alarm & Shutdown	
	Earth Fault	Remote Alarm & Shutdown	
	Over-current	Remote Alarm & Shutdown	
	Auto Start Failure	Remote Alarm & Shutdown	
	Start Failure After 3 Attempts	Remote Alarm & Shutdown	
	Water Jacket Heater Failure	Remote Alarm & Shutdown	
	OTHERS		
9	**MONITORING**		
	Generator Working Status and Alarms	Yes	
	Fuel management and Theft Prevention	Yes	
	Generic Sensors: - Smoke Detection - Humidity, etc.	Yes	

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 the change-over panel and associated 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 All cable racking utilized shall be epoxy coated with Chlorine /hypochlorous acid resistant epoxy product to prevent corrosion. If alternative cable racks are offered the Contractor shall supply full details with the RFQ.

1.3.2.4 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.

1.3.2.5 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. The Contractor to perform a cable detection along the new cable route.

1.5 Cabling

1.5.1 Function: To provide power to the Chlorine plant.

1.5.2 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 the LV system**. 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.

1.6 Earthing

1.6.1 Function: to provide adequate earthing for all equipment.

1.6.2 The Contractor shall ensure all electrical equipment e.g. diesel generator, 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.

1.7 Design philosophy and calculation document

a) The contractor shall ensure that all equipment are designed as per the Rand Water specification and National standards. This will include the submission of all calculation and document including operating and maintenance manuals and drawings.

2. Automation

The Contractor's Automation scope shall cover the design, supply, delivery, offloading, installation, testing, commissioning, and putting into operation the monitoring of the Generator, but not limited to the following:

2.1. Complete Modbus TCP/IP Interface of the Generator to the Chlorine Plant Main PLC and Engine Room 4 SCADA System

2.2. Provision of the Fibre Optic link to the Chlorine Plant Main PLC Panel

2.3. Provision of the CAT6 Ethernet cables

2.4. Provision of the cable trenches between the generator room PLC panel and the new Chlorine Plant complete with accessories i.e., splicing boxes and patch leads

2.5. Update the existing SCADA application at Engine Room 4 and Engine Room 2

2.6. Update the existing Historian at Engine Room at Engine Room 4 and Engine Room2

3. Civil

3.1. The Contractor's Civil scope of works shall cover the: design, supply, delivery, offloading, installation, testing, commissioning and putting into operation of all necessary structural components associated with commissioning the diesel generator. The scope of works shall include, but not be limited to:

3.1.1. Preparation and submission of tender documents.

3.1.2. Topographical survey and services detection (including the re-routing or protection of existing services);

3.1.3. Preparation and submission of designs, including quality and health, safety, quality, risk, and environmental compliance documents – for all structural components applicable to the works.

3.1.4. Fencing off designated works area and traffic management.

3.1.5. Interface management with chlorine and poly plant contractors (as applicable).

3.1.6. Setting out works (a proposed location for the generator and change over panel is shown in the Figure 1 below – the Contractor is to evaluate the feasibility of the location given all Contract requirements, any deviation from the proposed position must be approved by Rand Water. Comments on the proposed position must be raised before the completion of design for the generator and associated shelter).

3.1.7. Removal of paving (as may have been placed by chlorine building contractor) and other a

Excavation, construction of foundations and filling (earthworks).

3.1.8. Testing of foundation earthworks and concrete.

3.1.9. Procurement and erection of generator shelter and change over kiosk concrete plinth.

3.1.10 Construction of cable racks and trenches as applicable under the electrical and other project requirements.

3.1.11 Demolition existing and re-construction of plinth as per electrical scope.

3.1.12 Construction progress monitoring to South African national standards (sans 2001 and sabs 1200) and applicable acts.

3.1.13 Reinstatement of paving and levelling to tie into the chlorine building's stormwater design.

3.1.14 Generation of as-builts.

3.2. The Contractor's attention is drawn to typical Rand Water drawing RA28926/002 for the Generator shelter. The Contractor shall adapt the design to suit site conditions.

3.3. All quality control documents and designs shall be submitted to Rand Water for Approval. The review period for any submission shall be governed by the type of Contractor entered with Rand Water.

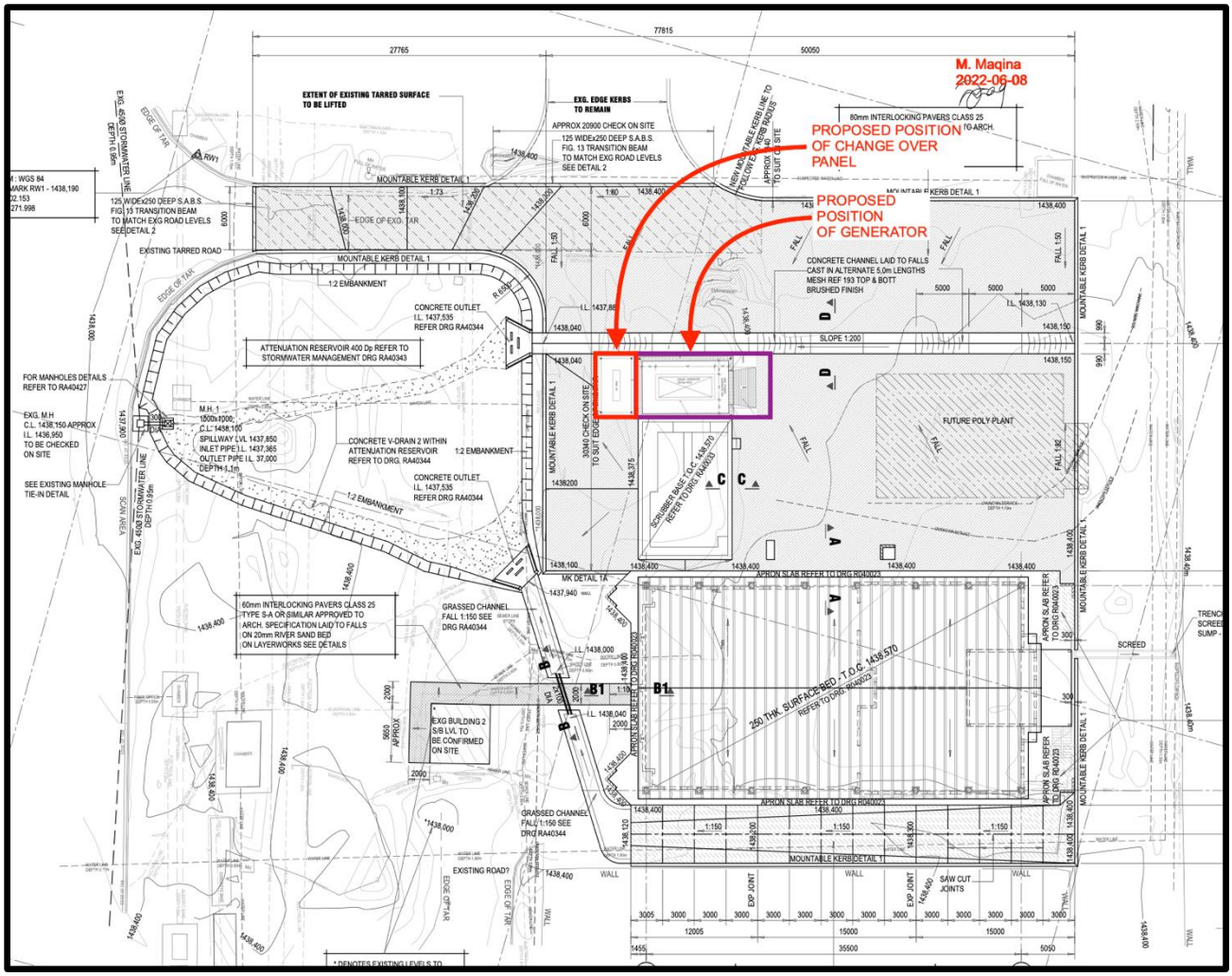

Figure 1 – Proposed Location of Generator Set and Change Over Panel

4. Architecture

Functional design shall comprise of but not limited to the following:

4.1. Accommodation –

Functional fit for purpose design of structure to accommodate a generator and supporting switch gear.

4.2. Accessibility

Maximise plant ease of access.

Make provision for adequate ergonomic circulation for operating and servicing of plan, equipment and safety routes.

4.3. Form giving

Structure match existing nearby structures form and context.

4.4. Materiality

All new building materials, components and fixture to match existing nearby structures.

4.5. Statutory Requirements

National Building Regulations

RW Architectural Specification Standards

4.6. Architectural Documentation

Provision of drawings, design and detailed construction drawings, specifications, reports and as-built drawings after construction. As per RW Architectural Specifications document.

5 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 Emergency Standby Diesel Generator complete with two changeover panels and bund wall as per the Rand Water Specs**				
1.1.	Design, supply, and Manufacture	1	No		
1.2.	Factory Test and Deliver	1	No		
1.3.	Install, test, Commission and Putting into Operation	1	No		
2.	**Install complete IP65, 400V, 500A, Automatic Change-over Panel with Distribution as per drawing (RBXXXX)**				

Item No	Description	Qty (A)	UOM	Rate (B)	Total
2.1.	Design, Supply and Manufacture the 500A floor standing automatic change-over Panel. The panel should the distribution section comprising 1 x Poly Plant feeder(120A), 1 x Chlorine Plant Feeder (400A) and 2 X 100A spare breakers.	1	No		
2.2.	Factory Test, Deliver the automatic change-over panel	1	Sum		
2.3.	Install, test, Commission and Putting into Operation the automatic change-over panel	1	Sum		
2.4.	Supply, deliver, test and commission the LV Cables to feed the Generator Changeover Panel from the generator complete - 150mm^2 4 Core PVC PVC SWA PVC	20	Meter		
	Supply, deliver, install, test and commission the 150mm^2 4 Core PVC PVC SWA PVC terminations	4	No		
	Supply, deliver, test and commission the LV Cables to feed the Generator Changeover Panel from the generator - 70mm^2 1 Core black PVC insulated earth cable	10	Meter		
	Supply and install 70mm^2 1 Core black PVC insulated earth cable terminations	2	No		
3.	**Generator Civil/Architectural**				
3.1.	Generator Structure design and built (including services detection, dealing with water, re-routing and/protection of existing services), earthworks, foundations, concrete and soil testing, procurement and erection of generator shelter and change over panel support)	1	Sum		
3.2.	Any and all other structural and architectural scope of works items required in order to complete the works, not covered other items in this bill (items to be listed by Contractor).				
4.	**Small power and lighting including conduits, cables luminaries, welding socket, plug socket, photocell etc**				
4.1.	Supply and install indoor 5-feet, vapor proof light fittings complete with energy saving LED tubes	4	No		

Item No	Description	Qty (A)	UOM	Rate (B)	Total
4.2.	Supply and install industrial type flush mounted indoor socket outlets	3	No		
4.3.	Supply and install 25mm flush mounted steel conduit	40	Meter		
4.4.	Supply and install wiring for the socket outlets circuits - 4mmsq General purpose wire coil (Red, Black, Green/Yellow)	3	Meter		
4.5.	Supply and install wiring for the light circuits - 2.5mmsq General purpose wire coil (Red, Black, Green/Yellow)	3	Meter		
4.6.	Supply and install outdoor energy efficient light fitting complete with LED light	2	No		
4.7.	Supply and install daylight switch (photocell) for the outside lights	1	No		
4.8.	Supply and install a flush mounted distribution board (DB) fully equipped with: 63A Main circuit breaker with 30mA E/L, 2 x 20A single pole MCBs, 3 x 10A single pole MCBs, 1 x 10A single pole isolator (photocell bypass)	1	No		
4.9.	Provision of the Certificate/s of Compliance for the entire electrical system	1	Sum		
5.	**Equipment labelling and signage, cable sealing systems, Ethernet cable for communication to generator including conduit**				
5.1.	Roxtec system cable sealing system	1	Sum		
5.2.	Design, Supply, Deliver, Install, Test and Commission the Modbus TCP/IP Interface to the Generator and the new Chlorine Plant Main PLC	1	Sum		

Item No	Description	Qty (A)	UOM	Rate (B)	Total
5.3.	Supply and install fiber optic cable including trenching between the Generator Room PLC panel and the new Chlorine Plant complete with accessories i.e., splicing boxes and patch leads	1	Sum		
5.4.	Update and Commission the existing SCADA application at Engine Room 4 and Engine Room 2 Control Room	1	Sum		
5.5.	Update and Commission the existing Historian application at Engine Room 4 and Engine Room 2 Control Room	1	Sum		
5.6.	Supply and install 2mm thick, 1000mm x 600mm aluminium label for the generator building	1	No		
5.7.	**Fire detection for generator room (Power supply required as well as alarm contacts to PLC)**				
5.7.1	Supply and install fire detection system. The system should comprise 1 x fire panel, 2 x smoke & heat detectors, 1 x emergency break glass fire alarm, 1 x external audible alarm. The fire panel should include ethernet communication module to enable remote monitoring.	1	Sum		
6	**Administration, Preliminaries and General, Health and Safety, Environmental, Site Establishment and other related costs**				
6.1	Administration, Preliminaries and General, site establishments and other site related facilities.	1	Sum		
6.2	Compliance with all safety and environmental requirements as per SHE specifications	1	Sum		
7	**DOCUMENTATION**				

Item No	Description	Qty (A)	UOM	Rate (B)	Total
7.1	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 manuals	1	Lot		
8	**Any Other Costs (**Others: Please state any other item that is not specifically listed, but may be required to complete the installation**)**				
8.1					
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 _____