



**CONTRACT NO: RLM/RWST/OMM/0103/2024/25 – RE-ADVERT:
UPGRADING AND EXTENSION OF BOSPOORT WATER TREATMENT WORKS - MECHANICAL AND ELECTRICAL WORKS**

CONTRACT NO: RLM/RWST/OMM/0103/2024/25

**RE-ADVERT: APPOINTMENT OF A CONTRACTOR FOR THE UPGRADING AND EXTENSION OF BOSPOORT
WATER TREATMENT WORKS – MECHANICAL AND ELECTRICAL WORKS**

VOLUME 2: PROJECT SPECIFICATIONS

JULY 2025

NAME OF BIDDER:

BID PRICE: (VAT Incl.)

Prepared by:

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0300**

BID CLOSING: 01 August 2025 at 10:00

RUSTENBURG WATER SERVICES TRUST

BID No RLM/RWST/OMM/0103/2024/25

RE-ADVERT: UPGRADE AND EXTENSION OF BOSPOORT WATER TREATMENT WORKS – MECHANICAL AND ELECTRICAL WORKS

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RUSTENBURG WATER SERVICES TRUST

BID No RLM/RWST/OMM/0103/2024/25

RE-ADVERT: UPGRADE AND EXTENSION OF BOSPOORT WATER TREATMENT WORKS – MECHANICAL AND ELECTRICAL WORKS

C3.4 CONSTRUCTION SPECIFICATIONS

C3.4.2 CONSTRUCTION OF MECHANICAL WORKS

Contractor

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Employer

Witness 1

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C3.4.2 CONSTRUCTION OF MECHANICAL WORKS

C3.4.2.1. VARIATIONS AND ADDITIONS TO THE STANDARD AND PARTICULAR SPECIFICATIONS FOR MECHANICAL WORKS (PROJECT SPECIFICATIONS)

The Clauses under section C3.4.2.1 (referred to as Project Specifications) are numbered “PS” and refers to the clauses in the Standard or Particular Specifications for mechanical works. New clauses not covered by clauses in the Standard or Particular Specifications, if included here, are also designated “PS” followed by a number.

The full extent of the mechanical works is shown on the Drawings included in Volume 3, the General Clauses provided under Section C3.4.1 and the Specifications included under C3.4.2.1 (project specifications for mechanical works) and C3.4.2.2 (Particular specifications for mechanical works).

In addition, the project specifications for the civil works have been included under C3.4.4.1 with the civil particular specifications included under C3.4.4.2. Also the project specifications for the electrical and electronic works have been included under C3.4.3.1 with the electrical particular specifications included under C3.4.3.2

The various documents listed under section C3.4.2 shall be treated as mutually explanatory. However, should any requirement of section C3.4.2.2 conflict with any requirement of the Standard Specification or with any requirement of the Particular Specifications, then the requirement of section C3.4.2.1 shall prevail.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPLT FLOW METERS (Particular Specification PT)

Each flow meter supplied under this contract shall be equipped with separate mountable signal converter unit complete with sufficient length of signal cable. The signal converter shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall furthermore have an LCD display for instantaneous flow and totalize flow and shall have a 4-20 mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTB DISSOLVED AIR FLOATATION EQUIPMENT

(Refer to Drawing no 1890.08.EA.14.A001, D001, D002, X001-X003)

The process upgrade at the Bospoort WTW includes the addition of a third flotation tank. The flow splits equally into three pipelines from the inlet works and flows into the flocculation channels of each of the respective DAF units.

A third saturator will provide air saturated water to the new flotation tank through pipes fitted with nozzles which distribute the micro bubbles to float the particles. An additional recycle pump for the new flotation tank is located in the existing pump station that will supply water to the saturator.

This section of the Contract covers the supply, delivery, transport, handling, storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period of equipment for a flotation clarification plant comprising:

- a) Equipment for the new flotation tank,
- b) Air saturation pressure vessel with air receiver, compressor and pumps
- c) All pipework, nozzles and valves

PSPTB 1 SATURATORS

One (duty) free standing mild steel saturator consisting of a rubber lined pressure vessel shall be supplied to saturate sufficient water to the pressure required with a nominal diameter of 700 mm complete as shown on drawings 1890.08.EA.13.D002.

A schematic flow diagram of the saturator recycle, inlet and outlet pipework is shown on drawing 1890.08.EA.13.D003.

The Tenderer must provide for a gauge with a maximum operating pressure of 750 kPa (7.5 atmospheres). The Tenderer is to describe fully the operation of the pressure vessel in terms of time of retention, means of achieving the maximum saturation levels, the guaranteed percentage saturation to be achieved and means of controlling the air level in the saturation vessel.

The pressure vessel shall be mounted as close as possible to the point of discharge in the DAF tanks and a smooth (laminar) flow regime shall be maintained in the delivery pipe to ensure that the air remains in solution until the moment of blending with the feed water.

The saturator shall be manufactured and installed in accordance with the requirements of OHS act. Tenderers shall provide and install on the saturation vessels, at least the following equipment:

- a) pressure relief valve (safety valve)
- b) pressure gauge
- c) pressure transmitter (4 — 20 mA output signal)
- d) valves to atmosphere
- e) non-breakable sight glass indicating water level in vessel (protected against accidental damage)
- f) drain valves and water level control
- g) isolating valves

Tenderers shall provide for automatic control equipment and instrumentation of the saturation vessel which will allow complete automatic control and operation of the plant.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTB 2 NOZZLES

A total of 150 Grade 316L stainless steel nozzles are required as specified on drawing 1890.08.EA.14.X002.

PSPTB 3 PIPEWORK

The supply, delivery, handling, installation, testing and commissioning of the 150mm diameter recycle galvanized steel pipeline (including bends, fittings, flow meter, wall mounted brackets etc.) complete as required per Drawing 1890.08.EA.14.X001 and 1890.08.EA.13.M001.

PSPTB 4 AIR COMPRESSOR FOR DAF

One compressor shall be supplied for the new saturator (1 duty). The compressor shall be adequate for satisfying the air to solids ratio required for good flotation. The compressor shall be sized for maximum duty to deliver at least 63 litres per minute of free air at site conditions continuously into the flotation system. The compressor is to be housed in the new DAF unit.

The compressor shall be air cooled piston type, with pressure lubricated bearings. All bearings shall have removable liners. Operating speed shall preferably be not more than 750 rpm and V-belt drive shall be employed, complete with all necessary safeguards. Suction and delivery valves shall be sized for low air speeds. An adjustable governor shall be provided whereby a fairly constant delivery pressure can be maintained. The compressor shall be complete with electric motors, pressure vessel, valves, interconnecting pipework, and automatic control device and flow-and-pressure meters.

The compressor and motor in each set shall have a common baseplate of rigid construction in fabricated steel. The baseplates shall be provided with suitable openings for pouring in grout and all necessary holding down bolts for securing to the foundation. Concrete plinths for the baseplate will be constructed under another contract to the dimensions and details to be supplied by the Contractor under this Contract. The concrete plinths will be finished off approximately 20 mm below the underside of the baseplates and the Contractor under this Contract shall set each baseplate by means of steel wedges. Thereafter the civil construction contractor will grout in the holding down bolts and where applicable, will fill the open space inside the baseplate with grout, all under the supervision of and to the satisfaction of the Contractor under this Contract.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PSPTT RAPID GRAVITY FILTERS

(Refer to drawings 1890.08.FA.14.D001-D006, X001, X002)

PSPTT 1 General

Four rapid gravity filters will be built under the civil construction contract. Each filter box contains two filter floors (4.2 x 6.48m) as indicated on drawing 1890.08.FA.14.D002.

Each filter floor slab makes provision for a central duct in the floor in order to accommodate the air scour and washwater systems. Pipe laterals can be placed on the concrete floor, spanning the floor and duct. The complete pipework floor system can then be embedded in a concrete layer approximately 200mm thick with nozzles projecting above the concrete, see drawing 1890.08.FA.14.X002.

The incoming flow will be equally divided on the inlet side to the filters by fixed level weirs. The outlet valves will allow filter water to waste on a time cycle, and will allow a slow start operation.

The minimum water level will be maintained by a fixed outlet weir.

Tenderers are required to design, supply, deliver and install a complete filter floor system i.e with lateral pipes, central duct and nozzles. Preference will be given to nozzles with 3 mm slot openings.

Nozzles must make provision for separate air scour and backwash water. The preferred backwash rate is 7.5mm/sec for air as well as water.

Suitable filter media must be offered for the above filter floor system. Two supporting layers 150 mm and 100 mm respectively is preferred with a 700mm layer of sand covering it.

Filter Media Specification	150 mm support layer Grain size 4 mm – 8 mm
	100mm grit 2 mm – 4 mm Grain size
	700 mm sand (0.6 mm – 1.35 mm grain size)

The sand must have uniformity coefficient $UC < 1.4$. A limit is placed on the over size and under size fractions, not more than 3% of the mass should pass the 0.6 mm sieve and not more than 3% of the mass should be retained on a 1.35 mm sieve.

The sand must be clean i.e have an acid solubility of less than 0.15% and must have a silica content of greater than 98%.

The media above must be placed in horizontal layers within 5% of the specified thickness. The level and thickness can be controlled by letting water into the filter box after each layer is placed.

PSPTT 2 Air Blowers for Rapid Gravity Sand Filters

The two (2) existing blowers located in the high lift pump station will be refitted with variable speed drives (VSD's) as specified in the Electrical and Electronic Project Specifications in this document.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTTG GRANULAR ACTIVATED CARBON FILTERS

(Refer to Drawing no 1890.08.FB.14.A001, D001-D006, X001-X004; FB.13.M001-M002)

PSPTTG 2 GENERAL

PSPTTG 2.1 Filter Box

Six (6) additional GAC filters will be constructed under the civil construction contract, bringing the total number of filters to twelve (12). Each filter box contains one filter floor (3.5x5.22m) as indicated on drawing no 1890.08.FB.14.D006. Each filter floor slab makes provision for a central duct in the floor in order to accommodate the air scour and washwater systems. Pipe laterals can be placed on the concrete floor, spanning the floor and the duct. The complete pipework floor system can then be embedded in a concrete layer approximately 200 mm thick with nozzles projecting above the concrete, see drawing no 1890.08.FB.14.D007. A level transmitter shall be installed in the filter box to enable the monitoring of the headloss in the filter, the water level at different stages of the backwash cycle as well as the control of the level in the filter by controlling the outlet valve.

PSPTTG 2.2 Inlet Box/Channel/Washwater Trough

(Drawing 1890.08.FB.14.X001)

The incoming flow will be equally divided between the 12 filters on the inlet side of the filters by means of fixed level weirs. The incoming water will then be further spread across the length of the filter by means of an inlet trough suspended above the filter floor. The trough shall be manufactured from epoxy coated steel and shall also serve as a backwash trough.

PSPTTG 2.3 Filter Floor

Tenderers are required to design, supply, deliver and install a suitable and complete filter floor system i.e. with lateral pipes, central duct and nozzles for the media specified in PSPTTG 1.5.

PSPTTG 2.4 Filter Nozzles

Nozzles must make provision for separate air scour and backwash water. The preferred backwash rate is 8.3 mm/sec (30 m/h) for consecutive air and water backwashing/scouring. The nozzles shall be suitable for filter media as specified in PTTG 2.5.

PSPTTG 2.5 Filter Media (Grading)

Filter Media : 8 x16 GAC

The GAC must have a uniformity coefficient (UC) d less than 1,8. A limit is placed on the over size and under size fractions, not more than 5% of the mass should pass the 1,18 mm (16 US sieve size) sieve and not more than 5% of the mass should be retained on a 2,36 mm (8 US sieve size) sieve.

The media above must be placed in horizontal layers within 10% of the specified thickness. The level and thickness can be controlled by letting water into the filter box after each layer is placed.

The hydraulic properties, i.e. bed expansion at different backwash rates as well as clean media headloss, shall be included in the tender submission.

PSPTTG 2.6 Outlet Box

The outlet valves will allow filter water to waste on a time cycle, and will allow a slow start operation. The minimum water level will be maintained by a fixed outlet weir.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PSPTTG 3 MATERIALS

PSPTTG 3.1 Selection against Corrosion

Any metal in direct contact with GAC media shall be manufactured from 316 Stainless Steel.

PSPTTG 3.6 Filter Media

Refer to PTG 3 and PSPTTG 2.5.

PSPTTG 5 GAC MEDIA TESTING

Refer to PTG 5.

PSPTTG 5 CONSTRUCTION

PSPTTG 5.2 Filter Floor

The filter floor system shall be capable of operating at filtration rates between 3 and 10 m³/m²/h and backwash rates of up to 30 m³/m²/h. This allows for a maximum of 2 filters that can be taken out of service while still maintaining the required production rate of 24 Ml/d.

PSPTTG 5.3 Filter Media Placement

The effective GAC media depth shall be 1.6m in order to provide an EBCT of 13 minutes at 24 Ml/d with all filters in operation. The filter structure makes provision for a free board of 2.3m above the top of the media and a maximum bed expansion of 60%.

PSPTTG 5.4 Air Blower Units

The two (2) existing blowers located in the high lift pump station will be refitted with variable speed drives (VSD's) as specified in the Electrical and Electronic Project Specifications in this document.

PSPTTG 5.7 Valves

All valves shall be electrically actuated. Tenderers shall price at least two types of actuators. Actuators on the filter outlet shall be continuously rated for a modulating duty controlled by the level in the filter box.

PSPTTG 5.8 Filter Control Panels

The filter control and backwash methodology is described in the Control, Instrumentation, PLC and SCADA section below.

PSPTTG 5.13 GAC Media Trap

The GAC media trap shall be installed as indicated on Drawings 1890.08.QK.14.D001 and shall capture media released from the GAC backwash.

PSPTTG 7 CONTROL, INSTRUMENTATION, PLC AND SCADA

PSPTTG 7.1 General

Contractor

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Witness 2

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Witness 1

Witness 2

The air scour flow rate shall be measured with an orifice plate and differential pressure transmitter calibrated for the flow range and indicating litres per second. The backwash flow rate shall be measured with a turbine type mechanical flow meter installed in the high lift pump station. In addition, each filter shall be equipped with the following instrumentation:

- An online turbidity meter;
- One level transmitter for monitoring the level in the filter box; and
- Limit switches and position indicators to enable automation of filters.

The different modes of filter operation shall be as described in the Particular Specification PTTG. The filter system shall be fully automated with the SCADA functionality included in the table below.

Function	Detail
Filtration mode	In service, backwash, out of service
Step in filter mode (filter, backwash out of service)	Indicate step in mode sequence, time since start of step, step duration to completion, interlocks, faults and status
Valve position	Open, close, % open, trip
Water level in filter	% full, low and high limits
Media level in filter	m
Flow rate into each filter	Ml/d
Filter bed volumes treated	Number
Outlet turbidity	NTU

PSPTTG 7.2 Filter Selections

A filter is selected for operation (filter mode) by opening the inlet penstock.

PSPTTG 7.3 Normal Filter Operations

During normal operation the water will enter the filter via the inlet penstock, fill the inlet/backwash trough and overflow into the filter box. The water level in the filter box will be controlled by modulating the filter outlet valve based on a signal received from a level transmitter installed in the filter box. The control of the outlet valve shall be programmed such that the level in the filter does not vary by more than 5% from the set point selected via the SCADA system.

If the level in the filter box rises above the maximum level an alarm will be generated on the SCADA indicating to the operator that the filter is due for a backwash.

Each filter will be equipped with an on-line low range turbidity meter. Should the turbidity increase above a certain value an alarm will be generated on the SCADA system.

PSPTTG 7.4 Filter Backwash Operation

The backwash sequence can be initiated with an operator initiated backwash or via a time based backwash sequence selected from the SCADA. Once a filter is in a backwash mode the backwash sequence should be as follows:

- Inlet penstock closes;
- Level control of outlet valve is disabled;
- Outlet valve opens fully to drain filter to pre-determined level 50 mm above the media;

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- Once the water level in the filter reaches the required level, the filter outlet valve is closed and the air release valve on the air scour pipeline is opened and the air blower is started. The air release valve then closes slowly;
- The filter is air scoured for an adjustable time selected from the SCADA;
- On completion of the air scour step, the blower is stopped and the filter is allowed to release air entrained in the media for a time selected from the SCADA system;
- After completion of the resting period the air release valve is again opened, the backwash valve, the backwash trough outlet valve is opened and the backwash pump is ramped from 0 to maximum backwash flow rate. The air release valve is closed. The maximum backwash flow rate shall be adjustable from the SCADA system. The backwash shall continue for a period selected from the SCADA. The backwash pump is stopped;
- After completion of the first backwash cycle the SCADA system shall be programmed such that a second backwash cycle can be initiated;
- After completion of the second backwash cycle the filter is filled with water via the backwash system to a predetermined SCADA adjustable level above the media; and
- After filling the filter box to a predetermined level the backwash valve is closed, the backwash trough outlet valve is closed and the filter is put back into operation by opening the inlet valve and the outlet valve.

PSPTTG 10 MEASUREMENT AND PAYMENT

PSPTTG 10.6.2 Filter Media

The Tenderer shall submit with his tender the rates of four different types of GAC that complies with the minimum requirements as specified. The highest of the four rates shall be carried forward to the bill of quantities summary page. Technical brochures shall be supplied for all types of GAC media with the Tender.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTG GRANULAR ACTIVATED CARBON MEDIA

PSPTG 1 The media to be used shall comply with the requirements of the PSPTTG 2.5 as well as the general requirements of Particular Specification PTG.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTO OZONE EQUIPMENT

PSPTO 1 GENERAL EQUIPMENT AND CONTRACTOR INFORMATION

(Refer to Drawing no's 1890.08.AA.01.A015, SUC.16.D001, SUC.16.E001, SUC.16.E002, OA.13.D001-D002, OA.13.M001, SUF.16.D001-D002, SUF.16.E001 and SUF.13.D001.M001)

PSPTO 1.1 Equipment standards and reliability

The ozone supplier must be ISO9001:2000 certified on the date of tender. A copy of the certificate shall be provided. All equipment and systems shall be in conformity with ISO and IEC standards.

PSPTO 1.2 Contractor design, manufacture, installation and commissioning ability

In addition to the requirement of Particular Specification – PTO the ozone Supplier shall demonstrate its design, manufacturing, installation and commissioning ability of at least 5 installations with capacities larger than 10 kg O₃/hr and at an ozone concentration of at least 10% (WT).

PSPTO 1.3 Contractor local presence and support ability

In addition to the requirements of Particular Specification - PTO the ozone Supplier shall have at least two plants in South Africa with ozone generators larger than 5 kg O₃/h.

The tenderer is required to complete tables PSPTO 1 and PSPTO 2 and provide supporting technical brochures.

PSPTO 2 GUARANTEES AND PENALTIES

PSPTO 2.1 Ozone production

The Tenderer shall specify the ozone production rate in kg/hr O₃. The maximum required ozone production rate is based on an applied ozone dose of 12 mg/l, plant flow rate of 26.4 Ml/d (or 13.2 kg/hr O₃) and a cooling water temperature of 25°C. The rated ozone generator capacity shall coincide with the 100% power requirement at 10 %wt ozone¹ and 25°C cooling water temperature as indicated by the greyed out cell in table PSPTO 2 (operating point 3C.2).

The ozone system shall indicate the % nitrogen bleed (only applicable to LOX installation) required to achieve the guaranteed ozone production rates.

1 In the case of an air fed system, the rated ozone generator capacity shall coincide with the 100% power requirement at 3%wt ozone and 25 °C cooling water temperature as indicated by the greyed out cell in table PSPTO 4 (operating point 1c.2)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Operating point no	Production rate (kg O ₃ /hr)	O ₃ Concentration (% WT)	Energy consumption (% of maximum power)	LOX consumption (kg LOX/hr)	% N ₂ required
1a.1		6	50		
1b.1			75		
1c.1			100		
2a.1		8	50		
2b.1			75		
2c.1			100		
3a.1		10	50		
3b.1			75		
3c.1			100		
4a.1		12	50		
4b.1			75		
4c.1			100		

Table PSPTO 1 - Ozone production rate and LOX consumption at 20°C cooling water temperature and 5°C ΔT.

Operating point no	Production rate (kg O ₃ /hr)	O ₃ Concentration (% WT)	Energy consumption (% of maximum power)	LOX consumption (kg LOX/hr)	% N ₂ required
1a.2		6	50		
1b.2			75		
1c.2			100		
2a.2		8	50		
2b.2			75		
2c.2			100		
3a.2		10	50		
3b.2			75		
3c.2			100		
4a.2		12	50		
4b.2			75		
4c.2			100		

Table PSPTO 2 - Ozone production rate and LOX consumption at 25°C cooling water temperature and 5°C ΔT.

The ozone production rates requirements stated in Tables PSPTO 1 to 2 will be used to assess the net present value over a 10 year period, using a CPIX of 9% a discount rate of 6% above the CPIX, a LOX cost of R3.70/kg and an energy cost of R0.92/kWh.

The anticipated plant raw water pump rate and applied ozone dose is indicated in table PSPTO 5.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

	J	F	M	A	M	J	J	A	S	O	N	D
Plant flow rate (Mℓ/d)	24	24	24	24	24	24	24	24	24	24	24	24
Applied Ozone (mg/ℓ O ₃) dose	12	12	10	8	7	7	7	8	9	10	12	12

Table PSPTO 5 – Seasonal applied ozone dose and plant raw water pump rate.

PSPTO 2.2 Power consumption

The Tenderer shall guarantee:

- The maximum power consumption
- The specific power consumption (kW/kg O₃) at the production rates specified in PSPTO 2.1.
- The power consumption at the production rates specified in PSPTO 2.1

PSPTO 2.3 LOX consumption

The Tenderer shall guarantee:

- The maximum LOX/GOX consumption
- The specific LOX/GOX consumption (kg O₂/kg O₃) at the production rates specified in PSPTO 2.
- The LOX/GOX consumption at the production rates specified in PSPTO 2.

PSPTO 2.4 Ozone system reliability

The Tenderer shall specify the ozone system reliability and MTBF operated at the rated capacity of 13.2 kg O₃/hr at 10% ozone (%WT) for a LOX-fed system with a cooling water temperature of 25°C. The reliability and MTBF shall include all ozone generation equipment, instruments and ancillary equipment up to and including the destructing units.

PSPTO 2.5 Corrosion Protection

The Tenderer shall include a complete list of all material used for each of the liquid, gas and solution process lines and shall guarantee all equipment against corrosion for a minimum of 5 years.

PSPTO 3 GENERAL TECHNICAL REQUIREMENTS

Provisional layouts of the oxygen supply, ozone generation, ozone diffusion, sidestream mixing and off-gas destructing systems are shown on the drawings listed in PSPTO 1. The Tenderer shall submit with his tender the proposed layout of the above ozone systems. All sub-systems and components shall be complete and will include ancillaries required to ensure safe and reliable performance of the ozone system as specified.

Tenderers shall indicate in their submissions any items that are required in addition to the equipment specified.

The battery limits of the different ozone sub-systems are defined as follows:

- Oxygen production sub-system, from liquid oxygen (LOX) offloading connector to Gaseous Oxygen (GOX) supply point at LOX installation fence as indicated on 1890.08.AA.01.A015.
- Nitrogen bleed sub-system, from air intake and preparation to the point where air is mixed with GOX.
- Ozone generation sub-system, from GOX supply point at fence of LOX installation to ozone

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Employer

Witness 1

Witness 2

- supply pipes feeding dosing points outside of ozone generator building.
- Ozone bubble diffusion sub-system, from the ozone supply pipe outside of the ozone generator building up to and including dosing points at the bubble diffuser system.
- Pre-ozone side stream diffusion and degassing sub-system, from the ozone supply pipe outside of ozone generator building up to and including the dissolved ozone dosing point and inlet chamber gas vent.
- Vent off-gas destruction sub-system, from outlet flange on main ozone contact tank to the outlet of the destructing unit located in the destructor room above the contact tank.

Tenderers shall split the pipework, valves, sampling lines and instrumentation according to the above battery limits and complete the schedule of quantities accordingly.

PSPTO 4 OXYGEN PRODUCTION EQUIPMENT

PSPTO 4.1 LOX equipment and oxygen quality

The LOX equipment will be supplied by others. The exact vaporizer capacity will not be known at tender stage but will be specified at a minimum of 200 kg/h O₂ at 200 kPa. It is anticipated that one 30-ton LOX tank will be installed by the LOX supplier with the option to install a second 30 ton LOX tank at a later stage. This will provide LOX storage of 9 days at the maximum ozone production rate. Any additional requirements need to be specified by the ozone equipment supplier.

The oxygen quality is expected to be at least 99.5%. The Tenderer will therefore have to supply nitrogen bleed equipment as specified in PSPTO 7 in order to optimize the ozone production performance. The ozone supplier shall also indicate the ozone production at 0% nitrogen bleed.

PSPTO 4.2 PSA equipment and oxygen quality

LOX based ozone generation equipment are preferred. A PSA unit is therefore not required but can be submitted as an additional alternative for consideration by the Client.

PSPTO 5 OZONE GENERATION EQUIPMENT
(Refer to Drawing no 1890.08.SUC.16.D001, 1890.08.AA.10.U002)

PSPTO 5.8 Generator turn down ratio

The turn down ratio of all ozone generators shall be at least 1:10.

PSPTO 5.9 Ozone generator design

The ozone generator shall be capable of generating ozone at a maximum concentration of 14 (%WT).

Sufficient ventilation and air conditioning shall be provided by the Contractor to displace the heat generated by the ozone generators and ancillary equipment. Provision was made for ventilation louvers and extraction fans as indicated on drawing 1890.08.SUC.16.D001. The contractor shall indicate any additional requirements in order to maintain a reasonable room temperature.

PSPTO 7 NITROGEN BLEED EQUIPMENT

PSPTO 7.1 The capacity of the nitrogen bleed system shall be at least 10 m³/hr clean and dry air with a dewpoint of less than minus 70°C. The nitrogen bleed system capacity shall be suitably sized in order to optimize the efficiency of the ozone generation equipment.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSPTO 8 COOLING WATER EQUIPMENT

PSPTO 8.1 The cooling water pumps shall receive cooling water from the low lift pump discharge flume and shall return the water to a position downstream of the abstraction point in the same flume as indicated on Drawing no 1890.08.OA.14.D001. The Contractor shall size the cooling water pipework to ensure that the cooling water pumps can supply the required amount of cooling water and that the pumps will at all times operate with sufficient NPSH to meet the 0% headloss NPSH requirement specified by the pump manufacturer.

PSPTO 8.2 The cooling water pumps shall be sized to suite the cooling requirements of the ozone generation equipment under all operating conditions.

PSPTO 8.3 The low lift pumps will have to be started before the cooling water pumps will be able to start. A suitable interlock shall be hardwired and interlocked with PLC controls. An ozone contact tank level probe shall be provided for this purpose. The Contractor shall ensure that the low lift pumps are commissioned before the ozone wet commissioning commences.

PSPTO 9 OZONE BUBBLE DIFFUSION EQUIPMENT

(Refer drawing no's 1890.08.OA.14.D001, X001, X002, X003, 1890.08.OA.13.M001)

PSPTO 9.1 General

The pre-GAC or main ozonation system consists of a chamber comprising 12 compartments and 3 of these compartments shall be fitted with ozone bubble diffuser systems.

Each diffuser compartment shall be able to receive between 25% and 50% of the total gas flow to each compartment. The maximum gas flow requirements to each diffuser compartment are summarized below.

The contractor needs to ensure that the diffusers and gas flow rates can be adjusted for the following flow rates:

Maximum flow rate per chamber	=	26.4 Mℓ/d
Minimum flow rate per chamber	=	10 Mℓ/d

		Chamber 1 Compartment no			
		2	4	8	Max Total Dose
Applied ozone dosing rate	Minimum (mg/ℓ)	2	1	1	12
	Maximum (mg/ℓ)	6	3	3	12

PSPTO 6 – Minimum and maximum ozone dosing requirements

UV254 sampling points and analyzers shall be installed to control the dosing rate into each bubble diffuser chamber as indicated on the process flow diagram Drawing no 1890.10.AA.01.A015. Manual sampling points shall be installed in each compartment. All sampling lines, valves and fittings shall be manufactured from 316 L stainless steel.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

The ozone transfer efficiency of the bulk diffusion system shall be at least 95% at the maximum ozone dosing rate.

PSPTO 10 SIDE STREAM DIFFUSION AND DEGASSING EQUIPMENT

PSPTO 10.1 General

All sidestream pump systems shall be sized for a minimum of 0.15 gas to liquid ratio operating at 10% (WT) ozone concentration for the following applied ozone dosing rates and plant flow rates.

		Pre-ozone
Applied ozone dosing rate	Minimum (mg/l)	2
	Maximum (mg/l)	3
Plant raw water flow rate (Mℓ/d)	Minimum	10
	Maximum	26.4

PSPTO 7 – Minimum and maximum ozone dosing requirements

PSPTO 10.2 Material and design

The **pre-ozone sidestream** injection system shall be installed, as indicated on Drawing nos 1890.08.AA.10.U002, 1890.08.SUF.16.D001, D002. This sidestream injection system needs to be installed upstream the inlet works and shall comprise the following:

- 2 off recycle pumps (1 duty and 1 standby);
- 2 off ozone injection systems;
- 1 off inline diffuser;
- 316L stainless steel insert piece on main pipeline;
- All process piping and valves (316L stainless steel); and
- Instrumentation as specified in PSPTO 15 and 16.

The system was designed to degas unreacted O₃ and O₂ in the degassing chamber. The recycle stream will be taken from the main pipeline and reintroduced back into the main pipeline directly upstream of the inlet chamber as indicated on Drawing no 1890.08.SUF.12.D001. A maximum headloss of 0.2 m can be accommodated for the injection nozzles in the main pipeline.

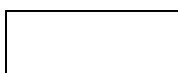
The ozone transfer efficiency shall be at least 85% at the maximum ozone dosing rate.

PSPTO 11 VENT OFF-GAS DESTRUCTION EQUIPMENT

PSPTO 11.2 Ozone destructor

Ozone destructor units shall be supplied at the following positions indicated on Drawing no 1890.08.AA.01.A015 and be suitably sized for the required ozone dose at each dosing point. The minimum sizes indicated in the table PSPTO 8 are based on an ozone transfer efficiency of 85%. The Tenderer shall optimize the size of the destructing units to suite the guaranteed ozone transfer efficiency at each ozone dosing point and all other operating conditions.

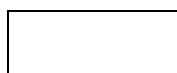
Position	Minimum Capacity(kg/hr)
Main Ozone	150
Pre-Ozone	75



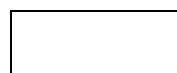
Contractor



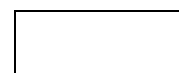
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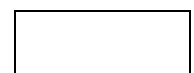
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Employer



Witness 1



Witness 2

PSPTO 15 INSTRUMENTATION AND CONTROL EQUIPMENT

The instrumentation indicated on Drawing no 1890.08.AA.01.A015 shall be supplied as a minimum.

PSPTO 15.4 SCADA AND MMI DISPLAY

In addition to the requirements of the Particular Specification – PTO the following information shall be displayed in the ozone generation room and SCADA system:

- Ozone production rate (per ozone generator and total production)
- Ozone dosing rate at each dosing point
- Ozone concentration at destructor outlet
- Ozone transfer efficiency at each dosing point
- UV254 at pre-ozone and main ozonation dosing points as indicated on the process flow diagram
- GOX mass flow rate
- Energy consumption at each ozone generation unit and each sidestream injection system.

The contract shall supply the following hand held instruments to enable the operator to perform ad-hoc analysis:

- 1 off portable residual ozone analyzer
- 3 off portable ozone gas detector (low concentration)

PSPTO 16 INSTRUMENTATION

Refer to PTO for detailed requirements of instruments. The following instruments are required if not included as part of the ozone generation, ozone diffuser or ozone destruction equipment.

- Oxygen supply
- Nitrogen bleed system
- Ozone generation (per generator)
- Ozone contacting (Bubble diffuser per system)
- Ozone mixing (Sidestream mixing per system)
- Ozone destruction (per system)
- Hand held instruments

PSPTO 22 OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS

PSPTO 22.2 Breathing apparatus set

Two self-contained breathing apparatus sets shall be installed in the ozone generation room plus one set at each ozone dosing point.

Four gas masks with ten disposable ozone adsorbing cartridges shall be supplied.

PSPTO 23 MEASUREMENT AND PAYMENT

The contractor shall supply rates for two different ozone generator equipment suppliers. The highest of the two rates shall be carried forward to the bill of quantities summary page. Technical schedules and equipment brochures shall be supplied for both types of ozone equipment with the tender.

Contractor

Witness 1

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Employer

Witness 1

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PSPT PUMPS

PSPT 1 SCOPE

The supply and installation of the following new pumping equipment have been included under the scope of this Contract:

- ONE DAF recycle pump (1 duty);
- TWO filtrate pumps (1 duty, 1 stand-by); and
- THREE low lift pumps (2 duty, 1 stand-by)
- FOUR high lift pumps.

The specific requirements of each of the pumps are described below.

Tenderers shall take cognizance of the information required in terms of clause PT 5.2.2 to be submitted with the tender.

PSPT 1.1 DAF Recycle Pumps

ONE dry-well centrifugal pump (1 duty) is required to be installed in the high lift pump station to feed the saturator at the new DAF tank. This will bring the total amount of pumps to four (3 duty and 1 stand by).

The **indicative duty point** of each pump is **8 l/s** at a total head of **65m**. The duty point shall be determined by the Contractor once the pipe arrangement has been finalised and only then shall the final pump selection be made, to the approval of the Engineer. The BEP shall coincide with this point.

The closed valve pressure of the pumps shall not exceed 100m.

The facility to rotate the duty pump shall be provided.

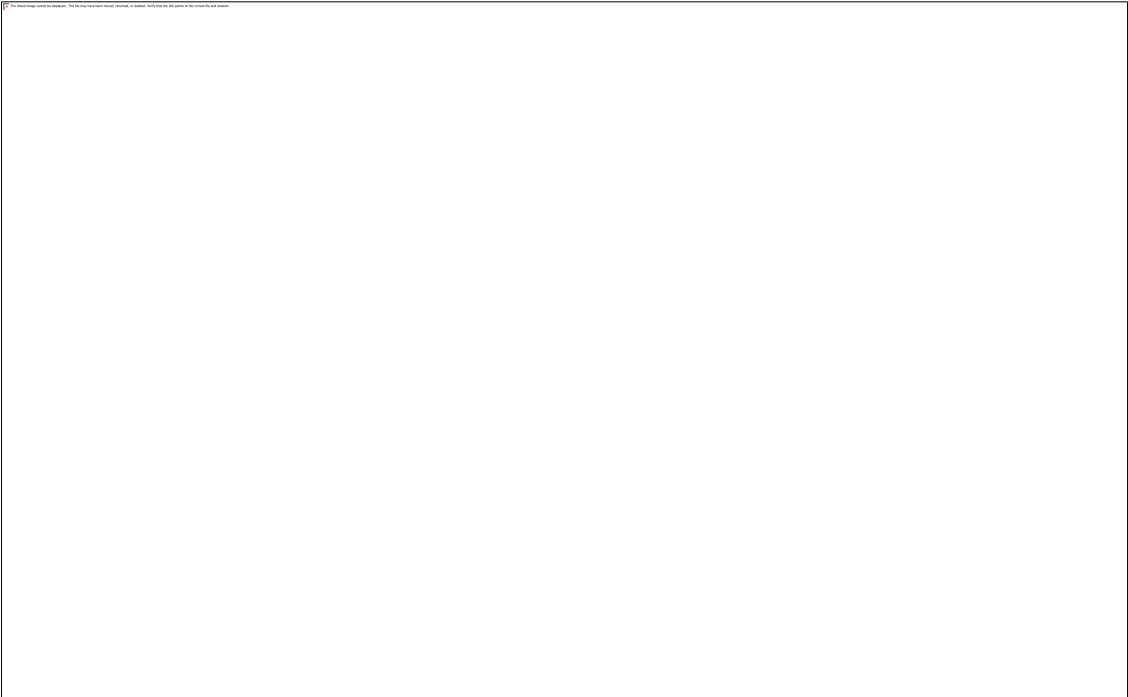
Pressure gauges shall also be provided for the pumping installation. One pressure gauge shall be fitted to the suction manifold with a range of 0 – 50 kPa. Gauges shall be glycerin filled.

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

PSPT 1.2 Filtrate Pumps

TWO wet-well submersible pumps (1 duty, 1 stand-by) are required to be installed at the filtrate sump adjacent to the dewatering building.

The **indicative duty point** of each pump is **63 ℓ/s** at a total head of **9.4m**. The duty point shall be determined by the Contractor once the pipe arrangement has been finalised and only then shall the final pump selection be made, to the approval of the Engineer. The BEP shall coincide with this point.



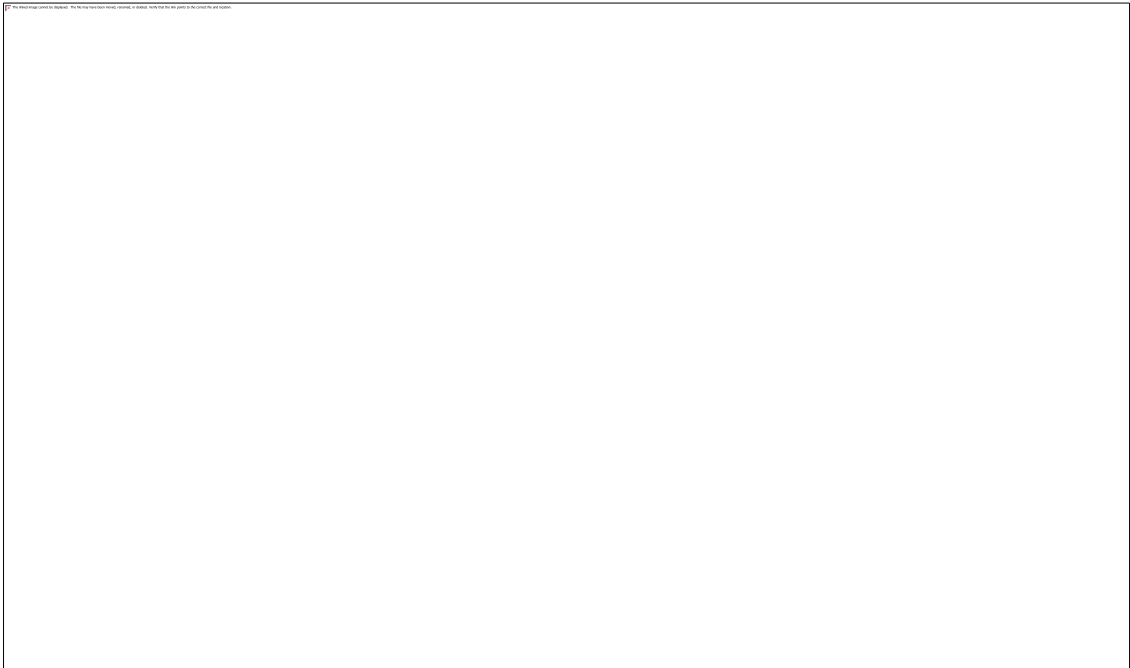
The closed valve pressure of the pumps shall not exceed 100m.

The facility to rotate the duty pump shall be provided.

Pressure gauges shall also be provided for the pumping installation. One pressure gauge with a range of 0 – 1000 kPa shall be fitted to the common delivery manifold, while a pressure gauge shall be fitted to each suction manifold (2 total) with a range of 0 to 50 kPa. Gauges shall be glycerin filled.

PSPT 1.3 Low Lift Pumps

THREE low lift vertical spindle pumps (2 duty, 1 stand-by) shall be installed each with a capacity of 12 Mℓ/d and a variable pumping head of 7.4 m – 8.9 m. The pumping capacity of each pump shall be varied by means of a variable speed drive between 8 and 12 Mℓ/d.



The low lift pump speed shall be controlled by means of a fuzzy logic controller and a level transmitter measuring the level in the low lift pump sump. Two permanent weir plates shall be installed on the overflow into the ozone contact tank and together with a level transmitter be used to calculate the flow rate into the ozone contact chamber.

The pump motors shall be 4 pole speed or lower. The shaft shall be chrome steel. The impeller shall be chrome-nickel cast steel. All materials shall be selected to be suitable for the water quality being pumped.

The shaft seal shall be of the cartridge slurry type mechanical seal. The shaft shall be of the dry shaft type with media lubrication.

The motor and pump thrust bearings and seals shall be at two different levels to facilitate access and easy maintenance.

The bearing life shall be at least 10 years. The pump thrust bearings shall be of the oil lubricated ball bearing type. The oil shall be prevented from entering the process water stream.

The pump shall be able to operate at a speed not exceeding 1450 rpm at a flow rate of 12 Mℓ/d at the lowest and highest suction levels and able to adjust the flow downward to 8 Mℓ/d at the highest and lowest suction levels as indicated on drawing 1890.08.OA.14.X001.

PSPT 1.4 Sludge Pumps

The TWO existing sludge pumps installed have a duty point of 108 m³/hour at a head of 8 m. These pumps will be fitted with variable speed drives (VSD's) to allow these pumps to feed sludge to the filter belt presses in the new dewatering building as shown on the drawings. The **indicative duty point** for pumping to the dewatering building is 40 **m³/hour** at a head of **10 m**. Refer to the electrical and electronic works project specification for more information.

Contractor

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PSPT 1.5 HIGH lift Pumps

The current Bospoort high lift pump station configuration includes two pump set trains (lines) in parallel, each with two horizontal split casing pumps in series.

The design, supply and installation of two parallel pump set trains (whether in series similar to the current configuration or not), are required as part of the scope of this contract, together with all specified associated equipment. Dismantling, removal and storage of existing four pump sets and equipment that are not required in the upgraded pump station will also be part of the scope.

Each pump train (two (2x) pumps in series) shall meet an ultimate duty of 278 l/s at a total head of 164 m. To facilitate interchangeability of pump set components, the head generation by each pump shall be the same. The pumps shall be sized to supply both the existing Magalies Water (MW) Bospoort reservoirs and the proposed Bospoort North reservoirs, separately. Use of variable speed / frequency drive (VSD / VFD) motors will be made to achieve the different hydraulic requirements when pumping to the different reservoirs.

System curves for the supply system are provided above. The specified duty was determined on the upper curve. The offered pumps shall however be suitable for operation anywhere between the lower and the upper curve and NPSH required shall not exceed NPSH available of 7,5 m less a safety margin.

However, until the upgrading of the Bospoort WTW from 12 Ml/d to 24 Ml/d is complete, the upgraded Bospoort pump station will pump 12 Ml/d (138 l/s) to the existing MW Bospoort reservoirs. This will be achieved by installing VSD / VFD's motors to speed the pumps down to the required rotation.

The specifications for the VSD / VFD motors connected to the pumps are as follows:

- VFD Motors= Insulated non-drive end bearing AND Common mode filter at the converter shall be implemented
- IE3 = Premium efficiency
- Voltage = 400V
- Class = F insulation
- Class = B temperature rise
- Earthing and cabling = Symmetrical concentric protective earth shall be implemented
- Resistance Temperature Detectors = PT100 shall be added in all three windings, NDE and DE Bearings shall be added by motor manufacturer
- Vibration = Vibration monitoring shall be inclusive x, y z axis shall be added by motor manufacturer

The specifications for the pumps are as follows:

Contractor

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- Resistance Temperature Detectors = PT100 shall be added in the NDE and DE Bearings
- Vibration = Vibration monitoring shall be inclusive x, y z axis shall be added by motor manufacturer

Tenderers shall take cognizance of the information required in terms of Particular Specification PT: Pumps, to be submitted with the tender.

Mechanical seals shall be provided as per PT 5.8.4.

Monitoring devices (temperature sensors, pressure gauges, vibration sensors, air vents and gland leakage detection) shall be provided as per PT 5.11.

The new pump sets will be installed on the plinths where the existing pump sets are located. The existing pump inlets are 300mm diameter and the outlets are 200 mm diameter. Any changes that may be required to the suction and delivery pipework shall form part of the scope of work and shall be allowed for in the Bill of Quantities. Changes that may be required to the plinth levels and dimensions shall likewise form part of the scope and shall be allowed for in the Bill of Quantities.

The pump station shall remain operational during the installation period. One existing pump train can be decommissioned and dismantled for the installation of the new pump sets and equipment while the other existing pump train remains operational. Once the new pump train installation has been completed and commissioned and reliable operation has been illustrated the remaining existing pump train can be decommissioned and dismantled for the installation of the new pump sets and equipment.

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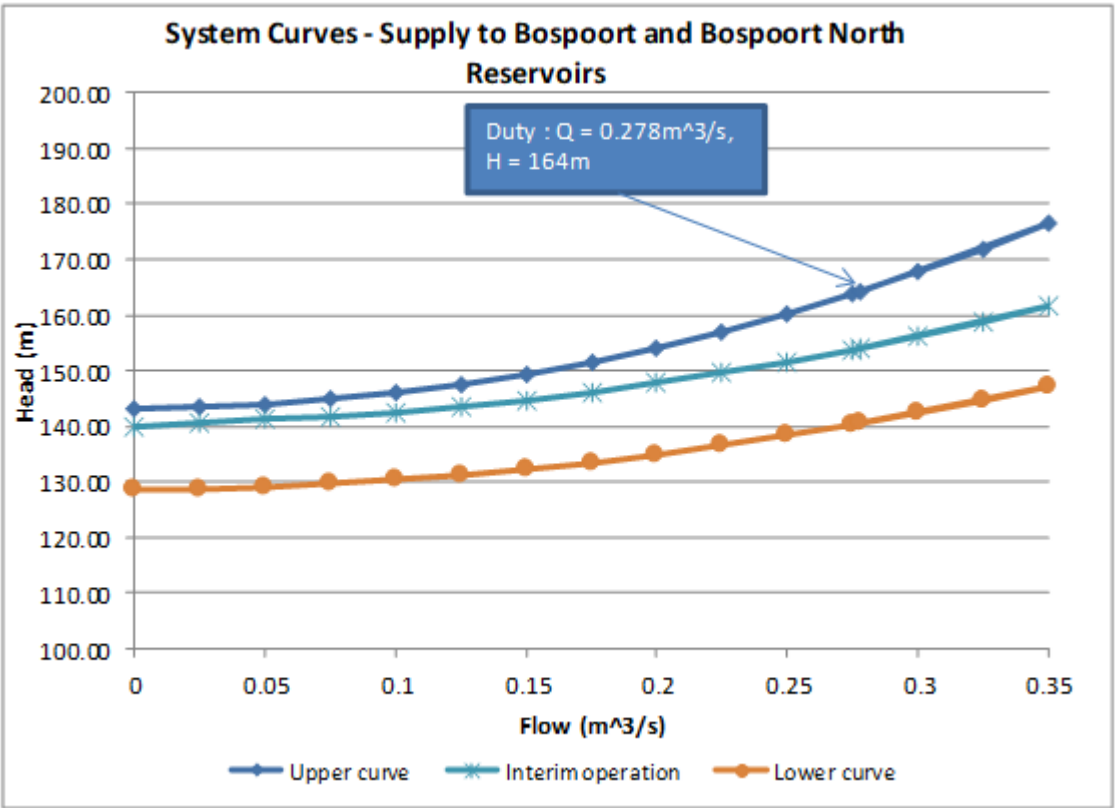
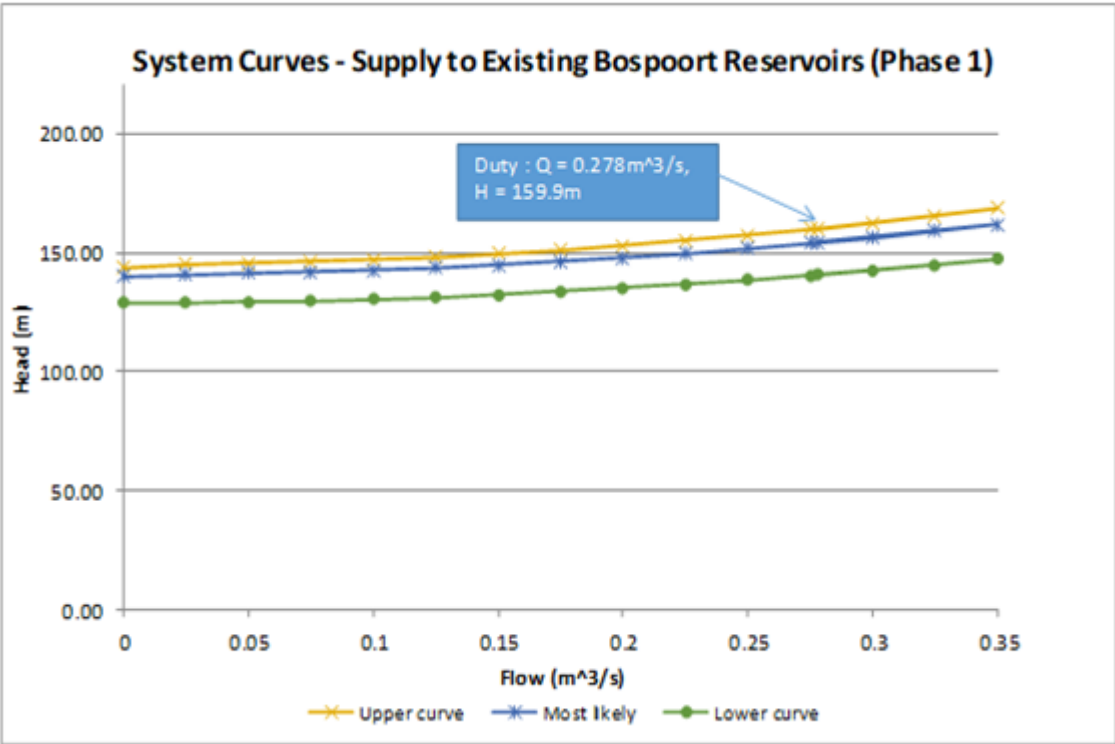
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PSPTU **CHLORINE DOSING EQUIPMENT**

PSPTU-1 **Scope**

This section of the Specification includes the supply, delivery, installation, commissioning and upholding during the Defects Liability Period of chlorination equipment.

PSPTU-2 **Materials**

The chlorinator equipment and all associated chlorine dosing pipework and accessories that may come in contact with chlorine gas or solution shall be constructed of materials resistant to corrosion from the effects of chlorine.

PSPTU-3 **Equipment Required**

The existing plant has been equipped with a chlorination system extracting gas under vacuum from 1 ton chlorine containers. One (1) additional chlorinator that will form part of the post chlorination system is envisaged.

The following equipment will be added to system under this Contract:

- i) New motive water pump with self-cleaning strainer and associated pipe work and fittings installed and suitably sized to provide motive water to dosing points;
- ii) New automated 0 - 5 kg/hr chlorinator with flow pacing functionality required to maintain a fixed chlorine dose irrespective of flow rate for the existing chlorine dosing point; the chlorinator shall receive data from the outlet flow meter and adjust dosage accordingly.
- iii) New chlorine dosing pipeline and dosing point diffuser at the new clearwater tank.

An emergency shut-off system will not be required.

Contractor

Witness 1

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Employer

Witness 1

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PSPLC CHEMICAL DOSING EQUIPMENT

PSPLC 1 Scope

This section of the Specifications covers the project specific requirements with respect to the handling and dosing of chemicals at the Bospoort WTW, and specifically the dosing of ferric chloride liquid and lime slurry as described below.

All the required inlet and outlet pipes, valves, specials, jointing and fixing materials, and any additional fittings or equipment required to complete the chemical dosing installation to the Engineers' approval shall form part of this Contract. The Contractor shall submit final design and General Arrangement (GA) drawings to the Engineer for approval prior to procurement or installation.

All pipes shall be clearly marked for identification purposes and the method of marking will be to the Engineers' approval.

The pipes will run in ducts, pipe supports or trenches as indicated on the drawings. Pipes shall be uPVC, HDPE or similar and approved material.

PSPLC 2 Interpretations

PSPLC 2.1 Application

The application of this Specification shall include for water treatment works.

PSPLC 5.1.1 MAIN COAGULANT DOSING EQUIPMENT

The Specification shall apply to the storage and dosing of ferric-chloride and poly-electrolyte as per drawing 1890.08.AA.01.A012.

Two (2) additional chemical dosing pumps as per clause PLC 5.1 shall be supplied under this Contract one (1) for pumping undiluted ferric-chloride (typically 43% solution) and one (1) for pumping poly-electrolyte to the inlet works.

Dosing pumps shall also be stroke adjustable between 10 and 100% of maximum stroke.

All coagulant dosing equipment supplied under this Contract shall be fitted with electronic variable speed drives in order to maintain a fixed dosage with varying flows through the plant. The set point will be controlled by means of a PLC and SCADA selectable between pH control and operator selected dosing rate. The variation and repeatability of the dosing rate of the pumps must be within 1% of a minimum and maximum dosing rate.

All pipework to and from the ferric chloride tanks shall be included in the Tender Sum.

PSPLC 5.1.2 Hydrogen Peroxide Dosing Pumps

Provision for hydrogen peroxide storage and dosing is required. The hydrogen peroxide dosing system shall be sized to dose a maximum of 6 mg/l.

The hydrogen peroxide dosing equipment will be housed in a building to be constructed as part of the Contract for the civil works. The storage tanks are to be located in the covered area adjoining the hydrogen peroxide dosing building and which will provide secondary containment. Refer to dwg 1890.08.SUG.16.D001.

The dosing equipment for hydrogen peroxide shall generally adhere to the particular specification for coagulant dosing equipment except where specific amendments are made below.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Two single phase dosing pumps (one stand-by unit) are required for feed hydrogen peroxide from the storage tank to a dosage point downstream of the ozone contact tank at the inlet to the GAC filters. Allowance must be made for possible future pump.

The dosing pumps must be constructed of peroxide resistant materials and shall be required to deliver between 0 and 7 l/hour at an indicative pumping head of 10 m by means of flow paced electronic variable speed controls.

Dosing pumps shall also be stroke adjustable between 10 and 100% of maximum stroke. The set point will be controlled by means of a PLC and SCADA or operator selected dosing rate. The variation and repeatability of the dosing rate of the pumps must be within 1% of a minimum and maximum dosing rate.

PSPLC 5.2.1 Hydrogen Peroxide Storage Tanks

Two polyethylene storage tanks with a capacity of 5000l are required to store the hydrogen peroxide.

The tank must be fully enclosed and supplied with an entry manhole and emergency vent and the following nozzle outlets:

- Overflow pipe with downcomer
- Level indicator (with alarm)
- Filling connection
- Hydrogen peroxide outlet at a low point
- Vent with filter
- Temperature indicator (with alarm)
- Drain valve at the lowest point

PSPLC 5.4.1 Hydrogen Peroxide Dosing Pipework, Valves and Fittings

The Contractor shall allow in his price for all the required pipework, fittings, valves, strainers etc. to and from the dosing pumps up to the dosing point. Allowance must be made by the Contractor to flush the pumps and pipework with clean water in the event of blockages.

Dual containment piping should be considered to minimize the risk of exposure to plant personnel. Acceptable pipe materials include 316 stainless steel, polyethylene, CPVC, and Teflon. Gaskets should be Teflon as natural rubber; Hypalon and EPDM are not resistant to hydrogen peroxide. All transfer pipelines shall be self-draining and preferably the lines should not pass over wooden floors or other combustible areas. Particular care should be taken to prevent the liquid in the receiving vessel being returned into the upstream pipework and storage tank by siphoning or any other means. A siphon breaker must be fitted if such an event is considered to be a possibility. Flange bolts and gaskets should not be greased.

The number of valves must be minimised although more than one valve is usually necessary on the outlet system of the storage tanks and arrangements to prevent pressure build up between valves must be made. Only valves that are capable of venting gas should be used. Valves located in the bund area should be installed so that they can be reached from outside the bund.

Contractor

Witness 1

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Employer

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PSPTN SLUDGE DEWATERING EQUIPMENT

PSPTN 1.1 SCOPE

This specification, read together with the applicable Particular Specifications included under section C3.4.2.2 covers the performance specifications, design parameters, manufacture, supply and delivery to site, installation, testing, adjustment and commissioning of the new sludge dewatering plant to be provided under this Contract.

This specification allows for the supply and installation of a belt filter-type dewatering equipment.

This section of the Contract will include the following equipment:

- (i) Sludge feed and control system;
- (ii) Polyelectrolyte handling, make-up and dosing equipment;
- (iii) Belt press complete with all ancillaries to dewater sludge;
- (iv) Belt press washwater piping and associated equipment;
- (v) Filtrate and washwater piping and associated equipment;
- (vi) Dry cake conveyors;
- (vii) Filtration and pressure reducing system for washwater;
- (viii) All pipework and fittings associated with the sludge dewatering plant inside the belt press building;
- (ix) Liquid level, flow and solids density meters;
- (x) Electrical installation and instrumentation system;
- (xi) Automatic control of the entire dewatering system via PLC control;

Reference shall be made to the proposed process and instrumentation diagram (P&ID), drawing no 1890.08.AA.01.A004 for tendering purposes. However, in terms of clause C3.4.1.13, the responsibility for the final design shall rest with the Contractor, who shall ensure that the installed system shall suit and meet the objectives of the installation in terms of the Employer's Requirements. Any/all items deemed necessary for the effective and safe operation of the system and which are not specifically measured in the respective schedules shall be included in the tender offer and clearly highlighted.

Tenderers shall take note that offers from at least three suitable dewatering plant suppliers shall be included in the tender submission. Two of the offers shall be from suppliers with at least 30 operational units in South Africa, while the third shall be from a supplier with at least 10 operational units in South Africa. A list of treatment facilities and the number of units currently operational shall be submitted with the tender offer.

The dewatering equipment with the highest tendered rate for manufacturing and installation shall be used to determine the Tenderer's financial offer and the overall tendered amount for the Contract.

The Employer reserves the right to, after conducting a full life cycle costing, choose any one of the two offers and the guaranteed figures related to the chosen system shall be binding on the Contractor.

PSPTN 1.3 FILTER BELT PRESS EQUIPMENT

Two (one duty and one stand-by installation) filter belt press shall be required to dewater the sludge emanating from the DAF process units containing mostly organic material (algae) and silt with an expected solids concentration of 0.5% (min requirement) - 3%. The sludge will be collected in the existing sludge sump and pumped to the dewatering facility. The filtrate from the dewatering process will gravitate to the filtrate sump from where it will be pumped to the inlet of the works.

Contractor

Witness 1

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Employer

Witness 1

Witness 2

At maximum load, the belt filter press system will operate with 1 duty and 1 standby unit for a 12 hour per day period. Each unit shall be sized to dewater 600 kgDS/hr and handle a hydraulic load of 40 m³/hr.

Under normal operating conditions, sludge from the sludge sump, with an expected solids concentration of 2%, will be dewatered and the belt filter system must be designed to achieve a minimum cake dryness of 10% with a maximum poly dose of 7 kg/ton DS dewatered. Tenderers shall record in their offers the guaranteed poly consumption rate and expected cake dryness.

The minimum capture of incoming solids shall not be less than 95%.

Washwater will be sourced from the 100 mm diameter uPVC pipeline installed from the Ozone contact tank to the dewatering facility feeding the two pump sets installed in the dewatering building.

Polymer dilution water shall be sourced from site water reticulation main.

PSPTN 2 POLY-ELECTROLYTE MAKE-UP SYSTEM

The poly-electrolyte preparation system shall be a continuous batching system utilizing polymer emulsion delivered to site in 1 m³ flow bins (50% concentrate).

The offered system shall include, as a minimum, a (raw product) poly electrolyte feeder pump (duty and standby), associated pipework, valves and a flow meter feeding a suitably sized mixing and maturation tank for the batching of a poly solution of 0.3 – 0.5%.

The maturation tanks shall have a retention time of at least 1 hour prior to dosing and shall incorporate suitable stirrers.

The Contractor shall state in his bid the type of poly-electrolyte proposed and the cost (per kilogram) delivered to the Site of the Works. ***Non-disclosure of this information may render a bid non-responsive.***

The Contractor shall also allow for the following in his tender price:

- (a) Cost of provision sufficient poly-electrolyte for commissioning and performance testing purposes;
- (b) Cost of providing a single 120-L container of two suitable alternative poly electrolyte emulsions for optimization tests.

PSPTN 5 DRY SLUDGE CONVEYORS

The contractor shall design and supply adequately-sized sludge out loading equipment in terms of Particular Specifications PTN (Sludge Dewatering Equipment) and PTY (Conveyor equipment).

Dewatered sludge shall be discharged onto a horizontal belt conveyor installed at an appropriate elevation of at least 500mm above final floor level to accommodate access for maintenance purposes underneath the belt. This requirement will influence the final positioning (elevation) of the belt filters and must be taken into account when designed and pricing the system.

The dried sludge will be conveyed into a 7m³ waste skip which shall also be supplied under the Contract.

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<div>02_Vol2_ME_June25_Part C3.4.2.1</div> <div style="text-align: right;">June 2025</div>					

PSPTN 6 CONTROL PHILOSOPHY

The proposed system is based on a constant hydraulic loading being maintained to the dewatering plant and the dose of polyelectrolyte being varied according to changes in the feed solids concentration.

The following parameters shall be set by the Operator on the local HMI:

- The duty press/filter(s) to be used in cases where there are more than one unit;
- Polyelectrolyte dosing rate in kg/ton DS;
- Flow rate of the feed sludge in m³/hr;
- Time that the plant must start and run time e.g. 09h00 am & 10 hours.

The automatic control system of the master PLC provided for the plant shall then:

- Calculate the required polyelectrolyte pumping rate in accordance with the polyelectrolyte solution concentration and the required dose rate;
- Initiate the start-up sequence for each of the selected units (master PLC to initiate start-up only, after which individual PLC's will start-up the units);
- Open the washwater lines;
- Open the suction and delivery valves of the selected polyelectrolyte dosing pumps;
- Open the dilution water supply valves (if applicable);
- Start the sludge feed pump;
- Adjust the speed of the polyelectrolyte dosing pumps to maintain the pre-set dose. This shall be calculated from the concentration of the dosing solution, sludge feed rate (which should be constant) and the sludge concentration as measured by in-line solids density meters. Two meters shall be provided on the main sludge incoming manifold and calculations shall be based on an average measurement of the two meters.

Once the pre-set period for dewatering has been reached:

- Polyelectrolyte dosing pumps shall be stopped and suction/delivery valves closed;
- Stop sludge feed pump;
- Stop dilution water supply (if applicable);
- Stop washwater supply
- Stop filter/press unit(s)

All electrical and instrumentation equipment shall comply with the specifications of Volume 3. The design shall allow the complete belt press installation to be incorporated in the SCADA system. The milestone for this section will terminate all cabling to a local MCC forming part of this installation, and from the MCC the network and electrical cabling to a point terminating 1,0m outside the building.

A complete P&ID of the sludge dewatering installation shall be submitted with the tenders.

PSPTN 10 TESTING OF EQUIPMENT

The contractor shall carry out the following performance testing, in the presence of the Engineer, prior to the commencement of the operational acceptance period. Testing of all equipment shall be in accordance with Volume 1 of the Tender document.

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PSPTN 10.1 Polyelectrolyte Feed and Dosing Pumps

Calibration curves shall be produced throughout the operating range to demonstrate the repeatability of the performance.

After the plant has been operating for 1 month the calibration curves shall be produced. The second curve shall not deviate from the first by more than 5%.

PSPTN 10.2 Poly electrolyte batching tank

Satisfactory performance shall be indicated by proving that a homogeneous poly electrolyte mixture is achieved within the 0.3 – 0.5% target range.

PSPTN 10.3 Dewatering Equipment

After commissioning, the dewatering equipment shall be subjected to a 5 working day acceptance test to demonstrate compliance with the specification. The Contractor shall be responsible for taking all the necessary samples and performing the analyses to prove compliance.

- (a) The following measurements shall be taken every three hours (3 per day or 15 in total) during the 5-day testing period:
 - (i) Flow rate to each belt press;
 - (ii) Sludge feed solids concentration;
 - (iii) Volatile solids concentration of the waste activated sludge feed;
 - (iv) Polyelectrolyte consumption;
 - (v) Solids concentration of the filtrate;
 - (vi) Solids concentration of the washwater;
 - (vii) Filtrate flow;
 - (viii) Washwater flow;
 - (ix) Solids concentration of the dry cake on a mass basis;
 - (x) Polyelectrolyte dilution water flow rate.
- (b) Based on samples taken and analyses performed by an accredited laboratory, the Contractor shall submit calculations showing the performance of the dewatering equipment with respect to:
 - (i) Hydraulic and solids loading
 - (ii) Polyelectrolyte consumption in kg/tonDS dried.
 - (iii) Solids recovery as a percentage of feed solids.
 - (iv) Solids concentration of the dry cake.

The tests shall be repeated at the conclusion of the maintenance period if required by the Engineer.

PSPTN 10.4 Guaranteed Figures and Penalties

Based on the envisaged quantity and quality of sludge to be dewatered, the Contractor shall guarantee the following operating parameters:

- 1) Dried cake solids concentration (% mass/mass)
- 2) Poly electrolyte dosing rate (kg/ton DS)
- 3) Solids capture (%)
- 4) Total power consumption when system is operational (kW)
- 5) Washwater requirement (m³/hr)

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The following penalties shall be applicable for performance below the guaranteed figures:

a) Dried cake solids concentration:

% Dry Solids	Reduction in Contract Value (excluding VAT)
Between 0,5 and 1,5% below concentration specified	R 100 000
Between 1,6 and 2,5% below concentration specified	R 200 000
Between 2,6 and 3% below concentration specified	R 300 000
3% below concentration specified	Rejected

b) Polyelectrolyte consumption

For every 0,5 kg/tDS of sludge feed or part thereof that consumption exceeds that which have been guaranteed, the Contract Value shall be reduced by R 125,000.00.

PSPTN 11 PUMPING EQUIPMENT

The content of this sub-clause shall be read together with Particular Specification PT (Pumps), PTN (Sludge Dewatering Equipment) and PXC (Low voltage electrical motors).

The following pumps shall be required for this system:

PSPTN 11.1 Belt filter press feed pumps

Sludge shall be extracted from the sludge sump and pumped to a series of 2 belt filter presses (1 duty, 1 stand-by) by means of two (1 duty, 1 stand-by) existing solids handling submersible pumps. The existing pumps will be fitted with new VSD's in the sludge sump with an **indicative duty** of 40 m³/hr at 10 m head to feed the belt filter presses and 108 m³/h at 8m head when pumping to the sludge dams.

Sludge shall be routed to each duty (1 max) belt filter press from a sludge feed ring main by means of motorised valves and flow meters with excess sludge being routed back to the sludge sump.

The pumps will be started/stopped based on a timer-basis or the level of the sludge sump and any one of the belt filter presses being operational.

PSPTN 11.2 Belt filter press washwater pumps

Washwater for the belt filter presses will be sourced from the 100 mm diameter uPVC pipeline installed from the Ozone contact tank to the dewatering facility. It is envisaged that two (1 duty, 1 standby) centrifugal pumps to be installed in the dewatering building shall have an **indicative duty** of 15 m³/hr at 80 m head and fitted with a 5 kW motors.

The pumps will be started/stopped based on a timer-basis or the level of the sludge sump and any one of the belt filter presses being operational.

PSPTN 11.3 Polymer dosing pumps

Poly-electrolyte will be dosed from one of two bulk storage/day tanks for the conditioning of un-

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watered sludge prior to being discharged onto the belt filter presses. The pumps shall be positive displacement units fitted with an envisaged 2.2 kW variable speed drive and dosage 0.5% max polymer solution up to 1 m³/hr. Each belt press shall be supplied with a dedicated dosing pump with 1 common standby unit i.e. 2 pumps in total.

PSPTN 12 PIPEWORK AND SPECIALS

All pipework supplied under the contract shall comply with Particular Specification PLN (Manufacture, supply and testing of steel pipes) as well as PLQ (Corrosion protection of steel pipes and fittings).

Valves and specials shall conform to the requirements of PLK (Manufacture and supply of valves).

Unless otherwise stated, the dimensions and drilling of flanges shall comply with the requirements of SABS 1123, Table 16 for pipes with a diameter of 150 mm and smaller and Table 10 for diameters exceeding 150 mm.

PSPTN 13 INSTRUMENTATION

All instrumentation supplied under the contract shall comply with Particular Specification PLP (Process Instrumentation).

Relevant instrumentation has been specified and measured under the electrical scope of works.

PSPTN 14 DESIGN CRITERIA AND REQUIREMENTS

The Contractor shall execute and submit the following design and technical documentation associated with this sludge dewatering system:

- a) General arrangement (GA) drawings for pipework, mechanical equipment installations and structural steel elements as required;
- b) Process and Instrumentation Diagrams (P&ID's) for the system as a whole.
- c) Technical and dimensional drawings of mechanical equipment.
- d) Performance documents for mechanical elements such as pump curves, dewatering equipment capacities and chemical dosing units.
- e) Electrical design documents and wiring diagrams;
- f) Functional Design Specification (FDS) for the system as a whole;
- g) As built drawings and Operation and Maintenance Manuals

The dewatering plant shall be designed to achieve the following minimum performance and the Contractor shall be expected to state where performance better than the minimum can be guaranteed. Such guaranteed figures shall be used to evaluate the proposed plant in terms of a life cycle costing in order to determine which supplier and design shall be implemented.

Minimum performance criteria:

Minimum dry cake solids concentration on a mass/mass basis:	10%
Maximum poly-electrolyte consumption:	7.0 kg/ton DS
Minimum solids capture:	95%

Any equipment offered that is not likely to achieve these minimum performance criteria will be rejected.

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PSPTN 15 MEASUREMENT AND PAYMENT

Measurement and payment will be done in accordance with the methods stated below:

	<i>Pay Item</i>	<i>Unit</i>
PSPTN 15.1	<u>Design, Drawings and General</u>	
	The tendered rate shall include for the submission of design calculation as well as the submission of quality assurance documentation, manufacturing and General Arrangement Drawings and P&IDs per Section 2, Design Requirements.	Sum
PSPTN 15.2	<u>Supply and Delivery to Site</u>	
	The rate tendered shall include for the ordering, manufacturing, factory applied corrosion protection, supply and delivery to site.	
PSPTN 15.2.1	Mechanical dewatering belt filter press complete, including flocculation tanks, in-line mixers, pressure transmitters, piping and valves;	No.
PSPTN 15.2.2	Belt filter press feed pumps, including all pipework, valves/fittings and instrumentation as described.	No.
PSPTN 15.2.3	Polyelectrolyte batching and dosing system complete with all pumps, pipework, batching tanks, flow meters, mixers, feeders etc as may be required to service all units;	Sum
PSPTN 15.2.4	All filtrate and washwater pipework as described. Although solids density meters and flow meters shall not be required on the filtrate line as a permanent installation, the Contractor shall make allowance for the supply and installation of such instruments to test the solids capture efficiency of the system during testing and commissioning.	Sum
PSPTN 15.2.5	Belt filter press washwater pumps, including all pipework, valves/fittings and instrumentation as described	No.
PSPTN 15.2.6	All sludge feed pipework and pumps, valves, 2(off) solids density meters, clamp-on ultrasonic flow meters as defined in terms of the applicable battery limits.	Sum
PSPTN 15.2.7	Sludge outloading equipment	Sum
PSPTN 15.2.8	7 cubic metres waste skip	Sum
PSPTN 15.3	<u>Installation</u>	
	The rate tendered shall include taking delivery of materials on site, handling, safeguarding, installing, painting, fixing, grouting as required.	
PSPTN 15.3.1	Mechanical dewatering belt filter press complete, including flocculation tanks, in-line mixers, pressure transmitters, piping and valves;	No.
PSPTN 15.3.2	Belt filter press feed pumps, including all pipework, valves/fittings and instrumentation as described.	No.

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PSPTN 15.3.3	Polyelectrolyte batching and dosing system complete with all pumps, pipework, batching tanks, flow meters, mixers, feeders etc as may be required to service all units;	No.
PSPTN 15.3.4	All filtrate and washwater pipework inside the dewatering building. Although solids density meters and flow meters shall not be required on the filtrate line as a permanent installation, the Contractor shall make allowance for the supply and installation of such instruments to test the solids capture efficiency of the system during testing and commissioning.	Sum
PSPTN 15.3.5	Belt filter press washwater pumps, including all pipework, valves/fittings and instrumentation as described	No.
PSPTN 15.3.6	All sludge feed pipework, valves, 2(off) solids density meters, clamp-on ultrasonic flow meters as defined in terms of the applicable battery limits	Sum
PSPTN 15.3.7	Sludge out loading equipment	Sum
PSPTN 15.3.8	7 cubic metres waste skip	Sum
PSPTN 15.4	<u>Commissioning and Trial Operation (refer to C3.4.1.24)</u> Rate tendered shall include for the dry and wet testing of the separate system components as well as the commissioning and trial operation of the complete system under full operating conditions.	
PSPTN 15.4.1	Testing, commissioning and trial operation of the complete Sludge Dewatering System	Sum

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PSPLT FLOW METERS

Each flow meter supplied under this contract shall be equipped with separate mountable signal converter unit complete with sufficient length of signal cable. The signal converter shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall furthermore have a LCD display for instantaneous flow and totalize flow and shall have a 4-20mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle.

PSPLT 1 CLAMP ON ULTRASONIC FLOW METERS

Clamp on Ultrasonic meters shall be supplied in the following areas:

- | | |
|-----------------------------|---------------|
| a) Raw water feed | (0 – 300 l/s) |
| b) Pre-ozone | (0 – 50 l/s) |
| c) Sludge feed to BFP | (0 – 30 l/s) |
| d) Wash water supply to BFP | (0 – 100 l/s) |

PSPLT 2 FLANGED MECHANICAL TURBINE FLOW METERS

Flanged mechanical meters shall be supplied in the following areas:

- | | |
|-------------------------|---------------|
| a) RGS Filters backwash | (0 – 300 l/s) |
| b) GAC Filters backwash | (0 – 300 l/s) |

PSPTP HOISTING EQUIPMENT

The following hoisting equipment is required:

Description		Max Load	Reference Drawing
a)	<u>Low Lift Pump Station:</u> Portal A - frame bolted to concrete floor complete with I-beam, trolley and chain hoist.	max load of 750kg	1890.08.OA.13.D002
b)	<u>Pre-Ozone Building:</u> I-beam fixed to ring beam with trolley and chain hoist.	max load of 1000kg	1890.08.SUF.16.D001 1890.08.SUF.16.D002
c)	<u>Dewatering Building:</u> Portal A - frame bolted to concrete floor complete with I-beam, trolley and chain hoist.	max load of 1500kg	1890.08.SUD.16.X002
d)	<u>GAC Filter:</u> I-beam fixed to beams with trolley and chain hoist.	max load of 1000kg	1890.08.FB.14.X002

The installation shall include the steel support structure, stop ends, crane beams, hoisting equipment and lifting tackle tested and certified to the specified capacity.

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RUSTENBURG WATER SERVICES TRUST

BID No RLM/RWST/OMM/0103/2024/25

RE-ADVERT: UPGRADE AND EXTENSION OF BOSPOORT WATER TREATMENT WORKS – MECHANICAL AND ELECTRICAL WORKS

C3.4 CONSTRUCTION SPECIFICATIONS

C3.4.3 CONSTRUCTION OF ELECTRICAL AND ELECTRONIC WORKS

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C3.4.3.1 VARIATIONS AND ADDITIONS TO PARTICULAR SPECIFICATIONS FOR ELECTRICAL AND ELECTRONIC WORKS (PROJECT SPECIFICATIONS)

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C3.4.3 PROJECT SPECIFICATIONS FOR ELECTRICAL AND ELECTRONIC WORKS

C3.4.3.1 VARIATIONS AND ADDITIONS TO PARTICULAR SPECIFICATIONS (PROJECT SPECIFICATIONS)

C3.4.4.1.1 STATUS OF SPECIFICATION

Clauses under this Section C3.4.3.1 should be read in conjunction with Particular Specifications for Electrical and Electronic Engineering Works which are numbered by adding a “PS” prefix to the numbering of the Particular Specification. As per example, any variation to the Particular Specification pertaining to Electrical: Motor Control Centres (EMCC) will be numbered “PS-EMCC” followed by the relevant clause number as detailed within the Particular Specifications.

Refer to Section C3.4.3.2 for the list of Particular Specifications as applicable to this project.

Additional project specifications not referring to particular specifications have been added at the end of the section. These will be number PSE1, PSE2 and PSE3 respectively if required.

The full extent of the Electrical and Electronic Engineering Works are specified on the Drawings, the General Clauses provided under section C3.4.1 and the Project Specifications included under section C3.4.3.1. Cognisance shall also be taken of the mechanical specifications included under sections C3.4.2. These documents shall be treated as mutually explanatory. However, should there be any ambiguity in the requirements stated therein, the priority of documents shall be (a) General Clauses (section C3.4.1); (b) Variations and Additions to Standard and Particular Specifications; (c) Particular Specifications, (d) Drawings and (e) Standard Specifications (if applicable).

The following Variations and Additions to the Standard and Particular Specifications will be applicable to this Contract.

PSEGEN.A ABBREVIATIONS

AI	Analogue Inputs
AO	Analogue Outputs
C&I	Control and Instrumentation
COC	Certificate of Compliance
CPU	Central Processing Unit
DB	Distribution Board
DI	Digital Input
DO	Digital Output
EC&I	Electrical, Control and Instrumentation
FT	Flow Transmitter
GA	General Arrangement
HMI	Human Machine Interface
LT	Level Transmitter
LV	Low Voltage
FDS	Functional Description Specification
FM	Flow Meter
MCC	Motor Control Center

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

MV	Medium Voltage
O&M	Operations & Maintenance
OHL	Overhead Line
PLC	Programmable Logic Controller
PST	Primary Settling Tank
PT	Pressure Transmitter
RCC	Regulatory Conformance Certificate
RIO	Remote I/O
SABS	South African Bureau of Standards
SLD	Single Line Diagram
SOW	Scope of Work
SST	Secondary Settling Tank
TB	Turbidity sensor
TT	Temperature Transmitter
VSD	Variable Speed Drive
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works
S/S	Substation
M/S	Miniature Substation

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSEGEN. B DESIGN AND DRAWINGS

The Contractor shall be responsible for the complete and detailed designs for all electrical equipment and installations required for the project. The general electrical specifications following hereafter shall serve as a basis for all designs and they set out the design requirements for the project as a whole. Any design work and drawings issued with the project specifications, are to be viewed as concept designs and have been prepared to serve as an extension of the specifications. They have also been prepared to assist with pricing of the project requirements. Drawings issued with this specification, shall also serve the purpose of setting a minimum drawing and documentation standard required for the project.

In the event of there being conflicting specifications between the specifications in this section with regard to mechanical equipment required and electrical control equipment specified, this must be brought to the attention of the Engineer not later than two weeks before the tender close, who will duly clarify the matter or issue an addendum in this regard.

All design work shall be backed up with detailed design calculations and these calculations shall be made available to the Engineer for checking and approval purposes.

The Contractor shall be responsible for the design, execution and completion of the Works in accordance with Clause 4.1 of the general conditions of contact. This shall include, inter alia, the compilation of the following:

- a. General arrangement (GA) drawings for all electrical and electronic installations as required.
- b. Process and Instrumentation Diagrams (P&ID's) for the system as a whole.
- c. Medium Voltage and low voltage coordination calculations and settings
- d. Motor List
- e. Instrumentation Lists
- f. Loop diagrams
- g. Cable schedules
- h. Technical and dimensional drawings of electrical and electronic equipment.
- i. Performance documents for electrical and electronic equipment such as medium voltage switchgear, soft starters, variable speed drives for proposed pumps etc.
- j. All equipment shall be submitted for approval.
- k. All data sheets shall be submitted for approval.

The Contractor may use the specified performance criteria for tender purposes. However, all equipment specifications and duties are to be checked and confirmed as correct prior to ordering any equipment. Clause 5.1 of the general conditions of contract shall apply in this regard.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSEGEN. C GENERAL

The contractor shall be responsible for the complete and detailed designs for all electrical equipment and installations required for the project. The general electrical specifications following hereafter, shall serve as a basis for all designs and they set out the design requirements for the project. Any design work and drawings issued with the project specifications, are to be viewed as concept designs and have been prepared to serve as an extension of the specifications. They have also been prepared to assist with pricing of the project requirements. Drawings issued with this specification, shall also serve the purpose of setting a minimum drawing and documentation standard required for the project.

All design work shall be backed up with detailed design calculations and these calculations shall be made available to the Engineer for checking and approval purposes.

When design drawings are produced for electrical switchboards a detailed circuit schematic shall be produced for every incomer, feeder or motor circuit. The provision of typical circuits shall not be accepted.

A protection and grading study shall be carried out for substation and according to the requirements of the particular specification.

C3.4.3.1.9 DETAILS OF CONTRACT – SCOPE OF WORK (SOW)

Bospoort Water Treatment Works (WTW) is situated about 20km north of Rustenburg. The WTW is in the process of being upgraded from 12MI/day to 24MI/day.

The Electrical and Control, Instrumentation scope of work for upgrading the process Infrastructure will include the following upgrades and additions to the plant, whereas the mechanical equipment will be supplied under the Mechanical scope of work. This equipment shall be integrated to the existing control system of the plant.

1. Additional chemical dosing equipment;
 - a. Ferric Chloride; and
 - b. Poly.
 - c. Small power and lighting
 - d. Earthing and lightning protection
 - e. Associated instrumentation
2. New flocculation channel and DAF tank equipment;
 - a. Saturator ; and
 - b. Compressor.
 - c. Small power and lighting
 - d. Earthing and lightning protection
 - e. Associated instrumentation

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

3. Rapid gravity sand filters equipment (Four (4) additional filters);
 - a. Raw water inlet valve actuator
 - b. Filtered water outlet valve actuator
 - c. Wash water inlet valve actuator
 - d. Wash water outlet valve actuator
 - e. Air Scour inlet valve actuator
 - f. Small power and lighting
 - g. Earthing and lightning protection
 - h. Associated instrumentation
4. Ozone contact tank equipment;
 - a. Three (3) low lift pump sets
 - b. Small power and lighting
 - c. Earthing and lightning protection
 - d. Associated instrumentation
5. Ozone building equipment;
 - a. Two (2) ozone generation units
 - b. Two (2) cooling water pump sets
 - c. Two (2) Nitrogen Bleed Compressors
 - d. Small power and lighting
 - e. Earthing and lightning protection
 - f. Associated instrumentation
6. Dewatering building equipment;
 - a. Two (2) belt presses
 - b. Small power and lighting
 - c. Earthing and lightning protection
 - d. Associated instrumentation
7. Filtrate sump equipment;
 - a. Two (2) filtrate pump sets
 - b. Small power and lighting
 - c. Earthing and lightning protection
 - d. Associated instrumentation
8. Hydrogen peroxide building equipment;
 - a. Two (2) hydrogen peroxide tanks
 - b. Two (2) dosing pumps.
 - c. Small power and lighting

Contractor

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Employer

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- d. Earthing and lightning protection
 - e. Associated instrumentation
9. GAC filter equipment (Six (6) additional filters)
- a. Inlet valve actuator
 - b. Clear water outlet valve actuator
 - c. Wash water inlet valve actuator
 - d. Wash water outlet valve actuator
 - e. Filter to waste valve actuator
 - f. Air scour valve actuator
 - g. Small power and lighting
 - h. Earthing and lightning protection
 - i. Associated instrumentation
10. Telemetry for Water Distribution
- a. Small power and lighting
 - b. Earthing and lightning protection
 - c. Telemetry System
 - d. Associated instrumentation

A detailed electrical design should be submitted by the Tenderer, including the following returnable documentation;

- MCC specifications and technical details
- Cable schedules
- Cable layouts
- O&M Manuals
- Technical schedules

Refer to the control and instrumentation section for the detailed list of required instrumentation.

A detailed C&I design should be submitted by the Tenderer, including the following returnable documentation;

- Loop diagrams
- Hoop-up diagram
- Logic diagrams
- Cable schedules
- O&M Manuals
- Instrument Index
- Cable layouts

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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- Piping and instrumentation diagrams
- C&I data sheets and technical schedules
- Control system philosophy
- Control system network layout
- RTU, instrumentation and communication specifications and technical details

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSERMU RING MAIN UNITS [RMU]

Substation as detailed below shall be provided with an 22kV ring main units as specified and in the standard specification for 22kV ring main units. There is one

PSERMU-1.1 Scope of Works

PSERMU-1.2 Current and Fault Ratings Limitations

Nominal system voltage	: 22kV
Rated impulse withstand voltage	: 125kV
Rated frequency	: 50Hz
Rated busbar current	: 630A
Rated breaking capacity	: 25kA for 3 seconds
Power frequency withstand voltage	: 50kV (r.m.s) minimum (sea level)
Number of busbars	: Single, 3 phase
Metal	: As per Particular Specification

PSERMU-1.3 Basic Construction

The switchgear assembly shall consist of free-standing dead-front steel structures containing circuit breaker compartments and circuit breakers, primary bus system, ground bus system, auxiliary compartments and control devices, control bus (as required) and connection provisions for primary, ground, and control circuits. All the parts of the switchboard shall be able to withstand any mechanical stresses, which may develop out of normal duty or during maximum short circuit conditions without any damage or distortion to any part. The instrument and relay panel shall form an integral part of the switchboard with all the instruments and protection relays flush mounted.

The switchboard shall be equipped with arc venting off venting system and front doors and panels shall be reinforced with special door locks to withstand explosion forces associated with maximum short circuit conditions. Panels shall be manufactured from steel with a minimum thickness of 2 mm.

Batteries and Charger Tripping Units [BTU] Additional for RMU

*New outdoor Battery tripping unit shall be supplied under this contract under a **provisional amount**. The DC batteries and charger units shall be supplied under this contract for the new RMU and shall receive a supply of electricity from the mains electrical supply in the substation. The unit shall be suitably sized for the RMU, with at least one additional panel additional spare capacity available for future upgrades must be catered for on the battery tripping unit. The DC Batteries shall be capable to last atleast 12 (twelve) hours [plus one additional spare panel must be catered for in the 12hours]. The battery charger shall be used for relays, power monitoring and Easener system and all communication from the generator to RMU and keep a stable supply voltage during switching. The batteries shall be Ni-Cad minimum and shall be so designed to keep the batteries cold in the steel enclosure. A **provisional amount has been allocated for this requirement. The write-up provides detailed information about the system.***

The following ring main units shall be provided under this contract, as listed in the Table below;

QTY	DESCRIPTION	LOCATION
1	The specified Ring Main Unit will be installed outdoors within a 3CR12 enclosure that is powder-coated in avocado green. A plinth will also be provided, and its cost is included in the price.	Existing Substation yard next to existing Rhino unit.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Ring main units offered under this contract must conform in full to the requirements of SANS. **OUTDOOR** type fitted fully sealed cable boxes and cable termination box.

Clamps for heat shrinkable medium voltage cable ends shall be provided in the medium voltage cable termination box.

All the bolts used to bolt the different parts of the panel together shall be provided with jack nuts or another approved method to secure the nuts. No Self-Tapping Screws Shall Be Allowed. All the bolts and nuts visible from the outside shall be chromed and of the dome type.

PSERMU-2.18.1 Current Transformers

PSERMU-2.18.1.A Generator / Eskom Ring Main Unit [RMU No.1]

QTY	DESCRIPTION	LOCATION
Two	Medium Voltage Panels comprising the following:	Generator Incomer and Eskom Incomer
1	Set 200/1A 15VA Class 10P10 current transformers for over current and earth fault protection [Tender shall select all components to preferred manufacturers]	Protection C.T's
One	Medium Voltage Panel comprising the following:	2000kVA feeder Rhino
1	Set 200/1A 15VA Class 10P10 current transformers for over current and earth fault protection [Tender shall select all components to preferred manufacturers]	Protection C.T's

PSERMU-2.18.3 Low Voltage Compartment [Protection]

PSERMU-2.18.3.A Generator / Eskom Ring Main Unit [RMU No.1]

QTY	DESCRIPTION	LOCATION
Three	Medium Voltage Panel comprising the following:	Generator Incomer, Rhino Feeder and Eskom Incomer
All	Self-Powered feeder protection Relay O/C and E/F plus O/C high sets relay. Protection Relay with settings between 15% and 200% for O/C and between 20% and 80% for E/F elements. The incomer / feeder protection shall come with the core balanced CT's and similar and equal to VIP410 relay. [Tender shall select all components to preferred manufacturers]	Relay
All	Additional power supply will be fed from UPS from the main PLC section.	All sub connections
All	The batteries and all systems. The voltage detection relay, load current indicator, voltage presence indicator, phase concordance unit, low voltage power transformers are all equipment to ensure that monitoring systems is active.	Additional equipment

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	LOCATION
All	Circuit Breaker motor mechanism, auxiliary Contacts, opening release and contacts.	
1	The meter shall be equal or similar to the METSEPM5560 - PM5560 Meter. The PowerLogic PM5000 will be connected to the PLC to closely monitor the system, ensuring proper activation of the generator and generator controller, as well as the load break when needed. The meter shall also be connected to the SCADA system, with all parameters displayed for real-time monitoring. The meters shall come complete with all equipment necessary and communication protocols to ensure operation: Plus	All
All	The RMU shall be equipment with equal or similar Easenery remote terminal unit, gateway, switch controller, low voltage monitoring, power supply for control monitoring separately mounted in outside of the unit.	
3	Ammeters with saturation C.T.'s [Tender shall select all components to preferred manufacturers]	CT's
1	Trip/neutral/close selector switch [Tender shall select all components to preferred manufacturers]	Selector switch
1	Local/Remote switch [Tender shall select all components to preferred manufacturers]	Local remote
All	Indication lights [Tender shall select all components to preferred manufacturers]	Indication
1	Front panel mounted "chicken switch" socket for switching of circuit breaker from a safe distance [Tender shall select all components to preferred manufacturers]	Chicken switch
Sum	ALL Incomers shall be fitted with medium voltage Dehnguard nominal discharge current of 10kA.	Surge Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMVS MEDIUM VOLTAGE SWITCHGEAR

PS EMVS-1 SCOPE OF WORKS

The existing Actom 22kV 6-way Rhino substation was installed at the Bospoort Water Treatment Works. The manufacturer's project details are recorded under CAD No.08171G13, or alternatively, drawing number DRG No. S.Z.0817.1.G1.01, completed on 08-06-05 with order number MS.0817.1. Of the six panels, four were utilized: 1 x incomer, 1 x voltage transformer, and 2 x 2MVA transformer feeders. As part of the plant's upgrade, this contract will include the provision of two additional circuit breakers, enabling the future completion of a ring configuration.

The installation of the new switchgear within the existing substation will necessitate a shutdown of the plant's main electricity supply. To minimize disruptions to plant operations, careful planning is required to keep outages to a minimum. The contractor must submit a detailed method statement for the shutdown, along with a comprehensive program, to the Engineer for approval before any work begins. Since the method statement requires client approval, it is the contractor's responsibility to submit it at the start of the contract.

Two outdoor metal-clad 22kV panels must be provided within the existing Rhino switchgear at the substation, including two ring incomer circuit breaker panels, in strict accordance with the relevant specifications. These panels must be similar to the existing medium-voltage switchgear already installed on-site.

Additionally, a new SF6 22kV 3CR12 enclosure will be installed to house a Ring Main Unit (RMU), which includes a 630Amp main incomer and two 630Amp circuit breakers. These breakers will serve as the main breaker from Eskom, the incomer from the generator, and the feeder to the existing Rhino unit.

PS EMVS-5 CURRENT AND FAULT RATINGS LIMITATIONS

Nominal system voltage	: 22kV
Rated impulse withstand voltage	: 125kV
Rated frequency	: 50Hz
Rated busbar current	: 630A
Rated breaking capacity	: 25kA for 3 seconds
Power frequency withstand voltage	: 50kV (r.m.s) minimum (sea level)
Number of busbars	: Single, 3 phase
Metal	: As per Particular Specification

PS EMVS-5.2 CIRCUIT BREAKER RATING

An allowance shall be made for two off new circuit breakers, rated at 630A, under the medium voltage section.

PS EMVS-8.3 CLOSING OF A CIRCUIT BREAKER

Motor wound spring assisted mechanisms shall be provided. Spring charging motors shall be operated off the 110V DC supply.

PS EMVS-8.9 INTERLOCKING AND SAFETY MECHANISMS

The two feeder panels shall be one duty and one standby unit and shall be electrical and mechanical interlocked to prevent parallel operation.

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PS EMVS-10 CURRENT TRANSFORMERS

The Incomer panel situated at the Rhino substation shall be equipped with the following:

QTY	LOCATION	DESCRIPTION
1	Rhino Substation Feeder	Replace existing Set 200/100/5A in incomer panel with a new Set 650//200A/5A 7.5VA Class CL.0.5 current transformers for metering.
1	Rhino Substation Feeder	Replace existing Set 200/100/5A in incomer panel with a new Set 650//200A/5A 15VA Class 10P10 current transformers for over current and earth fault protection.
1	Rhino Substation Feeder	Replace existing Maximum Demand ammeter with a new Maximum Demand ammeter scaled 0-650Amp
1	Rhino Substation Feeder	Replace existing selector switch with new Selector Switch.

The two off ring feeder panels situated at the Rhino substation shall be equipped with the following:

QTY	LOCATION	DESCRIPTION
2	Rhino Substation Feeder	Set 650/400/5A 7,5VA Class CL.0.5 current transformers for metering
2	Rhino Substation Feeder	Set 800/400/5A 15VA Class 10P10 current transformers for over current and earth fault protection
2	Rhino Substation Feeder	Maximum Demand ammeter scaled 0-800Amp
2	Rhino Substation Feeder	Selector Switch

PS EMVS-11 POTENTIAL TRANSFORMERS

The two off ring feeder panels situated at the Rhino substation shall be equipped with the following:

QTY	LOCATION	DESCRIPTION
2	Rhino Substation Feeder	200VA 22kV/110V Class 0.5 potential transformer and fuses for metering (If necessary)
2	Rhino Substation Feeder	Over voltage relay
2	Rhino Substation Feeder	Voltmeter selector switch
2	Rhino Substation Feeder	Voltmeter with suitable scale to measure phase-phase voltages.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMVS-14 CONTROL, INSTRUMENT AND RELAY PANELS

The outside of the panels shall be painted light grey.

PS EMVS-16 PROTECTION SYSTEM AND RELAYS

All the protection and control circuits on the feeder panels shall be suitable for operation from the existing 110V DC source.

The circuit breaker protection on the system shall be set for discrimination between the local authorities' protection system settings and local settings.

PS EMVS-16.A RHINO SUBSTATION FEEDER NO.1 & 2

The two off incomer panels equipped with the following equipment (Ring Feeder No.1&2):

QUANTITY	DESCRIPTION
1	Feeder Protection with Differential Protection Relay o/c and e/f plus o/c high sets relay equivalent to existing protection relays on similar equipment on site which is P543 MiCOM Series. The Feeder protection must come complete with battery box and and communication module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP
1	Trip circuit supervision relay equivalent to existing relays on similar equipment on site
3	Combined maximum demand and instantaneous ammeters with C.T.'s
1	Trip/neutral/close selector switch.
1	Local/Remote switch
All	Indication lights
1	Front panel mounted "chicken switch" socket for switching of circuit breaker from a safe distance
1	MCAA Frame Leakage relay
1	Front panel mounted LCD digital display supply network analyzer comprising of combined voltage, current, Maximum Demand power measurement and power factor unit equal and similar to existing power meter at substation.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMVS-21 MONITORING, CONTROL AND WIRING

The following functions shall be wired to the back of each panel for each circuit breaker and from there to an existing supervisory junction box for the monitoring of the following from the remote control centre:

- Breaker open
- Breaker closed
- DC voltage below 90 V
- Mechanism springs charged
- Mechanism springs discharged
- Spring charging motor tripped
- Protection device operated (individual indication per device)
- Event records must be added on the SCADA,
- Relay alarm conditions must be added on the SCADA,
- Relay trip conditions must be added on the SCADA,
- Fault records, the data which is recorded for any relevant fault,
- Measurement, IA, IB, IC, Harmonics and IAsym

PSEMVS-25 Batteries and Charger Tripping Units [BTU]

Batteries and Charger Tripping Units [BTU] Additional for RMU

*New outdoor Battery tripping unit shall be supplied under this contract under a **provisional amount**. The DC batteries and charger units shall be supplied under this contract for the new RMU and shall receive a supply of electricity from the mains electrical supply in the substation. The unit shall be suitably sized for the RMU, with at least one additional panel additional spare capacity available for future upgrades must be catered for on the battery tripping unit. The DC Batteries shall be capable to last atleast 12 (twelve) hours [plus one additional spare panel must be catered for in the 12hours]. The battery charger shall be used for relays, power monitoring and Easenary system and all communication from the generator to RMU and keep a stable supply voltage during switching. The batteries shall be Ni-Cad minimum and shall be so designed to keep the batteries cold in the steel enclosure. A provisional amount has been allocated for this requirement. The write-up provides detailed information about the system.*

PS EMVS-36 MISCELLANEOUS

The Contractor must supply and install the following substation accessories:

- Notices as required under the latest addition of the Occupational Health and Safety Act must be fixed to all gates and or doors of the substation.
- A rigid aluminium standard danger plate must be fixed to the outside of the substation yard gates.
- A line diagram of the MV distribution network supplied from the substation must be installed against the wall of the new MCC room inside a wooden frame with hinged glass door.
- The diagram shall be to the satisfaction of the Engineer but not smaller than 600 mm x 600 mm.

Contractor

Witness 1

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Employer

Witness 1

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- A first aid kit suitable for the treatment of cuts, burns and shock must be supplied and mounted against the wall near the entry door in the new substation room.

The equipment above must be allowed for under the measurement and payment items.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMSS MINIATURE SUBSTATIONS

PS EMSS-1 SCOPE OF WORKS

One miniature substation forms part of this tender and shall be supplied and installed under this contract. The miniature substation shall be installed in close proximity of the Ozone Building, exact location can be determined from the drawings.

The miniature substations should be supplied, installed and commissioned according to the following particular and project specifications. The ring main unit is specified under the ring main unit section and will be housed inside the miniature substation.

The tenderer shall allow for the following [refer to particular specification]:

- Enclosures shall be 3CR12 and shall be powder coated green avocado green.
- Refer to particular specification.
- Outdoor unit and the tenderer shall allow for plinth for each miniature substation.

PS EMSS-7 MV COMPARTMENT

The miniature substation with two 630Amp isolator units with fuses, 630Amp busbars and one SF6 200Amp gas circuit breaker transformer feeder complete with phase to phase, over current and earth fault protection. The isolators and circuit breaker of the ring main unit will be motorised and come complete as detailed in the particular specification.

The transformer feeder panel equipped with the following equipment:

PSERMU-2.18.1 Current Transformers

PSERMU-2.18.1.A Miniature Substation No.1 [M/S No.1]

QTY	DESCRIPTION	LOCATION
Two	Medium Voltage Panels comprising the following:	Miniature Substation Isolators – Incomer and Feeder
1	Refer to particular specification	Incomer and Feeder
One	Medium Voltage Panel comprising the following:	1000kVA 22kV / 400V Transformer Feeder
1	Set 100/1A 15VA Class 10P10 current transformers for over current and earth fault protection [Tender shall select all components to preferred manufacturers]	Protection C.T's

Contractor

Witness 1

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Employer

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Witness 2

QTY	DESCRIPTION	LOCATION
Two	Medium Voltage Panel comprising the following:	Incomer and Feeder Isolators – Incomer and Feeder
All	The isolators shall come complete with fuses and all equipment required to complete the installation in terms of the particular specifications	All
1	Trip/neutral/close selector switch [Tender shall select all components to preferred manufacturers]	Selector switch
1	Local/Remote switch [Tender shall select all components to preferred manufacturers]	Local remote
All	Indication lights [Tender shall select all components to preferred manufacturers]	Indication
1	Front panel mounted “chicken switch” socket for switching of circuit breaker from a safe distance [Tender shall select all components to preferred manufacturers]	Chicken switch
Sum	ALL Incomers shall be fitted with medium voltage equal and similar to Dehnguard nominal discharge current of 10kA.	Surge Protection
One	Medium Voltage Panel comprising the following:	1000kVA 11kV / 400V Transformer
All	Self-Powered feeder protection Relay O/C and E/F plus O/C high sets relay. Protection Relay with settings between 15% and 200% for O/C and between 20% and 80% for E/F elements. The incomer / feeder protection shall come with the core balanced CT's and similar and equal to VIP410 relay. [Tender shall select all components to preferred manufacturers]	Relay
3	Instantaneous ammeters with saturation C.T.'s [Tender shall select all components to preferred manufacturers]	CT's
1	Trip/neutral/close selector switch [Tender shall select all components to preferred manufacturers]	Selector switch
All	Voltage transformer to detect voltage	Voltage transformer
1	Local/Remote switch [Tender shall select all components to preferred manufacturers]	Local remote
All	Indication lights [Tender shall select all components to preferred manufacturers]	Indication
1	Front panel mounted “chicken switch” socket for switching of circuit breaker from a safe distance [Tender shall select all components to preferred manufacturers]	Chicken switch

PS EMSS-8 TRANSFORMER COMPARTMENT

The **1000kVA** miniature substations transformer shall have a no-load voltage ratio of **22kV/420/242V** with “off-load” tap changers with **±2.5%** and **±5%** taps. The transformer impedance should be as low as possible, **with values less than 5.1% deemed acceptable**.

Transformer windings are to be constructed from copper. In addition to the standard fittings detailed on Table 1 of SABS 780, the transformer must be provided with an oil-level gauge and oil drain plug.

Contractor

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Witness 2

Employer

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PS EMSS-9 LOW VOLTAGE COMPARTMENT

The following low voltage circuit breakers shall be provided in the low voltage compartments:

Fault level: 30kA

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	Distribution Section
1	1600Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays with automatic reset and all accessories: Plus	Main Circuit Breaker
Set	1600/5Amp continuous current rated current transformer: Plus	Current inputs
1	Ammeter scaled 0-1600Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Equal or similar to Power Logic PM870: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Power Analyser
4	1600Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	800Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses

Contractor

Witness 1

Witness 2

Employer

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker: Plus	Indicators for 3 Phase (Red , White and Blue Indications)
1	1250Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays adjusted to 1250Amp: Plus	Ozone Building
1	225Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays adjusted to 160Amp: Plus	Dewatering Building
1	100Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays adjusted to 100Amp: Plus	Hydrogen peroxide Building
1	100Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays adjusted to 100Amp: Plus	Existing MCC Building feed
1	63Amp continuous current rated TP distribution MCCB with electronic trip, monitoring relays adjusted to 63Amp: Plus	Lox Building
One	Panel comprising the following:	Area Lighting
1	63Amp continuous current rated TP MCCB with electronic trip, monitoring relays with automatic reset and all accessories: Plus	Area Lighting
Set	63/5Amp continuous current rated current transformer: Plus	Current inputs
1	Ammeter scaled 0-63Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Voltmeter	Voltmeter
1	7 Position Selector switch	R-W-B phase indication
1	80Amp continuous current rated TP Type 2 Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCCB: Plus	Area Lighting

Contractor

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
1	5Amp continuous current rated SP MCCB: Plus	Coil Protection
1	Digital Time switch equal and similar Schneider electric ITA digital with 100-hour standby capacity.	Digital Timer Switch

PS EMSS-11 INSTALLATION OF MINIATURE SUBSTATION

The miniature substation shall be installed on a concrete plinth in a position as indicated on the drawings supplied and installed under this contract. Around the transformer yard an earth ring must be placed by means of a 70mm² bare copper earth cable with 1m earth spikes until 1Ω is achieved. Contractor must allow for an earth resistivity test, drawings and documentation for approval by the engineer before placing the earth mat.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSEPPT POWER AND DISTRIBUTION TRANSFORMERS

PSEPPT -1 Scope Of Works

One [x1] 400V / 22000V transformer shall be supplied and installed under this contract. The Contractor shall make sure that the space provided for the transformers and plinth dimensions are sufficient for the transformers offered under this contract.

The Contractor shall provide three copies of drawings showing outline of the transformers. Because the Civil Works are done under a different Contract it is the responsibility of the Contractor to provide layout drawings within 4 weeks after appointment.

PSEPPT-2 Conditions Of Service

All transformers shall be suitable for outdoor installation and shall be equipped with low and medium voltage weatherproof cable end boxes and have adequate cooling for inside operation without forced ventilation.

Paint:	Painted in accordance with clause 4.17 of SANS 780.
Tank Bottom, Sides & Covers:	3CR12
MV Cable Box:	3CR12
LV Compartment:	3CR12
Radiator Tubes:	3CR12
Skid Base:	3CR12
Testing:	Accordance to SANS 780

The transformers shall be installed on level, steel-reinforced concrete plinths which shall be 100mm longer and wider than the transformers, and with a minimum thickness of 500mm. The plinths shall have bevelled corners and shall protrude 150mm above the finished ground level. The Contractor shall submit detail transformer drawings in AutoCAD for coordination in order for the Engineer can coordinate with Civil Contractor.

PSEPPT-7 Transformer Types

The following transformers shall be provided under this contract, as listed in the Table below;

QTY	DESCRIPTION	LOCATION
1	400V / 22kV, 2500kVA, Y / Δ 3 phase	Generator No.1 transformors [x1]

Transformers offered under this contract must conform in full to the requirements of SANS 780 for LOW LOSS POWER transformers of the sealed **OUTDOOR** type fitted with temperature sensor and cable termination box for temperature monitoring. Four identical bushings must be provided on the LV side.

The transformers shall have a no-load voltage ratio of 22kV/420/242V with "off-load" tap changers with plus and minus 2.5% and 5% taps. The transformer windings shall be constructed from copper with impedance as low as possible with values less than 5.1% deemed acceptable.

Contractor

Witness 1

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Employer

Witness 1

Witness 2

In addition to the standard fittings detailed on Table 1 of SANS 780, each transformer must be provided with the following;

- An oil-level gauge;
- Oil drain plug;
- Bolted tank cover;
- Transformers shall come complete with wheels,
- Instantaneous indicating and maximum registering thermometer; and
- Trip and Alarm contacts on the thermometer complete with axes and wheels.
- Buchholz relay Trip and Alarm contacts,
- Oil level Trip and Alarm contacts,

Outdoor type cable termination boxes shall be provided at the medium and low voltage bushings for outdoor transformer(s). Wooden clamps for heat shrinkable medium voltage cable ends shall be provided in the medium voltage cable termination box.

PSEPPT-11 Earthing

An earthing resistance survey shall be done at the location of each transformer yard and sufficient earthing installation shall be installed. All fences, gates and the transformer shall be connected to this earthing system.

An earth mat with a resistance of less than 1ohm must be supplied and installed by the successful contractor. The following items must be connected to the earth bar via 70 mm² Bare copper earth cable with crimped on lugs at both ends:

- The earth terminal of the transformers;
- The earth bar on the panel at the substation;
- The armour clamp on each cable end; and
- The neutral terminals on the LT side of the transformers.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC MOTOR CONTROL CENTRES AND DISTRIBUTION BOARDS

PS EMCC-1 SCOPE OF WORKS

Bidders shall allow for proper liaison with all other contractors to ensure proper functioning of all equipment supplied and installed for this project.

Should there be conflicting specifications between the specifications in this section with regard to mechanical equipment required and electrical control equipment specified this must be brought to the attention of the Engineer not later than one week before the tender close.

Distribution Boards shall be installed in the positions indicated on the drawings and shall comply with SANS 1765. Electrical Contractors are advised to order their distribution boards from a reputable manufacturer, as inferior boards will not be accepted. It shall further be noted that late approval of drawings and distribution boards due to non-compliance with the specification will not relieve the Electrical Contractor from his obligations to complete the installation according to programme. No claims for delays or extension of time in this regard will be entertained.

All equipment offered under this contract shall be selected to **be equal and similar of make** as far as possible. The tenderer shall provide equipment for motor starter panels that is at **least Type 2 coordinated**. If moulded case circuit breakers and miniature circuit breakers are cascaded, supportive documentation must be supplied with the tender and the tenderer shall allow for the proper labelling as required by SANS.

Motor control centres (MCC) and distribution boards (DB) as specified shall be provided in the following locations;

No.	DESCRIPTION	LOCATION
A	Raw Water Pumpstation Modifications to existing MCC	Raw Water Pumpstation
B	High Lift Pump No.1 – No.4 VFD Drives	Raw Water Pumpstation
C	Chemical Dosing Modifications to MCC	Chemical dosing Building
D	Ozone building MCC	Ozone building
E	RGSF Filters MCC	RGSF Filters building
F	RGSF FCP - (No.01 - No.04)	RGSF Filters building (Filter Galaray)
G	DAF tank MCC	DAF tank No.3
H	Dewatering Building MCC	Dewatering building
I	Belt filter Press Panel No. 1 & No. 2	Dewatering building
J	GAC MCC	GAC filters building
K	GAC FCP - (No.01 - No.06)	GAC filters building (galaray)
L	Hydrogen peroxide MCC	Hydrogen peroxide building

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.A MODIFICATIONS TO EXISTING MAIN MOTOR CONTROL CENTRE

Main MCC and Modifications for GAC Building Section and New DAF Tank (No. 3)

The main motor control centre (MCC) includes spare cubicles that should be used for the electrical feeds to the additional GAC building section and the new DAF Tank (No. 3).

An additional DAF recycle pump, two blowers, and modifications to the existing high lift pump and cubicles will be integrated into the MCC. The existing MCC, located on the 2nd basement level of the High Lift Pump Station, will require on-site modifications. These changes involve the removal of the current High Lift Pump cubicle equipment and converting it to variable frequency drive feeders. It is crucial that the three existing High Lift Pump cubicles remain fully operational during this process. The contractor must ensure that all three free-standing variable frequency drives and any other necessary equipment for the MCC modifications are secured before starting work. The installation of the converted cubicles must be carefully coordinated and programmed in conjunction with Plant Operations.

Plant shutdowns must be kept to a minimum, and method statements along with a detailed program must be submitted to the Engineer for approval before commencing any work. The program should outline each step of the contractor's planning, while the method statement must cover all installation work, testing, and commissioning of the new drives.

To minimize plant downtime, the contractor must complete modifications on one pump cubicle at a time, ensuring the new installation is fully operational for at least seven days before proceeding to the next pump cubicle. The defects liability period will begin once each modified pump cubicle is accepted by the Employer.

Type: The Indoor floor mounted with front access and busbars shall be top rear mounted.

Supply: Existing supply, no cables required.

Colour: Electric orange

Fault level: 35kA

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	GAC filter building feed
1	160Amp continuous current rated TP MCCB: Plus	Main Feed to Main MCC
One	Panel comprising the following:	DAF building feed
1	100Amp continuous current rated TP MCCB: Plus	Additional breaker in the existing Main MCC
One	Panel comprising the following:	Incomer
1	160Amp continuous current rated TP MCCB complete with opening/closing release and sufficient auxiliary contacts (setting set to 160Amp) including electronic trip unit and: Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
1	Relay for undervoltages, phase sequence, and phase loss in three phase.	Protection relay
Set	160/5Amp continuous current rated current transformer: Plus	Current inputs
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	<p>Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Equal or similar to Power Logic PM870: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Accessories For Air Circuit Breaker
4	160Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	80Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
Two	Panel comprising the following:	Backwash Pump No.1 – No.2

Contractor

Witness 1

Witness 2

Employer

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QTY	DESCRIPTION	IDENTIFICATION
All	The Contractor shall be responsible for the complete removal of the existing cubicle, including all internal components and equipment. This involves removing the backplane, accessories, circuit breakers, starters, relays, timers, and any other equipment housed within the panel. Additionally, the Contractor is required to remove the front panel door and replace it with a new front panel door, powder-coated in orange to match the existing color. It is the Contractor's responsibility to visit the site to fully assess and establish the entire scope of work necessary for the removal of both the internal equipment and the panel doors. This site visit is crucial to ensure that all aspects of the removal are properly understood and accounted for before proceeding with the work. Replace with all with the following equipment, listed below:	All
1	30kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated core balanced current transformers: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	<p>30kW three phase heavy duty vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included, EMC filter, line choke motor chokes and sinus filters all shall be inclusive.</p> <p>The following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> • Thermal • Output Phase loss • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation 	Variable frequency drive

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Under current (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	
All	A separate door mountable display and programming control unit shall be front door mounted.	Separate display unit for VSD Drives with all parameters
All	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Communication module for VSD
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive fans supply
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for Variable Speed
All	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset (If provided on pump sets)
All	Thermistor relay: Plus	(If provided on pump sets)
All	Thermistor trip indication: plus	(If provided on pump sets)
All	Thermistor reset button: Plus	(If provided on pump sets)
1	Running hour meter: Plus	Running Hour Meter
All	All equipment necessary for remote emergency stop device	All
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions

Contractor

Witness 1

Witness 2

Employer

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Continuous current rated Ammeter: Plus	Heater ammeter
All	All equipment necessary for remote emergency stop device	All necessary equipment
All	Relays and auxiliary contacts necessary for:	
All	Refer to Common Control cubicle	Refer to common control
One	Cubicle comprising the following: [Common Control - Backwash Pump No.1 – No.2]	Backwash Pump No.1 – No.2
1	10Amp sized continuous current rated SP + N door interlocked MCB: Plus	Main Circuit Breaker
1	Manual – Off - Auto selector switch: Plus	Selector Switch
1	Backwash will be operated as One duty and One standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	The following Indication lights (LED type); Red – 'Motor Stopped'; Green - 'Motor Running'; Yellow – 'Motor Tripped': Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary for the following	
All	Interlocking with emergency stop stations on all motors to lockout main circuit breaker, if emergency stop is pressed the standby pump must automatically start: Plus	All motors shall have E-Stops
All	Interlock timer & relays to limit starts per hour, per the manufacturer's requirements, predetermined starts per hour allowed: Plus	Starts per Hour

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
All	Interlock motor sets as One duty and One standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.
All	Extraction fans in panel door for cooling in accordance with manufacturers specifications. If the Fans do not work in manual as well as automatic mode of operation, the start shall be interlocked to not to be able to start. Unhealthy status will displayed on indication: Plus	Extraction fan interlocks
All	Interlock pump in manual as well as automatic mode of operation with level control system. A predetermined low level will stop the pump: Plus	Level protection
All	Interlock motor with pressure sensors in common delivery and common suction pump line in automatic mode of operation. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. If a predetermined pressure is not obtained the duty motor sets, will stop and will ramp down. During start up and shut down this function must be bypassed for a predetermined period. Motor sets will only be able to start once pressure trip has been manually been reset: Plus	Pressure sensors
All	Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time: Plus	No-flow sensor
All	All RTD sensors shall be interlocked in manual and in automatic mode of operation to protect motors.	RTD Protection
All	Interlock all predetermined temperature settings in manual and auto mode of operation. The temperature settings shall be as per the manufacturer's recommendations: Plus	If supplied by mechanical Contractor - Temperature Protection
All	All Interlocks as described under operation of plant [PSEPLC-15]	Additional interlocks and writeup
All	Remote stop/start of backwash water pumps at filter plant control consoles in the event of a PLC communication failure and manual starting and stopping: Plus	Manual Starting capability
All	All motor/pump information and signals statuses shall be available on the PLC system: Plus.	Signals statuses
Two	Panel comprising the following:	Blowers No.1 – No.2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
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QTY	DESCRIPTION	IDENTIFICATION
All	The Contractor shall be responsible for the complete removal of the existing cubicle, including all internal components and equipment. This involves removing the backplane, accessories, circuit breakers, starters, relays, timers, and any other equipment housed within the panel. Additionally, the Contractor is required to remove the front panel door and replace it with a new front panel door, powder-coated in orange to match the existing color. It is the Contractor's responsibility to visit the site to fully assess and establish the entire scope of work necessary for the removal of both the internal equipment and the panel doors. This site visit is crucial to ensure that all aspects of the removal are properly understood and accounted for before proceeding with the work. Replace with all with the following equipment, listed below:	All
1	37kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated core balanced current transformers: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	37kW (3) phase heavy duty vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included, EMC filter, line choke motor chokes and sinus filters all shall be inclusive. The following minimum protection parameters shall be available on the Variable frequency drive: <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Locked rotor • Phase rotation • Under current 	Variable frequency drive

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	(Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	
All	A separate door mountable display and programming control unit shall be front door mounted.	Separate display unit for VSD Drives with all parameters
All	Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Communication module for VSD
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive fans supply
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for Variable Speed
All	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset (If provided on pump sets)
All	Thermistor relay: Plus	(If provided on pump sets)
All	Thermistor trip indication: plus	(If provided on pump sets)
All	Thermistor reset button: Plus	(If provided on pump sets)
1	Running hour meter: Plus	Running Hour Meter
All	All equipment necessary for remote emergency stop device	All
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply

Contractor

Witness 1

Witness 2

Employer

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QTY	DESCRIPTION	IDENTIFICATION
1	Continuous current rated Ammeter: Plus	Heater ammeter
All	Relays and auxiliary contacts necessary for:	
All	Refer to Common Control cubicle	Refer to common control
One	Cubicle comprising the following: [Common Control - Blowers No.1 – No.2]	Blowers No.1 – No.2
1	10Amp sized continuous current rated SP + N door interlocked MCB: Plus	Main Circuit Breaker
1	Manual – Off - Auto selector switch: Plus	Selector Switch
1	Blowers will be operated as One duty and One standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	The following Indication lights (LED type); Red – 'Motor Stopped'; Green - 'Motor Running'; Yellow – 'Motor Tripped: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary for the following	
All	Interlocking with emergency stop stations on all motors to lockout main circuit breaker, if emergency stop is pressed the standby pump must automatically start: Plus	All motors shall have E-Stops
All	Interlock timer & relays to limit starts per hour, per the manufacturer's requirements, predetermined starts per hour allowed: Plus	Starts per Hour
All	Interlock motor sets as One duty and One standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.

Contractor

Witness 1

Witness 2

Employer

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
All	Extraction fans in panel door for cooling in accordance with manufacturers specifications. If the Fans do not work in manual as well as automatic mode of operation, the start shall be interlocked to not to be able to start. Unhealthy status will displayed on indication: Plus	Extraction fan interlocks
All	Interlock motor with pressure sensors in common delivery and common suction pump line in automatic mode of operation. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. If a predetermined pressure is not obtained the duty motor sets, will stop and will ramp down. During start up and shut down this function must be bypassed for a predetermined period. Motor sets will only be able to start once pressure trip has been manually been reset: Plus	Pressure sensors
All	All RTD sensors shall be interlocked in manual and in automatic mode of operation to protect motors.	RTD Protection
All	Interlock all predetermined temperature settings in manual and auto mode of operation. The temperature settings shall be as per the manufacturer's recommendations: Plus	Temperature Protection
All	All Interlocks as described under operation of plant [PSEPLC-15]	Additional interlocks and writeup
All	Remote stop/start of blowers at filter plant control consoles in the event of a PLC communication failure and manual starting and stopping: Plus	Manual Starting capability
All	All motor/pump information and signals statuses shall be available on the PLC system: Plus.	Signals statuses
Four	Panel comprising the following:	DAF Recycle No.1 – No.4
All	The Contractor shall be responsible for the complete removal of the existing cubicle, including all internal components and equipment. This involves removing the backplane, accessories, circuit breakers, starters, relays, timers, and any other equipment housed within the panel. Additionally, the Contractor is required to remove the front panel door and replace it with a new front panel door, powder-coated in orange to match the existing color. It is the Contractor's responsibility to visit the site to fully assess and establish the entire scope of work necessary for the removal of both the internal equipment and the panel doors. This site visit is crucial to ensure that all aspects of the removal are properly understood and accounted for before proceeding with the	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	work. Replace with all with the following equipment, listed below:	
1	22kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated core balanced current transformers: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	22kW (3) phase heavy duty vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included, EMC filter, line choke motor chokes and sinus filters all shall be inclusive. The following minimum protection parameters shall be available on the Variable frequency drive: <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Locked rotor • Phase rotation • Under current (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Variable frequency drive
All	A separate door mountable display and programming control unit shall be front door mounted.	Separate display unit for VSD Drives with all parameters
All	Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: <ul style="list-style-type: none"> a) Profibus-DP b) Profinet 	Communication module for VSD

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus	
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive fans supply
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for Variable Speed
All	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset (If provided on pump sets)
All	Thermistor relay: Plus	(If provided on pump sets)
All	Thermistor trip indication: plus	(If provided on pump sets)
All	Thermistor reset button: Plus	(If provided on pump sets)
1	Running hour meter: Plus	Running Hour Meter
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Continuous current rated Ammeter: Plus	Heater ammeter
All	All equipment necessary for remote emergency stop device	All
All	Relays and auxiliary contacts necessary for:	
All	Refer to Common Control cubicle	Refer to common control
One	Cubicle comprising the following: [Common Control - DAF Recycle No.1 – No.4]	DAF Recycle No.1 – No.4
1	10Amp sized continuous current rated SP + N door interlocked MCB: Plus	Main Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Manual – Off - Auto selector switch: Plus	Selector Switch
1	DAF Recycle will be operated as three duty and One standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary for the following	
All	Interlocking with emergency stop stations on all motors to lockout main circuit breaker, if emergency stop is pressed the standby pump must automatically start: Plus	All motors shall have E-Stops
All	Interlock timer & relays to limit starts per hour, per the manufacturer's requirements, predetermined starts per hour allowed: Plus	Starts per Hour
All	Interlock motor sets as Three duty and One standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.
All	Extraction fans in panel door for cooling in accordance with manufacturers specifications. If the Fans do not work in manual as well as automatic mode of operation, the start shall be interlocked to not to be able to start. Unhealthy status will displayed on indication: Plus	Extraction fan interlocks
All	Interlock pump in manual as well as automatic mode of operation with level control system. A predetermined low level will stop the pump: Plus	Level protection
All	The pumps must be operated to keep a required pressure at the discharge of the Saturator regardless of flow. The Recycle system shall automatically start the required duty pump to keep the required pressure in the system. The system must ensure a minimum of pressure surges when starting and stopping pumps by ramping the pumps in according to required demand via a VFD. The system shall	Pressure Control

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
	incorporate a soft pressure build up (i.e. one pump shall start at a time ramping up to the required demand).	
All	Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time: Plus	No-flow sensor
All	All RTD sensors shall be interlocked in manual and in automatic mode of operation to protect motors.	RTD Protection
All	Interlock all predetermined temperature settings in manual and auto mode of operation. The temperature settings shall be as per the manufacturer's recommendations: Plus	Temperature Protection
All	Interlock with common delivery pipeline actuator in automatic mode of operation to only open once an predetermined pressure has been obtained by the pressure sensor. The predetermined pressure shall be interlocked with the opening of the actuator: Plus	Actuator interlocks
All	All Interlocks as described under operation of plant [PSEPLC-15]	Additional interlocks and writeup
All	Remote stop/start of Recycle pumps at DAF control consoles in the event of a PLC communication failure and manual starting and stopping: Plus	Manual Starting capability
All	All motor/pump information and signals statuses shall be available on the PLC system: Plus.	Signals statuses
Four	Panel comprising of the following:	High Lift Pump 1A, 1B, 2A & 2B
All	Change the wording of all name plates from High Lift Pump 1A, 1B, 2A & 2B to High Lift Feeder 1A, 1B, 2A & 2B: Plus	Panel Name Changes
All	Remove all internal equipment including back plane, accessories, circuit breakers, starters, relays, timers and all equipment inside the panel. It is the Contractors responsibility to visit the site and to establish the entire scope of work required for the removal of equipment: Plus	Removal of all equipment
All	Remove the front panel door and allow for new powered coated orange [same colour as existing] 2mm mild steel front panel door. Contractor's responsibility to visit the site and to establish the entire scope of work required for the removal of panel doors: Plus	Remove and replace
1	355kW continuous current rated TP door interlocked motor protection MCCB [thermal magnetic] with opening / closing	High Lift Pump feeders 1A, 1B, 2A & 2B

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	release contacts including adjustable electronic trip relay. The motor circuit breaker shall be IEC 60947 certified and shall have type 2 coordinated capabilities complete spreaders, door interlock and all accessories: Plus	
3	650/1 Amp continuous current rated current transformers: Plus	Local current
1	Ammeter scaled 0-650Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
1	Digital Running hour meter: Plus	Running Hour Meter
1	Pump sets will be operated as two duty and two standby units. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate the duty cycle between duty pump sets and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
1	Starting delay timer for sequence starting on motors: Plus	Sequence starting
6	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8-character two line display unit. A "lock" facility shall permit browsing of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display: Plus	All protection to be monitored for example; temperature DE, NDE, and vibration etc.
1	Indication light that shows trip indication of compressor pressure sensor: Plus	Pressure trip Indication light
1	Thermistor relay: Plus	Thermistor Relay
1	Thermistor trip indication: plus	Thermistor indication light
1	Thermistor reset button: Plus	Thermistor reset button
1	Resettable Running hour meter: Plus	Running Hour Meter

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
1	10Amp continuous current rated SP MCB cascaded with main circuit breaker: Plus	Heater supply
1	Ammeters scaled 0-10Amp: Plus	Heater ammeter
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start delay timer during start-up
1	Indication light that shows trip indication of high lift pressure sensor: Plus	Pressure trip Indication light
1	Reset push button for Pressure trip condition: Plus	Pressure trip reset button
1	No-Flow delay timer to prevent pump set to trip during start-up: Plus	Start delay timer during start-up
1	Indication light that shows trip indication of high lift No-Flow sensor: Plus	No-Flow trip Indication light
1	Reset push button for No-flow trip condition: Plus	No-Flow reset button
1	High performance surface mounted strobe and siren combination for pre-starting conditions warning equal or similar to 855H High performance from Allen Bradley: Plus	Pre-Start Siren & Strobe
1	Pre-Start delay timer to prevent pump sets from starting until Pre-Start Siren and Strobe finished: Plus	Start Delay timer during start-up
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Interlocks which include all relays and auxiliary contacts which are necessary and required as described below:	Relays, timers and interlocks
All	Interlock timer shall be provided for duty rotation after a 24-hour period of time [this will be confirmed as one set of pumps must operate more than the others]. Timer will be disabled in the event when motor is out of commission: Plus	Duty rotation for timer
All	Interlock with emergency stop to trip and lock out the starter, available standby pump set to become duty pump set : Plus	Emergency stop

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus	Delay for automatic starting
All	Interlock pump set in manual as well as automatic mode of operation with level control system. A predetermined low level will stop the duty motor sets and a predetermined high level will start the duty motor sets: Plus	Bospoort Magalies Water Reservoir Level
All	Interlock motor sets as two duties and two standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.
All	Extraction fans in panel door for cooling of soft starter in accordance with manufacturers specifications. If the Fans do not work in manual as well as automatic mode of operation, the motor must interlocked not be able to start. Unhealthy status will displayed on indication: Plus	Extraction fan interlocks
All	Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time: Plus	No-flow sensor
All	Interlock motor with pressure sensors in common delivery and common suction pump line in automatic mode of operation. Predetermined low pressure will stop the duty motor sets and predetermined high pressure will stop the duty motor sets. If a predetermined pressure is not obtained the duty motor sets, will stop and will ramp down. During start up and shut down this function must be bypassed for a predetermined period. Motor sets will only be able to start once pressure trip has been manually been reset: Plus	Pressure sensors
All	Interlock high lift pump sets [train] with strobe and siren in automatic and manual mode of operation. Siren and strobe will sound for predetermined time. Automatic and manual mode of operation will be that the siren and strobe will first be finished, and normal starting procedure will occur: Plus	Pre-start siren and strobe
All	Interlock with common delivery pipeline actuator in automatic mode of operation to only open once an predetermined pressure has been obtained by the pressure sensor. The predetermined pressure shall be interlocked with the opening of the actuator: Plus	Actuator interlocks
All	All RTD sensors shall be interlocked in manual and in automatic mode of operation to protect motors.	RTD Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025



QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.B HIGH LIFT MOTOR CONTROL CENTRE– FOUR FREE STANDING VARIABLE FREQUENCY DRIVES [X4]

Type: The floor standing variable speed drives shall be of the free-standing floor mounted type with a floor minimum IP rating of 42.

The compact enclosure IP42 equipping the variable frequency drive must supplied ready-assembled facilitate installation and setup and, in particular optimum ventilation. The Enclosure shall come complete fan to integrated with a drive ventilation.

The enclosure shall complete with a air intake is via a grille on the lower part of the enclosure door and Air outlet via a metal cover with protection against water splashes on the enclosure roof. The design of the free-standing variable frequency drive shall be so designed to prevent any internal turbulence. The incoming air temperature must be between 0°C and 40°C and internal temperature is monitored by a thermostat which can shut down the equipment.

Supply: 1 x 185mm² 4C Cu PVC SWA PVC cable plus 1 x 185mm² 4C Cu PVC SWA PVC cable plus 1mm² x 12pr twisted PVC SWA PVC (individually and overall screened) from existing main motor control center to the VFD .

1 x 185mm² 4C Cu PVC SWA PVC cable plus 1 x 185mm² 4C Cu PVC SWA PVC cable plus 1mm² x 12pr twisted PVC SWA PVC (individually and overall screened) from VFD to motor.

Colour: As per manufacturer details

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
Four	Cubicles comprising of the following:	High Lift Pump No.1 – No.4
1	355kW continuous current rated TP door interlocked motor protection MCCB [thermal magnetic] with opening / closing release contacts including adjustable electronic trip relay. The motor circuit breaker shall be IEC 60947 certified and shall have type 2 coordinated capabilities complete spreaders, door interlock and all accessories. door interlock and all accessories. (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Variable Speed Drive Tier Main Breaker
Set	Continuous current rated current transformers: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	<p>355kW (3) phase heavy duty vector control variable frequency drive completes with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. The variable speed drive shall come complete with braking, resistors, line chokes, filters, additional EMC input filters and all necessary harmonic sinus filters all shall be inclusive.</p> <p>The following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Locked rotor • Phase rotation • Under current • Metering • Communication Module: Plus <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following [Network Communications]:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p> <p>(Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus</p>	Variable Speed Drive
1	6Amp continuous current rated SP MCB: Plus	Ventilation fans supply
1	A separate door mountable display control unit and programming control unit shall be front door mounted which connected to protection relay. The following features shall be available on the display / HMI as listed below:	Separate display unit for VSD Drives with all parameters

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Were possible all Indication lights as specified under particular specification shall be displayed on the door mounted display unit: Plus Running hour meter shall be displayed on the door mounted display: Plus Local / Remote Selection push button: Plus Run / Stop push button: Plus Reset push button: Plus All Protection settings / faults and alarms shall be displayable on the display control unit: Plus All setting which are available on the motor manager shall be displayable on the display unit: Plus All settings of starter shall be sent to engineer for approval and shall be programmed during commissioning by Contractor: Plus Communication module: Plus <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following [Network Communications]:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	
6	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8-character two-line display unit. A "lock" facility shall permit browsing of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display: Plus	All protection to be monitored for example, temperature DE, NDE, and vibration etc.
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for variable frequency drive
1	10Amp continuous current rated SP MCB cascaded with main circuit breaker: Plus	Heater supply

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Ammeters scaled 0-10Amp: Plus	Heater ammeter
1	No-flow and Pressure delay timer to prevent pump set to trip during start-up: Plus	Start delay timer during start-up
1	Indication light that shows trip indication of pressure sensor and No-flow: Plus	Pressure trip Indication light
1	Reset push button for Pressure and no-flow trip condition: Plus	Pressure trip reset button
1	High performance surface mounted strobe and siren combination for pre-starting conditions warning: Plus	Pre-Start Siren & Strobe
1	Pre-Start delay timer to prevent pump sets from starting until Pre-Start Siren and Strobe finished: Plus	Start Delay timer during start-up
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Interlocks which include all relays and auxiliary contacts which are necessary and required as described below:	Relays, timers and interlocks
All	All accordance to the common control cubicle.	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EMCC-6.C CHEMICAL DOSING MOTOR CONTROL CENTRE ADDITION

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 42 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 1 x 16mm² 4core PVC SWA PVC cables plus a 1 x 10mm² bare copper earth cable (galvanised steel wires that are braided-interwoven) from the main intake substation

Colour: Electric orange

Fault level: 25kA

Figure 1: Additional tier to existing Chemical dosing MCC

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	Incomer Section
1	63Amp continuous current rated TP MCCB complete with opening/closing release and sufficient auxiliary contacts (setting set to 63Amp) including electronic trip unit and : Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Relay for undervoltages, phase sequence, and phase loss in three phase.	Protection relay
Set	80/5Amp continuous current rated current transformer: Plus	Current inputs
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	<p>Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> e) Profibus-DP f) Profinet g) Industrial Ethernet h) Modbus TCP/IP <p>Equal or similar to Power Logic PM870: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Accessories For Air Circuit Breaker
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
One	Panel comprising the following:	Additional Poly Dosing Pump

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	0.37kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor) : Plus	Main Circuit Breaker
1	<p>0.37kW (3) phase vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included including EMC filter, line choke motor chokes and sinus filters (as deem necessary per installation) (Estimated and should be confirmed with mechanical contractor)</p> <p>The following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation • Under current • Torque detection <p>: Plus</p>	Variable frequency drive
1	A separate door mountable LCD display and programming control unit shall be front door mounted.	Separate LCD display unit for VSD
1	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Communication module for VSD
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive Ventilation fans supply
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
1	Reset push button for pump casing temperature trip condition, thermister reset button & Diaphragm reset button: Plus	Pump casing temperature trip, thermister reset & Diaphragm reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Pump diaphragm faulty indicator light if monitoring function is part of pump set: Plus	(If provided on pump sets)
All	EMC Line Filter	
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
All	All equipment necessary for remote emergency stop device	All
1	Pump sets will be operated as three duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24 hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump : Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system. A predetermined low level will stop the duty motor and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock Dosing Pump Sets as three duties and one standby unit. Bospoort Plant have three existing Dosing Pump Sets No.1-No.3 which is interlocked as two duties and one standby, the contractor shall change the current interlock from two duties and one standby to three duties and one standby units. 	
	<ul style="list-style-type: none"> Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications 	
	<ul style="list-style-type: none"> Interlock with raw water flow to stop all dosing functions when raw water flow stops 	
	<ul style="list-style-type: none"> Automatic dosing shall be based on predetermined raw water flow rate. 	
One	Panel comprising the following:	Additional Ferric Chloride (FeCl) Dosing Pump
1	0.37kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	0.37kW (3) phase vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included including EMC filter, line choke motor chokes and sinus filters (as deem necessary per installation) (Estimated and should be confirmed with mechanical contractor) The following minimum protection parameters shall be available on the Variable frequency drive: <ul style="list-style-type: none"> Thermal 	Variable frequency drive

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Output Phase loss Input phase loss Drive overheat Over voltage Under voltage Frequency meter Locked rotor Phase rotation Under current Torque detection : Plus	
1	A separate door mountable LCD display and programming control unit shall be front door mounted.	Separate LCD display unit for VSD
1	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Communication module for VSD
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive Ventilation fans supply
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
1	Reset push button for pump casing temperature trip condition, thermister reset button & Diaphragm reset: Plus	Pump casing temperature trip, thermister reset & Diaphragm reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Pump diaphragm faulty indicator light if monitoring function is part of pump set: Plus	(If provided on pump sets)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	EMC Line Filter	
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
All	All equipment necessary for remote emergency stop device	All
1	Pump sets will be operated as three duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24 hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump : Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock Dosing Pump Sets as three duties and one standby unit. Bospoort Plant have three existing Dosing Pump Sets No.1-No.3 which is interlocked as two duties and one standby, the contractor shall change the current interlock from two duties and one standby to three duties and one standby units. 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications 	
	<ul style="list-style-type: none"> Interlock with raw water flow to stop all dosing functions when raw water flow stops 	
	<ul style="list-style-type: none"> Automatic dosing shall be based on predetermined raw water flow rate. 	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EMCC-6.D OZONE BUILDING MOTOR CONTROL CENTRE

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 42 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 5 x 240mm² 4core PVC SWA PVC cables in parallel plus a 5 x 70mm² Bare copper earth cable (galvanised steel wires that are braided-interwoven) from the miniature substation.

Colour: Electric orange

Fault level: 25kA

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	1250Amp continuous current rated TP draw out type air circuit breaker complete with opening/closing release and	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	sufficient auxiliary contacts (setting set to 1000Amp) including electronic trip unit and : Plus	
1	Control unit and display unit with adjustable overload and short circuit protection with time discrimination and earth fault equal or similar to micrologic 6A from Schneider Electric: Plus:	Accessories For Air Circuit Breaker
1	Electrical operating mechanism for remote closing of circuit breaker, 231V AC operation: Plus:	Accessories For Air Circuit Breaker
1	Separate panel mounted circuit breaker close push button: Plus	Accessories For Air Circuit Breaker
1	Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Communication Module
1	Relay for under voltages, phase sequence, and phase loss in three phases: Plus	Protection relay
Set	1600/5Amp continuous current rated current transformer: Plus	Current inputs
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet	Accessories For Air Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	d) Modbus TCP/IP Equal or similar to Power Logic PM870: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	
4	1600Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	800Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
One	Panel comprising the following:	Low Voltage Distribution
1	100Amp continuous current rated TP MCCB: Plus	RGS Filter building
1	80Amp continuous current rated TP MCCB: Plus	Ozone Contact Tank
1	100Amp continuous current rated TP MCCB: Plus	DAF Building
1	400Amp continuous current rated TP MCCB: Plus	Dewatering Building Building
1	100Amp continuous current rated TP MCCB: Plus	Existing MCC
2	0,37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Cooling Water Actuator 01-02
All	0,37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Actuator Valve (TBC)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	0,37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Nitrogen Bleed Compressor Actuator Valve (TBC)
2	1.1kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Actuator 01-02 (TBC)
1	0.37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Solenoid Valve 01 (TBC)
1	0.37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Purge Valve 01(TBC)
4	2.2kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Extraction Fans (No.1-No.4)
4	2.2kW Type 2 Coordination Direct-on-line motor starter: Plus	Extraction Fans Starter Extraction Fans (No.1-No.4)
1	Extraction Fan Controller to regulate all fans in the Ozone Building: Plus	Extraction Fans (No.1-No.4) Controller.
2	2.2kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Front Extraction Fans (No.1-No.4)
2	2.2kW Type 2 Coordination Direct-on-line motor starter: Plus	Front Extraction Fans Starter Extraction Fans (No.1-No.2)
3	10Amp continuous current rated SP MCCB: Plus	Ozone Kiosk No.1-3
6	10Amp continuous current rated SP MCCB: Plus	Drain point controllers
2	10Amp continuous current rated SP MCCB: Plus	Dryer controllers
2	10Amp continuous current rated SP MCCB: Plus	Dew point analyzers
2	10Amp continuous current rated SP MCCB: Plus	Ozone generator ozone concentration
1	10Amp continuous current rated SP MCCB: Plus	Leak detector

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
6	10Amp continuous current rated SP MCCB: Plus	Purge solenoids
4	10Amp continuous current rated SP MCCB: Plus	Flow switches
2	10Amp continuous current rated SP MCCB: Plus	LOX vaporizers
1	10Amp continuous current rated SP MCCB: Plus	LOX mass display units
All	Terminations for monitoring and control functions	Monitoring
All	Co-ordination necessary with mechanical sub-contractor for electrical and electronic supplies to the mechanical scope of supply and monitoring and control functions, (Estimated and should be confirmed with mechanical contractor)	Co-ordination with mechanical contractor
1	10Amp continuous current rated SP MCCB: Plus	Level Sensor
Two	Panel comprising the following:	Ozone Generator (no.1 to no.2) One Open blank panel must be made available for future.
1	225kW continuous current rated TP door interlocked motor protection MCCB complete with electronic trip unit: Plus	Main
3	450/5 Amp continuous current rated current transformers: Plus	Local current
1	continuous current rated ammeters scaled 0-450Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Volt meters scaled 0-500Amp: Plus	Volt Meter
1	7 Position Voltmeter selector switch: Plus	Selector Switch
Two	Panel comprising the following:	Cooling Water Pump Set (No.1-No.2)
1	11kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor) : Plus	Main Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	11kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
1	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> • Thermal Overload Protection • Thermal Memory • Pre-Loading • Locked Rotor Protection • Jam Protection • Current Unbalance Protection • Phase Loss Protection • User-Selectable Auto Reset • Underload / Dry Run Protection • Restart Timer • Restart Contact • Phase Rotation Protection • Over voltage Protection • Under voltage Protection • Voltage Phase Symmetry • Latched LED Trip Indication <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	Protection Setting on Relay
1	Ammeter scaled 0-30Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
3	30Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor) : Plus	Local current
1	Indication light that show trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Thermister reset button: Plus	(If provided on pump sets)
1	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged : Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
1	No-flow delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Reset push button for no-flow & Pressure trip condition: Plus	No-flow & Pressure trip reset Button
1	Pump sets will be operated as three duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24 hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus 	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure. 	
	<ul style="list-style-type: none"> Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time. 	
	<ul style="list-style-type: none"> Interlock pump set with level control system. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock motor with pressure sensor in common delivery pump line. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset. 	
	<ul style="list-style-type: none"> Interlock with ozone generators (No.1-No.2) with matching number cooling water motors (No.1-No.2). Cooling water (No.1-No.2) will start and stop when the matching number ozone generator (No.1-No.2) is in operation: Plus 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	Cooling Water Pump Set No.3
All	Panel allowance for Future	Allowance
Two	Panel comprising the following:	Nitrogen Bleed Compressors No. 1 to No.2
1	7.5kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	7.5kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
1	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> Thermal Overload Protection Thermal Memory Pre-Loading Locked Rotor Protection Jam Protection Current Unbalance Protection Phase Loss Protection User-Selectable Auto Reset Underload / Dry Run Protection Restart Timer Restart Contact Phase Rotation Protection Overvoltage Protection Undervoltage Protection Voltage Phase Symmetry Latched LED Trip Indication <p>Communications module must be provided, communication links with PLC/DCS Units. The</p>	Protection Setting on Relay

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus.	
1	Ammeter scaled 0-15Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	15Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current
1	Indication light that show trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Thermister reset button: Plus	(If provided on pump sets)
1	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
1	Timer for momentary opening of compressor moisture trap solenoid: Plus	Start Delay timer during start-up

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Reset push button for no-flow & Pressure trip condition: Plus	Pressure trip reset Button
1	Pump sets will have the capability to be operated as two duties. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	2 Duty-off-1 Duty-remote selector switches: Plus	Selector Switch for selection of duties
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus 	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure. 	
	<ul style="list-style-type: none"> Interlock motor with pressure sensor in common delivery pump line. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset. Interlock with pressure switch on compressor pressure vessel: Plus 	
	<ul style="list-style-type: none"> Interlock with ozone generators (No.1-No.2) with matching number Nitrogen Bleed Compressor (No.1- 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	No.2). Cooling water (No.1-No.2) will start and stop when the matching number ozone generator (No.1-No.2) is in operation: Plus	
Three	Panel comprising the following:	Low-Lift Pump-Set No. 1 to No.3
1	37kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	<p>37kW (3) phase vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included including EMC filter, line choke motor chokes and sinus filters (as deem necessary per installation) (Estimated and should be confirmed with mechanical contractor)</p> <p>The following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation • Under current • Torque detection <p>: Plus</p>	Variable frequency drive
1	A separate door mountable LCD display and programming control unit shall be front door mounted.	Separate LCD display unit for VSD
1	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP 	Communication module for VSD

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	Under no circumstances, shall the use of proprietary protocols be allowed: Plus	
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive Ventilation fans supply
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
1	Reset push button for pump casing temperature trip condition, thermister reset button & Diaphragm reset button: Plus	Pump casing temperature trip, thermister reset & Diaphragm reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Pump diaphragm faulty indicator light if monitoring function is part of pump set: Plus	(If provided on pump sets)
All	EMC Line Filter	
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
All	All equipment necessary for remote emergency stop device	All
1	Pump sets will be operated as three duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8 character two line display unit.. A "lock" facility shall permits browsing of the monitored parameters without	(If provided on pump sets) All protection to be monitored for example; temperature DE, NDE, and vibration etc.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display via telemetry system (Confirm with mechanical contractor): Plus	
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time in manual and auto mode of operation. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system in auto and manual mode of operation. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock low lift Pump Sets as two duties and one standby unit: Plus. 	
	<ul style="list-style-type: none"> Interlock with predetermined flow rate: Plus 	
	<ul style="list-style-type: none"> Interlock and control on a fuzzy logic system. 	
	<ul style="list-style-type: none"> Interlock pump-set with no-flow sensor in delivery pipeline. During start up this function must be bypassed for a predetermined period of time. 	
	<ul style="list-style-type: none"> Interlock motor with differential pressure sensor in sump-set's <u>delivery line (at self-cleaning strainer)</u>. Predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset. 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock pump control with seal leak detector in pump set: Plus 	
	<ul style="list-style-type: none"> Pump set statuses shall be available on the SCADA system: Plus. 	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC and HMI Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.E RGS FILTER MOTOR CONTROL CENTER

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 35mm² 4-core PVC/SWA/PVC Cu cable plus 25mm² bare copper earth cable (BCEW) from the Ozone building main MCC.

Colour: Electric orange.

Fault level: Cascaded to 6kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	100Amp continuous current rated TP MCCB: Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Relay for undervoltages, phase sequence, and phase loss in three phases.	Protection relay
Set	80/5Amp continuous current rated current transformer: Plus	Current inputs
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:	Accessories For Air Circuit Breaker
	<ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Equal or similar to Power Logic PM870: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
One	Panels comprising the following:	Distribution Section
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	63Amp TP earth leakage with overload protection: Plus	Earth Leakage for Welding Sockets
1	63Amp continuous current rated TP molded case circuit breaker: Plus	Welding plugs
1	20Amp continuous current rated TP MCB: Plus	Area Lighting – outside lighting
1	30Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Coil Protection
1	Time switches equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Digital Timer Switch
1	16Amp continuous current rated SP MCB: Plus	L1
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100-hour standby capacity: Plus	Electrocutor E1 Day/Night control
1	16Amp continuous current rated SP MCB: Plus	L1
One	Panels comprising the following:	Blowers No.1 & No2 (Hardwire Control)
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Thermister trip indication: plus	(If provided on pump sets)
All	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8 character two line display unit. A “lock” facility shall permits browsing	(If provided on pump sets) All protection to be monitored for example;

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
	of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display via telemetry system (Confirm with mechanical contractor): Plus	temperature DE, NDE, and vibration etc.
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock with remote panel to operate the blowers remotely, any fault on the blowers the operator will have to go to the blower position: Plus 	
One	Panels comprising the following:	Backwash Pump Set No.1 & No2 (Hardwire Control)
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Thermister trip indication: plus	(If provided on pump sets)
All	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8-character two line display unit. A “lock” facility shall permits browsing of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display via telemetry system (Confirm with mechanical contractor): Plus	(If provided on pump sets) All protection to be monitored for example, temperature DE, NDE, and vibration etc.
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock with remote panel to operate the blowers remotely, any fault on the blowers the operator will have to go to the blower position: Plus 	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.F RGS FILTERS CONTROL PANEL (X4)

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 6mm² 4-core PVC/SWA/PVC Cu cable plus 10mm² bare copper earth cable (BCEW) from RGS filters local distribution board (refer to Section PS ESPL).

Color: Electric orange.

Fault level: Cascaded to 6kA

QTY	DESCRIPTION	IDENTIFICATION
1	32Amp continuous current rated TP door interlocked MCB: Plus	Main
4	40Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	20Amp continuous current rated copper bus bar: Plus	Earth

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
4	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestor connection fuses
1	Three Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
12	0.37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	1) Inlet valve actuator 2) Clear water outlet valve actuator 3) Wash water inlet valve actuator 4) Wash water outlet valve actuator 5) Filter to waste valve actuator 6) Air scour valve actuator
1	16Amp continuous current rated SP MCB with auxiliary contact interlocked with circuit breaker open/close operation to supply UPS power PLC equipment only: Plus	UPS supply
2	10Amp continuous current rated SP MCB: Plus	Two (2) Turbidity controller supplies with three (3) turbidity sensors.
1	10Amp continuous current rated SP MCB: Plus	PLC Remote I/O power supply unit
1	10Amp continuous current rated SP MCB: Plus	230V/24V DC power supply
1	230V/24DC stabilized power supply for 24V DC requirements (Power supply shall have adequate capacity for the application): Plus	Power Supply
3	Loop isolators for filter level monitoring: Plus	Loop isolators
3	Intelligent loop powered ultrasonic level transducers (Transducer units must be mounted on grade 304 stainless steel brackets above relevant filter unit): Plus	Level control of filter unit

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	Wiring for control of back wash process: Plus	Hardwire for Back wash control on HMI
One	Panel comprising the following:	Control Equipment
1	Auto/Manual selector switch: Plus	Back wash control
	<ul style="list-style-type: none"> Where Automatic means PLC control: Plus Where manual means hand control of backwash process. 	
1	Selector switch for filter selection: Plus	Filter Selection (Determined per filter)
3	Filter selection Indication lights, particular specification PMC 6.2 – 6.5	When a filter is selected via the selector switch, the corresponding indication light has to activate.
All	Relays and auxiliary contacts necessary for the following items as specified under the mechanical scope of work; shall be placed in order of the process (Confirm with mechanical contractor):	Process order
1	Close push button: Plus	Close Inlet valve actuator
1	Inlet valve actuator closed Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open backwash outlet valve actuator
1	Backwash outlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close filtered water outlet valve actuator
1	Filtered water outlet valve actuator closed Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open air scour valve actuator
1	Air scour valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
2	Blower Start/Stop Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close air scour valve actuator
1	Air scour valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open Backwash inlet valve actuator
1	Backwash inlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Backwash Start/Stop Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close Backwash inlet valve actuator
1	Backwash inlet valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close Backwash outlet valve actuator
1	Backwash outlet valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open Inlet valve actuator
1	Inlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI & PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EMCC-6.G DAF TANK MOTOR CONTROL CENTRE / DISTRIBUTION BOARD

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 35mm² 4-core PVC/SWA/PVC Cu cable plus 25mm² bare copper earth cable (BCEW) from the existing main MCC in the pump station.

Colour: Electric orange.

Fault level: 15kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	80Amp continuous current rated TP MCCB (setting set to 80Amp) including electronic trip unit and: Plus	Main
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Relay for undervoltages, phase sequence, and phase loss in three phases.	Protection relay
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Equal or similar to Power Logic PM870: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Power measurement
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
1	80Amp continuous current rated TP MCCB (setting set to 80Amp) including electronic trip unit and: Plus	Main
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	<p>Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <p>a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP</p> <p>Equal or similar to Power Logic PM870: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Power measurement
One	Panels comprising the following:	Distribution Section
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
3	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	63Amp TP earth leakage with overload protection: Plus	Earth Leakage for Welding Sockets
1	63Amp continuous current rated TP molded case circuit breaker: Plus	Welding plugs
1	20Amp continuous current rated TP MCB: Plus	Area Lighting – outside lighting
1	30Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Coil Protection
1	Time switches equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Digital Timer Switch
1	16Amp continuous current rated SP MCB: Plus	L1
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100-hour standby capacity: Plus	Electrocutor E1 Day/Night control
1	16Amp continuous current rated SP MCB: Plus	L1
All	16Amp continuous current rated SP MCB: Plus	Saturator Solenoids
One	Panels comprising the following:	DAF Recycle Pump Sets No.1 – No4 (Hardwire Control)
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	All Indications for the Four Motors.
All	Monitoring and control equipment: Plus	Control & Monitoring functions
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock with remote panel to operate the DAF Recycle remotely, any fault on the DAF Recycle the operator will have to go to the DAF Recycle position: Plus 	
One	Panels comprising the following:	DAF Compressor
1	7.5kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	7.5kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	<p>Electronic motor protection relay complete with converter, with at least the following settings:</p> <ul style="list-style-type: none"> • Thermal Overload Protection • Thermal Memory • Pre-Loading • Locked Rotor Protection • Jam Protection • Current Unbalance Protection • Phase Loss Protection • User-Selectable Auto Reset • Underload / Dry Run Protection • Restart Timer • Restart Contact • Phase Rotation Protection • Overvoltage Protection • Undervoltage Protection • Voltage Phase Symmetry • Latched LED Trip Indication <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	Protection Setting on Relay
1	Ammeter scaled 0-15Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	15Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current
1	Indication light that shows trip indication of compressor pressure sensor: Plus	Pressure trip Indication light
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Thermister reset button: Plus	(If provided on pump sets)
1	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Reset push button for Pressure trip condition: Plus	Pressure trip reset Button
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	• Interlock with emergency stop to trip and lock out the starter: Plus	
	• Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure.	
	• Interlock motor with pressure sensor in saturator. Predetermined low pressure will start the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period. Motor will only be able to start once pressure trip has been manually been reset.	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following:	Saturator Level & Pressure Monitor
1	10Amp continuous current rated SP MCB: Plus	230V/24V DC power supply
1	230V/24DC stabilized power supply for 24V DC requirements (Power supply shall have adequate capacity for the application): Plus	Power Supply
1	Loop isolators for Saturator level monitoring: Plus	Loop isolators
1	Loop isolators for Saturator Pressure monitoring: Plus	Loop isolators
1	Intelligent level sensor unit mounted on a grade 304 stainless steel bracket at the Saturator for level measurement which should be coordinated with mechanical contractor: Plus	Level control of Saturator unit
1	Intelligent Pressure sensor unit mounted on a grade 304 stainless steel bracket at the Saturator for level measurement which should be coordinated with mechanical contractor: Plus	Pressure control of Saturator unit
All	Wiring for control of process: Plus	Hardwire for Saturator control on HMI
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI & PLC Equipment as specified under PLC descriptions

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.H DEWATERING BUILDING MOTOR CONTROL CENTRE

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 2 x 70mm² 4-core PVC/SWA/PVC Cu cable plus 2 x 70mm² bare copper earth cable (BCEW) from miniature substation (refer to Section PS ESPL).

Colour: Electric orange

Fault level: 25kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	320Amp continuous current rated TP MCCB (setting set to 320Amp) including electronic trip unit and : Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Relay for undervoltages, phase sequence, and phase loss in three phases.	Protection relay
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Equal or similar to Power Logic PM870: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Power measurement
4	400Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	250Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
One	Panel comprising the following:	Low Voltage Distribution
1	65Amp continuous current rated TP MCCB: Plus	Distribution Board Dewatering
3	32Amp continuous current rated TP MCCB: Plus	Belt Filter Presses Panel No.1-2

Contractor

Witness 1

Witness 2

Employer

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QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continuous current rated TP MCCB: Plus	UPS Feeder
All	Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	All Actuator Valves which must be coordinated with the mechanical contractor
6	10Amp Continuous current rated SP MCCB: Plus	Flow Meters
2	10Amp Continuous current rated SP MCCB: Plus	Sludge density analysers
6	10Amp Continuous current rated SP MCCB: Plus	Ultrasonic Level
1	3kW Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Overhead Crane which must be coordinated with the mechanical contractor
Two	Panel comprising the following:	Wash Water (No.1 - No.2)
1	5.5kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	5.5kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
1	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> Thermal Overload Protection Thermal Memory Pre-Loading Locked Rotor Protection Jam Protection Current Unbalance Protection Phase Loss Protection User-Selectable Auto Reset 	Protection Setting on Relay

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Underload / Dry Run Protection Restart Timer Restart Contact Phase Rotation Protection Overvoltage Protection Undervoltage Protection Voltage Phase Symmetry Latched LED Trip Indication <p>Communications modules must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	
1	Ammeter scaled 0-15Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	15 Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Thermister reset button: Plus	(If provided on pump sets)
1	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch

Contractor

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
1	No-flow delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Reset push button for no-flow & Pressure trip condition: Plus	No-flow & Pressure trip reset Button
1	Pump sets will be operated as one duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus 	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure. 	

Contractor

Witness 1

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Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time. 	
	<ul style="list-style-type: none"> Interlock pump set with level control system. A predetermined low level will stop the duty motor and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock motor with pressure sensor in common delivery pump line. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset. 	
	<ul style="list-style-type: none"> Interlock belt filter press as one duty and one standby unit. 	
	<ul style="list-style-type: none"> Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock pump control with seal leak detector in pump set: Plus 	
	<ul style="list-style-type: none"> Pump set statuses shall be available on the SCADA system: Plus. 	
Two	Panel comprising the following:	Poly Mixers (No.1 – No4)
1	5.5kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	2.2kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
2	2.2kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
6	2Amp HRC fuse holders and fused links: Plus	Voltage inputs

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
2	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
2	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> • Thermal Overload Protection • Thermal Memory • Pre-Loading • Locked Rotor Protection • Jam Protection • Current Unbalance Protection • Phase Loss Protection • User-Selectable Auto Reset • Underload / Dry Run Protection • Restart Timer • Restart Contact • Phase Rotation Protection 	Protection Setting on Relay
	<ul style="list-style-type: none"> • Overvoltage Protection • Undervoltage Protection • Voltage Phase Symmetry • Latched LED Trip Indication <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	
2	Ammeter scaled 0-10Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
2	3 Position Selector switch	R-W-B phase indication
6	10 Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
2	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
2	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
2	Thermister relay: Plus	(If provided on pump sets)
2	Thermister trip indication: plus	(If provided on pump sets)
2	Thermister reset button: Plus	(If provided on pump sets)
2	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
2	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
2	10Amp continuous current rated SP MCB: Plus	Heater Supply
2	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	• Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus	
	• Interlock with emergency stop to trip and lock out the starter: Plus	
	• Interlock motors to prevent simultaneously starting of all motors in the automatic mode and manual mode of operation after a power failure.	
	• Interlock pump set with level control system in manual and auto mode of operation. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus	
	• Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motor: Plus	

Contractor

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Employer

Witness 1

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June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Pump set statuses shall be available on the SCADA system: Plus. 	
Two (x2)	Panels comprising the following	Sludge Pump No.1 – No.2
1	7.5kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated current transformer: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	<p>7.5kW (3) phase heavy duty vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. The variable speed drive shall come complete with braking, resistors, line chokes, filters, additional EMC input filters and all necessary harmonic sinus filters all shall be inclusive.</p> <p>The following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> Thermal Output Phase loss Input phase loss Drive overheat Over voltage Under voltage Frequency meter Locked rotor Phase rotation Under current Real Time Clock Motor Winding Heater Function Diagnostic Faults and Alarms 	Variable Speed Drive

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Automatic Tuning of Motor Parameters Continuous heavy duty VSD Drive application <p>: Plus</p> <p>Communications modules must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following [Network Communications]:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <ul style="list-style-type: none"> Under no circumstances, shall the use of proprietary protocols be allowed: Plus <p>(Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus</p>	
1	6Amp continuous current rated SP MCB: Plus	Ventilation fans supply
All	A separate door mountable display and programming control unit shall be front door mounted.	Separate display unit for VSD Drives with all parameters
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for variable frequency drives
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Thermister reset button: Plus	(If provided on pump sets)
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Continuous current rated Ammeter: Plus	Heater supply
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary to complete the plant as follows:	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: [Common Control for Sump Pump No.1 – No.2]	Sump Pump No.1 – No.2
1	10Amp sized continuous current rated SP + N door interlocked MCB: Plus	Main Circuit Breaker
1	Manual – Off – Auto selector switch: Plus	Selector Switch
1	Sump sets will be operated as One duty and One standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary to complete the plant as follows:	
All	Interlocking with emergency stop stations on all motors to lockout main circuit breaker, if emergency stop is pressed the standby pump must automatically start: Plus	All motors shall have E-Stops
All	Interlock timer & relays to limit starts per hour, per the manufacturer's requirements, predetermined starts per hour allowed: Plus	Starts per Hour
All	Interlock motor sets as One duty and One standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.
All	Interlock pump in manual as well as automatic mode of operation with level control system. A predetermined low level will stop the pump, and high level will start the pump: Plus	Level Control
All	All Interlocks as described under operation of plant [PSEPLC-15]	Additional interlocks and writeup

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QTY	DESCRIPTION	IDENTIFICATION
All	All motor/pump information and signals statuses shall be available on the PLC system: Plus.	Signals statuses
All	Interlocking with emergency stop stations on all motors to lockout main circuit breaker, if emergency stop is pressed the standby pump must automatically start: Plus	All motors shall have E-Stops
All	Interlock timer & relays to limit starts per hour, per the manufacturer's requirements, predetermined starts per hour allowed: Plus	Starts per Hour
All	Interlock motor sets as One duty and One standby unit in manual as well as automatic mode of operation: Plus	Interlocks duty and standby.
All	Extraction fans in panel door for cooling in accordance with manufacturers specifications. If the Fans do not work in manual as well as automatic mode of operation, the start shall be interlocked to not to be able to start. Unhealthy status will display on indication: Plus	Extraction fan interlocks
All	All Interlocks as described under operation of plant [PSEPLC-15]	Additional interlocks and writeup
	Interlock pump set with level control system. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus	
	Interlock motor with pressure sensor in common delivery pump line. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset.	
	Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motors: Plus	
	Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motors: Plus	
	Interlock pump control with seal leak detector in pump set: Plus	
	Pump set statuses shall be available on the SCADA system: Plus.	

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QTY	DESCRIPTION	IDENTIFICATION
	The pumping system shall be equipped with a pressure sustaining device at the back end of the system to maintain a constant pressure in the discharge line. Capacity of each sludge feed pump shall be sized in accordance with specified design parameters and recommendations of the dewatering unit(s).	
	Primary sludge dewatering feed pumps shall be supplied via a ring main pump station installed and the respective storage facilities. The ring main and dewatering systems operation shall be interlinked. The ring main pumping system shall be equipped with pressure sensors on the suction and discharge of each pump. If a high or low pressure is registered the pumps shall switch off. Both ring main pipelines shall be equipped with flow and solids density meters in order to regulate the polymer dosing rate. The discharge of the ring main pumps shall be equipped with a pressure sustaining valve, consisting of pinch valve with a modulating actuator. The pinch valve shall be modulated with a pressure sensor located just upstream of the modulating valve.	
	The level sensor situated in the respective sludge storage tanks (Primary sludge storage tank No.1 & 2) shall transmit a stop signal to the ring main pumps if the tanks are empty.	
[x3]	Panels comprising the following	WAS Ring Main Pump No.1 – No.3
1	9kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated current transformer: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	9kW soft starter complete with ventilation fans on the unit and on the compartment door as well as a separate door mounted soft starter controller. The bypass circuit shall be connected to only bypass the semi-conductor section of the soft starter and maintain the integral motor protection of the soft starter.	Soft Starter

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Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<p>The following parameters shall be available on the Soft Starter:</p> <ul style="list-style-type: none"> • Soft Start • Kickstart • Current Limit • Pump Control • Sensorless Linear Speed Acceleration and Deceleration • Torque Control • Dual Ramp Start • Full Voltage Start • Preset Slow Speed • Coast • Soft Stop • Smart Motor Braking • Slow Speed with Braking • Accu-Stop • Integrated Motor Overload Protection • Metering • Real Time Clock • Motor Winding Heater Function • Diagnostic Faults and Alarms • Automatic Tuning of Motor Parameters • Protection and diagnostics [Amps, volts, kW, kWh, MW, MWH, elapsed time, power factor, motor thermal capacity usage] • Alarms [Overload, underload, undervoltage, overvoltage, unbalance, jam, stall, and ground fault] • Pump Control [starting and stopping period. Starting time is adjustable. Stopping time is adjustable]. <p>: Plus</p> <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following [Network Communications]:</p> <ol style="list-style-type: none"> Profibus-DP Profinet Industrial Ethernet Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	

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QTY	DESCRIPTION	IDENTIFICATION
1	<p>A separate door mountable display / HMI and programming control unit shall be front door mounted which connected to protection relay. The following features shall be available on the display / HMI as listed below:</p> <ul style="list-style-type: none"> • All Indication lights as specified under particular specification shall be displayed on the door mounted display: Plus • Running hour meter shall be displayed on the door mounted display • Motor switching state • Current in phases 1, 2, 3 and maximum current • Phase voltage 1, 2, 3 • Active power • Apparent power • Power factor • Phase unbalance • Phase sequence • Time to trip • Temperature rise, motor model • Remaining cooling time of the motor • Temperature • Actual value, analog signals • Motor operating hours • Motor stop times • Number of motor starts <p>Number of overload trips</p>	Separate display unit
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 98%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
All	Extraction fans in panel door for cooling of Soft Starter drives in accordance with manufacturers specifications: Plus	Fans for Soft Starter
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Thermister reset button: Plus	(If provided on pump sets)
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Reset button for oil pressure trip: Plus	Reset
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Front panel mounted timer to operate Pumps on a timed bases independent from level control system: Plus	Timer Control: hour delay with control duration in hours
1	Starting delay timer for sequence starting on motors: Plus	Sequence starting
1	Ball Valve manual mode of operation hardwire interlock: Plus	Ball Valve
1	No-flow delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Reset push button for no-flow & Pressure trip condition: Plus	No-flow & Pressure trip reset Button
1	Pump sets will be operated as two duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary to complete the plant as follows:	

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Employer

Witness 1

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QTY	DESCRIPTION	IDENTIFICATION
	Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus	
	An interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus	
	Interlock with emergency stop to trip and lock out the starter: Plus	
	Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure.	
	Interlock motor with no-flow sensor in suction pipeline. During start up this function must be bypassed for a predetermined period of time.	
	Interlock pump set with level control system. A predetermined low level will stop the duty motor and a predetermined high level will start the duty motor: Plus	
	Interlock motor with pressure sensor in common delivery pump line. Predetermined low pressure will stop the duty motor and predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset.	
	Interlock belt filter press as one duty and one standby unit.	
	Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motors: Plus	
	Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motors: Plus	
	Interlock pump control with seal leak detector in pump set: Plus	
	Pump set statuses shall be available on the SCADA system: Plus.	
	Interlock with Dewatering presses to start up procedure, pump sets will first start before dewatering system start.	
	The pumping system shall be equipped with a pressure sustaining device at the back end of the system to maintain	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
	a constant pressure in the discharge line. Capacity of each sludge feed pump shall be sized in accordance with specified design parameters and recommendations of the dewatering unit(s)	
	Waste Activated Sludge feed pumps shall be supplied via a ring main pump station installed and the respective storage facilities. The ring main and dewatering systems operation shall be interlinked. The ring main pumping system shall be equipped with pressure sensors on the suction and discharge of each pump. If a high or low pressure is registered the pumps shall switch off. Both ring main pipelines shall be equipped with flow and solids density meters in order to regulate the polymer dosing rate. The discharge of the ring main pumps shall be equipped with a pressure sustaining valve, consisting of pinch valve with a modulating actuator. The pinch valve shall be modulated with a pressure sensor located just upstream of the modulating valve.	
	The level sensor situated in the respective Waste Activated Sludge tanks (Waste Activated Sludge tank No.1 & 2) shall transmit a stop signal to the ring main pumps if the tanks are empty.	
Two	Panels comprising the following	Primary Sludge Storage Tank Mixing Pumps No.1 – No.2
1	5.5kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main
Set	Continuous current rated current transformer: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	5.5kW soft starter complete with ventilation fans on the unit and on the compartment door as well as a separate door mounted soft starter controller. The bypass circuit shall be connected to only bypass the semi-conductor section of the soft starter and maintain the integral motor protection of the soft starter.	Soft Starter

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<p>The following parameters shall be available on the Soft Starter:</p> <ul style="list-style-type: none"> • Soft Start • Kickstart • Current Limit • Pump Control • Sensorless Linear Speed Acceleration and Deceleration • Torque Control • Dual Ramp Start • Full Voltage Start • Preset Slow Speed • Coast • Soft Stop • Smart Motor Braking • Slow Speed with Braking • Accu-Stop • Integrated Motor Overload Protection • Metering • Real Time Clock • Motor Winding Heater Function • Diagnostic Faults and Alarms • Automatic Tuning of Motor Parameters • Protection and diagnostics [Amps, volts, kW, kWh, MW, MWH, elapsed time, power factor, motor thermal capacity usage] • Alarms [Overload, underload, undervoltage, overvoltage, unbalance, jam, stall, and ground fault] • Pump Control [starting and stopping period. Starting time is adjustable. Stopping time is adjustable]. <p>: Plus</p> <p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following [Network Communications]:</p> <ol style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	<p>A separate door mountable display / HMI and programming control unit shall be front door mounted which connected to protection relay. The following features shall be available on the display / HMI as listed below:</p> <ul style="list-style-type: none"> • All Indication lights as specified under particular specification shall be displayed on the door mounted display: Plus • Running hour meter shall be displayed on the door mounted display • Motor switching state • Current in phases 1, 2, 3 and maximum current • Phase voltage 1, 2, 3 • Active power • Apparent power • Power factor • Phase unbalance • Phase sequence • Time to trip • Temperature rise, motor model • Remaining cooling time of the motor • Temperature • Actual value, analog signals • Motor operating hours • Motor stop times • Number of motor starts <p>Number of overload trips</p>	Separate display unit
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 98%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
All	Extraction fans in panel door for cooling of Soft Starter drives in accordance with manufacturers specifications: Plus	Fans for Soft Starter
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Thermister reset button: Plus	(If provided on pump sets)
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Reset button for oil pressure trip: Plus	Reset
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Front panel mounted timer to operate Pumps on a timed bases independent from level control system: Plus	Timer Control: hour delay with control duration in hours
1	Starting delay timer for sequence starting on motors: Plus	Sequence starting
1	Ball Valve manual mode of operation hardwire interlock: Plus	Ball Valve
2	Pump sets will be operated as one duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24 hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
2	Duty rotation timer and flip-flop relay that will rotate the duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start delay timer during start-up
1	Indication light that shows trip indication of pressure sensor: Plus	Pressure trip Indication light

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Reset push button for Pressure trip condition: Plus	Pressure trip reset button
All	Relays and auxiliary contacts necessary for:	
	Interlock timer shall be provided for duty rotation: Plus	
	Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump: Plus	
	Interlock motors to prevent simultaneously starting of all motors in the automatic and manual mode of operation after a power failure: Plus	
	Interlock pump set with level control system in automatic and manual mode of operation. A predetermined low level will stop the duty motor, and a predetermined high level will allow the duty motor to start: Plus	
	Interlock Pump Sets as one duty and one standby unit in manual and automatic mode of operation.	
	Extraction fans in panel door for cooling of soft starter in accordance with manufacturers specifications.	
	Pump set statuses shall be available on the SCADA system: Plus.	
	Primary Sludge Storage Tanks shall be equipped with centrifugal pumps to recirculate the flow in the tanks via discharge nozzles. Each tank shall be equipped with a (1) duty + one (1) standby mixing pump configuration. The pumps shall operate continuously unless a pre-set low-low level is reached. The pumps shall be equipped with pressure transmitters on the suction and discharge side which shall act as protection to the pumps in the event of low or high situation arises.	
Two	Panels comprising the following	Dewatered sludge cake screw conveyor No.1 – No.2
1	5.5kW TP continuous current rated motor protection MCCB complete with extended rotary handle for door interlocking [Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility] (Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
Set	Continuous current rated current transformer: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	<p>5.5kW (3) phase heavy duty vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included, EMC filter, line choke motor chokes and sinus filters all shall be inclusive.</p> <p>The116 following minimum protection parameters shall be available on the Variable frequency drive:</p> <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation • Under current • Torque detection for motor on bridge • Speed or torque control • Braking unit via re-injection to the line supply <p>(Estimated and shall be coordinated with mechanical contractor to ensure correct supplies to mechanical equipment): Plus</p>	Variable frequency drive
All	A separate door mountable display and programming control unit shall be front door mounted.	Separate display unit for VSD Drives with all parameters
All	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP 	Communication module for VSD

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	Under no circumstances, shall the use of proprietary protocols be allowed: Plus	
1	6Amp continuous current rated SP MCB: Plus	Variable frequency drive fans supply
1	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus	Fans for VFD
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
All	Thermister relay: Plus	(If provided on pump sets)
All	Thermister trip indication: plus	(If provided on pump sets)
All	Thermister reset button: Plus	(If provided on pump sets)
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply
1	Continuous current rated Ammeter: Plus	Heater supply
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays, auxiliary contacts, indicating lights, wiring and reset buttons necessary for the following	
	Interlock with torque limit switch in manual and automatic mode of operation, supplied by others [mechanical contractor]. Part of this scope is to supply limit switches under the motor control centre on the torque limit switch to trip once limit has been reached: Plus	
	The conveyor shall be required to transport dewatered sludge from the dewatering presses and discharge the sludge into a set of sludge cake pump hoppers. The dewatering building layout will require the provision of two conveyor systems per dewatering train (i.e. WAS and Primary sludge), resulting in a total of four (4) horizontal screw conveyors systems. Each screw conveyor shall be sized to accommodate the maximum achievable sludge cake production rate of the associated dewatering units, which will be four (4) units per screw: Plus	
	Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus	
	Interlock with emergency stop to trip and lock out the starter: Plus	
	Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus	
	Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus	
	Pump set statuses shall be available on the SCADA system: Plus	
	Interlock conveyor with corresponding dewatering train, once a belt starts so does the conveyor start.	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI & PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.I BELT FILTER PRESS PANEL NO.1 – NO.2 (TWO UNITS)

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 10mm² 4-core PVC/SWA/PVC Cu cable plus 10m² bare copper earth cable (BCEW) from dewatering MCC

Colour: Electric orange

Fault level: 15kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Comprising the following:	Normal Supply
1	32Amp continuous current rated TP MCCB (setting set to 32Amp) including electronic trip unit and : Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
4	50Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	25Amp continuous current rated copper bus bar: Plus	Earth
4	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
All	Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Actuator Valve which must be coordinated with the mechanical contractor
One	Comprising the following:	Poly Dosing Pump Set No.1 – No.2
1	2kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
2	0.55kW sized continuous current rated TP motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
2	0.55kW (3) phase vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included including EMC filter, line choke motor chokes and sinus filters (as deem necessary per installation) (Estimated and should be confirmed with mechanical contractor) The following minimum protection parameters shall be available on the Variable frequency drive:	Variable frequency drive
	<ul style="list-style-type: none"> Thermal Output Phase loss Input phase loss 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation • Under current • Torque detection : Plus	
2	A separate door mountable LCD display and programming control unit shall be front door mounted.	Separate LCD display unit for VSD
2	<p>Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Communication module for VSD
2	6Amp continuous current rated SP MCB: Plus	Variable frequency drive Ventilation fans supply
2	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
2	Reset push button for pump casing temperature trip condition, thermister reset button & Diaphragm reset button: Plus	Pump casing temperature trip, thermister reset & Diaphragm reset
2	Thermister relay: Plus	(If provided on pump sets)
2	Thermister trip indication: plus	(If provided on pump sets)
2	Pump diaphragm faulty indicator light if monitoring function is part of pump set: Plus	(If provided on pump sets)
All	EMC Line Filter	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
6	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
All	All equipment necessary for remote emergency stop device	All
2	Pump sets will be operated as one duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
2	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic and manual mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system in automatic and manual mode of operation. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock Dosing Pump Sets as one duty and one standby unit in manual and automatic mode of operation. 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications. 	
	<ul style="list-style-type: none"> Interlock with sludge flow to stop all dosing functions when sludge flow stops. 	
	<ul style="list-style-type: none"> Interlock automatic dosing shall be based on predetermined sludge flow rate in manual and automatic mode of operation. 	
	<ul style="list-style-type: none"> Pump set statuses shall be available on the SCADA system: Plus. 	
1	Continuous current rated SP MCCB: Plus	Feed from Main MCC
1	Selector switch for normal/UPS power selection: Plus	Maintenance purposes
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	
All	Terminal connections for UPS unit: Plus	
All	UPS monitoring functions as specified: Plus	
1	Continuous current rated SP MCCB: Plus	PLC supply
1	Continuous current rated SP MCCB: Plus	HMI supply
All	Selector switch for Auto/Manual selection	Selection must also be on HMI
	<ul style="list-style-type: none"> Where Auto means PLC control Where Manual means hand control 	
1	10Amp continuous current rated SP MCB: Plus	230V/24V DC power supply
1	230V/24DC stabilized power supply for 24V DC requirements (Power supply shall have adequate capacity for the application): Plus	Power Supply
1	Loop isolators for filter level monitoring: Plus	Loop isolators
1	Ultrasonic level transducers equal and similar intelligent MSP900SH sensor unit mounted on a grade 304 stainless steel bracket at the poly tank for level measurement: Plus	Level control of filter unit

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	Wiring for control of process: Plus	Hardwire for Belt Filter control on HMI
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCC-6.J GAC MOTOR CONTROL CENTRE

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 1 x 50mm² 4core PVC SWA PVC cables plus a 35mm² earth cable from the main pump station MCC

Colour: Electric orange

Fault level: 10kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	Incomer

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	160Amp continuous current rated TP MCCB (setting set to 160Amp) including electronic trip unit and: Plus	Main
1	Relay for undervoltage, phase sequence, and phase loss in three phases.	Protection relay
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Equal or similar to Power Logic PM870: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Power measurement
4	180Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	100Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
One	Panel comprising the following:	Local Distribution

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
4	32Amp continuous current rated MCCB complete with opening/closing release contacts and sufficient auxiliary contacts (adjustable settings) including electronic trip unit and: Plus	Filter Control Console No.1-4
2	65Amp continuous current rated MCCB complete with opening/closing release contacts and sufficient auxiliary contacts (adjustable settings) including electronic trip unit and: Plus	Filter distribution boards No.1 & No.2
One	Panels comprising the following:	Blowers No.1 & No2 (Hardwire Control)
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Thermister trip indication: plus	(If provided on pump sets)
All	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8 character two line display unit. A "lock" facility shall permits browsing of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display via telemetry system (Confirm with mechanical contractor): Plus	(If provided on pump sets) All protection to be monitored for example; temperature DE, NDE, and vibration etc.
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock with remote panel to operate the blowers remotely, any fault on the blowers the operator will have to go to the blower position: Plus 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Backwash Pump Set No.1 & No2 (Hardwire Control)
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Thermister trip indication: plus	(If provided on pump sets)
All	Front panel mounted (48x48mm) digital microprocessor based local soft key programmable RTD controllers with non-volatile EEPROM based memory and 9mm high 8-character two-line display unit. A "lock" facility shall permits browsing of the monitored parameters without unauthorised changes. An isolated retransmit 4-20mA facility shall be available on the unit for SCADA system motor temperature display via telemetry system (Confirm with mechanical contractor): Plus	(If provided on pump sets) All protection to be monitored for example, temperature DE, NDE, and vibration etc.
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock with remote panel to operate the blowers remotely, any fault on the blowers the operator will have to go to the blower position: Plus 	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EMCC-6.K GAC FILTER CONTROL PANEL (X6)

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 10mm² x 4-core PVC SWA PVC cable plus 10mm² earth conductor from GAC MCC.

Colour: Electric orange

Fault level: 6kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
1	32Amp continuous current rated TP door interlocked MCB: Plus	Main
4	40Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	20Amp continuous current rated copper bus bar: Plus	Earth

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
4	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestor connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
18	0.37kW continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	7) Inlet valve actuator 8) Clear water outlet valve actuator 9) Wash water inlet valve actuator 10) Wash water outlet valve actuator 11) Filter to waste valve actuator 12) Air scour valve actuator
1	16Amp continuous current rated SP MCB with auxiliary contact interlocked with circuit breaker open/close operation to supply UPS power PLC equipment only: Plus	UPS supply
2	10Amp continuous current rated SP MCB: Plus	Two (2) Turbidity controller supplies with three (3) turbidity sensors.
1	10Amp continuous current rated SP MCB: Plus	PLC Remote I/O power supply unit
1	10Amp continuous current rated SP MCB: Plus	230V/24V DC power supply
1	230V/24DC stabilized power supply for 24V DC requirements (Power supply shall have adequate capacity for the application): Plus	Power Supply
3	Loop isolators for filter level monitoring: Plus	Loop isolators
3	Intelligent loop powered ultrasonic level transducers (Transducer units must be mounted on grade 304 stainless steel brackets above relevant filter unit): Plus	Level control of filter unit

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	Wiring for control of back wash process: Plus	Hardwire for Back wash control on HMI
One	Panel comprising the following:	Control Equipment
1	Auto/Manual selector switch: Plus	Back wash control
	<ul style="list-style-type: none"> Where Automatic means PLC control: Plus Where manual means hand control of backwash process. 	
1	Selector switch for filter selection: Plus	Filter Selection (Determined per filter)
3	Filter selection Indication lights, particular specification PMC 6.2 – 6.5	When a filter is selected via the selector switch, the corresponding indication light has to activate.
All	Relays and auxiliary contacts necessary for the following items as specified under the mechanical scope of work; shall be placed in order of the process (Confirm with mechanical contractor):	Process order
1	Close push button: Plus	Close Inlet valve actuator
1	Inlet valve actuator closed Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open backwash outlet valve actuator
1	Backwash outlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close filtered water outlet valve actuator
1	Filtered water outlet valve actuator closed Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open air scour valve actuator
1	Air scour valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
2	Blower Start/Stop Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close air scour valve actuator
1	Air scour valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open Backwash inlet valve actuator
1	Backwash inlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Backwash Start/Stop Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close Backwash inlet valve actuator
1	Backwash inlet valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Close push button: Plus	Close Backwash outlet valve actuator
1	Backwash outlet valve actuator close Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
1	Open push button: Plus	Open Inlet valve actuator
1	Inlet valve actuator open Indication, see particular specification PMC 6.2 – 6.5: Plus	Indication
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI & PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EMCC-6.L HYDROGEN PEROXIDE / FILTRATE SUMP MOTOR CONTROL CENTRE

Type: The motor control center or distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system. The Electrical contractor responsibility is to coordinate with the mechanical contractor in terms of P&ID's, motor sizes, operation of the plant and provide all equipment which is offered by the Mechanical Contractor.

The motor control center board or distribution board shall be of the free-standing pedestal mounted type with a minimum IP rating of 54 (Indoor). The motor control centre or distribution board shall be constructed with a minimum of **2mm 3CR12** steel which will rest on a rigid channel iron. Tenderer shall refer to the particular specification.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a **3CR12** 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 3CR12 cable and support gland plates along the entire length of the board and at least 230 mm above floor level.

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. The contractor shall prove to the Engineer by means of Anemometer or Differential that the requirements and manufacturer's requirements are met. The systems shall be designed to allow for 10% for future extensions.

Supply: 25mm² 4core PVC SWA PVC cables in parallel plus a 16mm² Bare copper earth cable from the main intake substation

Colour: Electric orange

Fault level: 35kA

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer no. 1
1	80Amp Continuous current rated MCCB complete with opening/closing release contacts and sufficient auxiliary contacts (adjustable settings) including electronic trip unit and: Plus	Main

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
Set	100/5Amp continuous current rated current transformer: Plus	Current inputs
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
4	315Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red , White and Blue Indications)
One	Panel comprising the following:	Low Voltage Distribution
1	63Amp continuous current rated TP MCCB: Plus	Hydrogen Peroxide Building DB
1	10Amp continuous current rated SP MCCB: Plus	Filtrate Flow Meter Kiosk
1	10Amp continuous current rated SP MCCB: Plus	Filtrate Level Meter Kiosk
1	10Amp continuous current rated SP MCCB: Plus	Filtrate Pressure and no-flow sensor
1	10Amp continuous current rated SP MCCB: Plus	Filtrate Pressure and no-flow sensor
1	3kW Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	Overhead Crane which must be coordinated with the mechanical contractor

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following:	Hydrogen Peroxide pump (No. 1-No. 2)
1	1.5kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	0.55kW sized continuous current rated TP motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Circuit Breaker
2	0.55kW (3) phase vector control variable frequency drive complete with 1) Programmable cards, 2) Communication card & 3) Encoder interface card. All necessary harmonic filters shall be included including EMC filter, line choke motor chokes and sinus filters (as deem necessary per installation) (Estimated and should be confirmed with mechanical contractor) The following minimum protection parameters shall be available on the Variable frequency drive: <ul style="list-style-type: none"> • Thermal • Output Phase loss • Input phase loss • Drive overheat • Over voltage • Under voltage • Frequency meter • Locked rotor • Phase rotation • Under current • Torque detection : Plus	Variable frequency drive
2	A separate door mountable LCD display and programming control unit shall be front door mounted.	Separate LCD display unit for VSD
2	Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP 	Communication module for VSD

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	Under no circumstances, shall the use of proprietary protocols be allowed: Plus	
2	6Amp continuous current rated SP MCB: Plus	Variable frequency drive Ventilation fans supply
2	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Turn knob speed adjustment by means of current source (4-20mA): Plus	Manual speed control
2	Manual-off-auto-remote selector switch: Plus	Selector Switch
2	Reset push button for pump casing temperature trip condition, thermister reset button & Diaphragm reset button: Plus	Pump casing temperature trip, thermister reset & Diaphragm reset
2	Thermister relay: Plus	(If provided on pump sets)
2	Thermister trip indication: plus	(If provided on pump sets)
2	Pump diaphragm faulty indicator light if monitoring function is part of pump set: Plus	(If provided on pump sets)
All	EMC Line Filter	
6	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
All	All equipment necessary for remote emergency stop device	All
2	Pump sets will be operated as three duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
2	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication and E-Stop engaged: Plus	Indication lights
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time. Timer will be disabled in the event when motor is out of commission in manual and automatic mode of operation: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump in manual and automatic mode of operation: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in manual and automatic mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system in manual and automatic mode of operation. A predetermined low level will stop the duty motor, and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock Dosing Pump Sets as one duty and one standby unit in manual and automatic mode of operation: Plus 	
	<ul style="list-style-type: none"> Extraction fans in panel door for cooling of variable speed drives in accordance with manufacturers specifications: Plus 	
	<ul style="list-style-type: none"> Interlock with raw water flow to stop all dosing functions when raw water flow stops: Plus 	
	<ul style="list-style-type: none"> Automatic dosing shall be based on predetermined raw water flow rate. 	
Two	Panel comprising the following:	Hydrogen Peroxide pump Mixers (No.1 – No4)
1	5.5kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	2.2kW continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
2	2.2kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
6	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
2	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
2	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
2	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> • Thermal Overload Protection • Thermal Memory • Pre-Loading • Locked Rotor Protection • Jam Protection • Current Unbalance Protection • Phase Loss Protection • User-Selectable Auto Reset • Underload / Dry Run Protection • Restart Timer • Restart Contact • Phase Rotation Protection • Overvoltage Protection • Undervoltage Protection • Voltage Phase Symmetry • Latched LED Trip Indication <p>Communications modules must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	Protection Setting on Relay
2	Ammeter scaled 0-10Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
2	3 Position Selector switch	R-W-B phase indication

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
6	10 Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current
2	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
2	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
2	Thermister relay: Plus	(If provided on pump sets)
2	Thermister trip indication: plus	(If provided on pump sets)
2	Thermister reset button: Plus	(If provided on pump sets)
2	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
2	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
2	10Amp continuous current rated SP MCB: Plus	Heater Supply
2	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	• Interlock timer & relays to limit starts per hour, 5 starts per hour allowed: Plus	
	• Interlock with emergency stop to trip and lock out the starter: Plus	
	• Interlock motors to prevent simultaneously starting of all motors in the automatic mode and manual mode of operation after a power failure.	
	• Interlock pump set with level control system in manual and auto mode of operation. A predetermined low level	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	will stop the duty motor, and a predetermined high level will start the duty motor: Plus	
	<ul style="list-style-type: none"> Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus 	
	<ul style="list-style-type: none"> Pump set statuses shall be available on the SCADA system: Plus. 	
Two	Panel comprising the following:	Filtrate sump pump (No 1 - No. 2)
1	10kW sized continuous current rated TP door interlocked motor protection MCCB (Estimated and should be confirmed with mechanical contractor): Plus	Main Circuit Breaker
1	10kW Type 2 Coordination Direct-on-line motor starter MCCB (Estimated and should be confirmed with mechanical contractor): Plus	DOL starter
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Set of Stop/Start push buttons: Plus	Stop/Start Push Buttons
1	Mains operated timer to limit starts per hour: Plus	Limit Starts
All	Power factor capacitors shall correct to a minimum of 95%, complete with all accessories (Fuses, Circuit breaker and Contactor) to complete the installation: Plus	Power Factor capacitors
1	Electronic motor protection relay complete with converter, with at least the following settings: <ul style="list-style-type: none"> Thermal Overload Protection Thermal Memory Pre-Loading Locked Rotor Protection Jam Protection Current Unbalance Protection Phase Loss Protection User-Selectable Auto Reset Underload / Dry Run Protection Restart Timer Restart Contact Phase Rotation Protection Over voltage Protection Under voltage Protection 	Protection Setting on Relay

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Voltage Phase Symmetry Latched LED Trip Indication <p>Communications modules must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus.</p>	
1	Ammeter scaled 0-20Amp (Estimated and should be confirmed with mechanical contractor): Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	20Amp continuous current rated current transformers (Estimated and should be confirmed with mechanical contractor): Plus	Local current
1	Indication light that shows trip indication of pump temperature sensor: Plus	Pump casing temperature trip Indication light
1	Reset push button for pump casing temperature trip condition: Plus	Pump casing temperature trip reset
1	Thermister relay: Plus	(If provided on pump sets)
1	Thermister trip indication: plus	(If provided on pump sets)
1	Thermister reset button: Plus	(If provided on pump sets)
1	Resettable Running hour meter: Plus	Running Hour Meter
All	All Indication lights as specified under particular specification PMC 6.2 – 6.5 including healthy, start delay indication, heater and E-Stop engaged: Plus	Indication lights
1	Manual-off-auto-remote selector switch: Plus	Selector Switch
All	Monitoring and control equipment: Plus	Control & Monitoring functions
1	10Amp continuous current rated SP MCB: Plus	Heater Supply

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Ammeters scaled 0-10Amp: Plus	Heater Ammeter
1	No-flow delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Pressure delay timer to prevent pump set to trip during start-up: Plus	Start Delay timer during start-up
1	Reset push button for no-flow & Pressure trip condition: Plus	No-flow & Pressure trip reset Button
1	Pump sets will be operated as two duty and one standby unit. A timer shall be provided for duty rotation of pump sets after a 24-hour period of time. In the event of a pump failure the duty cycle must be transferred to the next available pump set. Timer will be disabled in the event when one pump set is out of commission: Plus	Timer control in manual mode
1	Duty rotation timer and flip-flop relay that will rotate duty cycle between duty and standby pump sets on a daily basis. If standby pump set is not available duty pump set will remain in operation: Plus	Duty rotation in manual mode
All	All equipment necessary for remote motor status, speed monitoring and control.	Control and monitoring
All	Relays and auxiliary contacts necessary for:	
	<ul style="list-style-type: none"> Interlock timer shall be provided for duty rotation of after a 24-hour period of time in manual and auto mode of operation. Timer will be disabled in the event when motor is out of commission: Plus 	
	<ul style="list-style-type: none"> Interlock with emergency stop to trip and lock out the starter, available standby pump to become duty pump: Plus 	
	<ul style="list-style-type: none"> Interlock motors to prevent simultaneously starting of all motors in the automatic mode of operation after a power failure: Plus 	
	<ul style="list-style-type: none"> Interlock pump set with level control system in auto and manual mode of operation. A predetermined low level will stop the duty motor and a predetermined high level will start the duty motor: Plus 	
	<ul style="list-style-type: none"> Interlock low lift Pump Sets as one duty and one standby unit: Plus. 	
	<ul style="list-style-type: none"> Interlock with predetermined flow rate: Plus 	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
	• Interlock and control on a fuzzy logic system.	
	• Interlock pump-set with no-flow sensor in delivery pipeline. During start up this function must be bypassed for a predetermined period of time.	
	• Interlock motor with differential pressure sensor in sump-set's <u>delivery line (at self-cleaning strainer)</u> . Predetermined high pressure will stop the duty motor. During start up and shut down this function must be bypassed for a predetermined period of time. Motor will only be able to start once pressure trip has been manually been reset.	
	• Interlock pump-set winding temperatures. A predetermined high levels will stop the duty motor: Plus	
	• Interlock pump-set with pump casing temperature. A predetermined high level will stop the duty motor: Plus	
	• Interlock pump control with seal leak detector in pump set: Plus	
	• Pump set statuses shall be available on the SCADA system: Plus.	
One	Panel comprising the following:	Isolation Transformer for Control Circuit
1	Sized for the application continuous current rated SP door interlocked MCCB: Plus	Main
1	Selector switch for normal/Isolation Transformer power selection: Plus	Maintenance purposes
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
Set	Sized for the application continuous current rated current transformers: Plus	Current inputs
1	Volt meter: Plus	Volt Meter
1	Sized for the application continuous current ammeter scaled: Plus	Ammeter
1	230V/230AC Sized for the application Isolation transformer (Supply shall have adequate capacity for the application x 30% for future): Plus	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025



QTY	DESCRIPTION	IDENTIFICATION
1	Sized for the application continuous current rated SP MCCB: Plus	Main
2	Sized for the application continuous current rated copper bus bars full length of the motor control centre: Plus	1 Phase + N
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC Equipment as specified under PLC descriptions
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC: PROGRAMMABLE LOGIC CONTROLLERS

PS EPLC-1 SCOPE

Programmable Logic Controllers shall be provided in Motor control centers (MCC) and distribution boards (DB) as specified in the following locations:

No.	DESCRIPTION	LOCATION
A	Raw Water Pumpstation Modifications to existing MCC PLC	Raw Water Pumpstation
B	Chemical Dosing Modifications to MCC PLC	Chemical dosing Building
C	Ozone building MCC PLC	Ozone building
D	RGSF Filters MCC PLC	RGSF Filters building
E	RGSF Filters Control Stations - (No.01 - No.02) PLC	RGSF Filters building (Filter Galaray)
F	DAF tank MCC PLC	DAF tank No.3
G	Dewatering Building MCC PLC	Dewatering building
H	Belt filter Press Panel No. 1 & No. 2 PLC	Dewatering building
I	GAC MCC PLC	GAC filters building
J	GAC Control Stations - (No.01 - No.02) PLC	GAC filters building (galaray)
K	Hydrogen peroxide MCC PLC	Hydrogen peroxide building
L	Pre-Ozone MCC PLC	Pre-Ozone Building

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6 PROGRAMMABLE LOGIC CONTROLLERS HARDWARE

PS EPLC-6.A EXISTING MAIN MOTOR CONTROL CENTRE [MCC NO.1] PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

The existing PLC system is non-functional, and as part of this contract, the contractor is responsible for the complete removal of the existing PLC, including the I/O modules, surge arrestors, UPS, industrial managed switch, backplane, and termination system within the existing MCC.

A provisional sum has been allocated to cover all electrical work necessary to refurbish the existing tier. The new backplane will be constructed and tested off-site to ensure quality and functionality before installation. The installation and commissioning of the new system will take place on-site.

Following the installation, the contractor must perform a complete re-commissioning of the existing program to ensure seamless operation after the conversion. Additionally, the contractor is responsible for providing all necessary conversion software required for the successful completion of this project.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet or c) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor	Main Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	and all calculations shall be supplied to Engineer for approval): Plus	
1	<p>Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p> <p>Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus</p>	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.
All	The Contractor shall allow for the complete removal of the existing PLC, I/O, surge arrestors, UPS, industrial managed switch, back plane, termination system in the existing Main MCC at Bospoort WTW. A provisional Sum has been allowed for all Electrical work required to refurbish the existing tier. The new backplane will be built and tested off site while the installation and commission will occur on site [Bospoort Water Treatment Plant]. The contractor will backup and download the existing PLC program at Bospoort WTW and convert the existing PLC program and deploy it into the new PLC. Complete re-commissioning of the old program must be done after the conversion. All required conversion software must be supplied by the contractor. The contractor shall allow all necessary work on site to complete and integrate the new / old PLC on site.	Existing Tier
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
6	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
8	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Industrial Communication No.1 – No.8
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction <ul style="list-style-type: none"> 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms <ul style="list-style-type: none"> 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: <ul style="list-style-type: none"> Bandwidth management & Ethernet TCP/IP 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for HMI unit; Plus	Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.A SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR EXISTING MAIN MOTOR CONTROL CENTRE [MCC NO.1] PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
DAF Recycle No.4 healthy				1			1	1	1
DAF Recycle No.4 trip				2			2	2	2
DAF Recycle No.4 run/stop				2			2	2	2
DAF Recycle No.4 E-Stop				1			1	1	1
DAF Recycle No.4 Manual / Auto / Off				3			3	3	3
DAF Recycle No.4 Pressure		1	1		1		3	3	3
DAF Recycle No.4 Flow Meter		1	1		1		3	3	3
Blower No.1 - No.2 healthy				1			2	2	2
Blower No.1 - No.2 trip					2		2	2	2
Blower No.1 - No.2 run/stop					2		2	2	2
Blower No.1 - No.2 E-Stop				2			2	2	2
Blower No.1 - No.2 Manual / Auto / Off				6			6	6	6
Blower valve open/close				2	2		4	4	4
Blower Faulty				1	1		2	2	2
Blower No.1 - No.2 DE bearings motor	2		2				2	2	2
Blower No.1 - No.2 NDE bearings motor	4		4				4	4	4
Blower No.1 - No.2 Winding temperatures motor	6		6				8	8	8
Blower No.1 - No.2 DE bearings blower	2		2				4	4	4
Blower No.1 - No.2 NDE bearings blower	2		2				4	4	4

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Blower No.1 - No.2 Air Temperature (Cold)	2		2				4	4	4
Blower No.1 - No.2 Temperature (Hot)	2		2				4	4	4
Blower No.1 - No.2 vibration motor	2		2				4	4	4
Blower No.1 - No.2 vibration sensors blower	2		2				4	4	4
Blower No.1 - No.2 Thrust pad RTD	2		2				2	2	2
Blower No.1 - No.2 Pressure		2	2		2		6	6	6
Washwater Pump No.1 - No.2 healthy				1			2	2	2
Washwater No.1 - No.2 trip					2		2	2	2
Washwater No.1 - No.2 run/stop					2		2	2	2
Washwater No.1 - No.2 E-Stop				2			2	2	2
Washwater No.1 - No.2 Manual / Auto / Off				6			6	6	6
Washwater No.1 - No.2 DE bearings motor	2		2				2	2	2
Washwater No.1 - No.2 NDE bearings motor	4		4				4	4	4
Washwater No.1 - No.2 Winding temperatures motor	6		6				8	8	8
Washwater No.1 - No.2 DE bearings	2		2				4	4	4
Washwater No.1 - No.2 NDE bearings	2		2				4	4	4
Washwater No.1 - No.2 Air Temperature (Cold)	2		2				4	4	4
Washwater No.1 - No.2 Temperature (Hot)	2		2				4	4	4
Washwater No.1 - No.2 vibration motor	2		2				4	4	4
Washwater No.1 - No.2 vibration sensors blower	2		2				4	4	4
Washwater No.1 - No.2 Thrust pad RTD	2		2				2	2	2
Washwater No.1 - No.2 Pressure		2	2		2		6	6	6
Washwater No.1 - No.2 Flow Meter		2	2		2		6	6	6
Washwater No.1 - No.2 No-Flow Meter				2	2		4	4	4
Clearwater Level No.1		1	1		1		2	2	2
RGSF Filtrrs Flow meter		1	1		1		2	2	2
The Contractor shall allow for the complete removal of the existing PLC, I/O, surge arrestors, UPS, industrial managed switch, back plane, termination system in the existing Main MCC at Bospoort WTW. A provisional Sum has been allowed for all Electrical work required to refurbish the existing tier. The new backplane will be built and tested off site while the installation and commission will occur on	32	24	8	128	16		208	208	208

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
site [Bospoort Water Treatment Plant]. The contractor will backup and download the existing PLC program at Bosporrt WTW and convert the existing PLC program and deploy it into the new PLC. Complete re-commissioning of the old program must be done after the conversion. All required conversion software must be supplied by the contractor. The contractor shall allow all necessary work on site to complete and integrate the new / old PLC on site.									
Contractor to allow for additional 10% spare capacity.	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.B CHEMICAL DOSING MCC PLC

The New Chemical Dosing PLC, supplied and installed under this contract, shall communicate with the new plant SCADA system via Fiber Optic cable communication system.

The existing PLC system is non-functional, and as part of this contract, the contractor is responsible for the complete removal of the existing PLC, including the I/O modules, surge arrestors, UPS, industrial managed switch, backplane, and termination system within the existing MCC.

A provisional sum has been allocated to cover all electrical work necessary to refurbish the existing tier. The new backplane will be constructed and tested off-site to ensure quality and functionality before installation. The installation and commissioning of the new system will take place on-site.

Following the installation, the contractor must perform a complete re-commissioning of the existing program to ensure seamless operation after the conversion. Additionally, the contractor is responsible for providing all necessary conversion software required for the successful completion of this project.

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Communication Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet or c) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	<p>Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p> <p>Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus</p>	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	HMI supply
6	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 µs Boolean 0.17 µs double-length words 0.25 µs single-length words 1.16 µs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus	PLC CPU
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed) : Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for HMI unit; Plus	Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

**PS EPLC-6.B SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR CHEMICAL DOSING MCC
PLC PLC**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Poly Dosing Pump No.1 – No.4 motor run/stop				4	4		8	8	8
Poly Dosing Pump No.1 – No.4 motor healthy				4			4	4	4
Poly Dosing Pump No.1 – No.4 man-off-auto				8			8	8	8
Poly Dosing Pump No.1 – No.4 motor trip				4			4	4	4
Poly Dosing Pump No.1 – No.4 variable speed control		4	4				8	8	8
Poly Dosing Pump No.1 – No.2 E-Stop				2			2	2	2
Poly Bulk Tanks No.1 – No.4 and day Tank		4					4	4	4
Poly Dosing solenoid valves No.1 – No.6					6		6	6	6
Ferric Dosing Pump No.1 – No.6 motor run/stop				6	6		12	12	12
Ferric Dosing Pump No.1 – No.6 motor healthy				6			6	6	6
Ferric Dosing Pump No.1 – No.6 man-off-auto				12			12	12	12
Ferric Dosing Pump No.1 – No.6 motor trip				6			6	6	6
Ferric Dosing Pump No.1 – No.6 variable speed control		6	6				12	12	12
Ferric Dosing Pump No.1 – No.6 E-Stop				6			6	6	6
Ferric Bulk Tanks No.1 – No.4 and day Tank		4					4	4	4
Ferric Dosing solenoid valves No.1 – No.8					8		8	8	8
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.C OZONE BUILDING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
14	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
2	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Industrial Communication No.1 – No.2
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Ethernet to Profinet Converters to connect to Ozone Siemens PLC: Plus	Converter to communicate to vendor Siemens PLC
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the	Power Supply

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.C SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR OZONE MOTOR CONTROL CENTRE [MCC NO.3] PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Low Lift Pump No.1 - No.3 healthy				3			3	3	3
Low Lift No.1 - No.3 trip					3		3	3	3
Low Lift No.1 - No.3 run/stop				3	3		6	6	6
Low Lift No.1 - No.3 E-Stop				3			3	3	3
Low Lift No.1 - No.3 Manual / Auto / Off				9			9	9	9
Low Lift No.1 - No.3 DE bearings motor	3		3		3		9	9	9
Low Lift No.1 - No.3 NDE bearings motor	3		3		3		9	9	9
Low Lift No.1 - No.3 Winding temperatures motor	9						9	9	9
Low Lift No.1 - No.3 DE bearings	3		3		3		9	9	9
Low Lift No.1 - No.3 NDE bearings	3		3		3		9	9	9
Low Lift No.1 - No.3 Pressure		3	3		3		6	6	6
Low Lift No.1 - No.3 Flow Meter		3	3		3		9	9	9
Low Lift No.1 - No.3 No-Flow Meter				3	3		6	6	6
Low Lift No.1 - No.3 Seal Leak				3	3		6	6	6
Low Lift Tank Level		1	1		1		3		3
Ozone Kiosk No.1 - No.3 Actuator healthy				3			3	3	3
Ozone Kiosk No.1 - No.3 Actuator trip				3			3	3	3
Ozone Kiosk No.1 - No.3 Actuator open / close				6	6		12	12	12
Ozone Kiosk No.1 - No.3 Actuator Remote / Manual				6	6		12	12	12

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Ozone Kiosk No.1 - No.2 Flow Meter		3	3		3		9	9	9
Ozone Kiosk No.1 - No.2 Flow Meter		3	3		3		9	9	9
Ozone Kiosk Concentration		3	3		3		9	9	9
Destructor healthy				1			1	1	1
Destructor trip					1		1	1	1
Destructor run/stop				1	1		2	2	2
Destructor E-Stop				1			1	1	1
Destructor Manual / Auto / Off				3			3	3	3
All Information for control and monitoring from ozone generator No.1 & No.2 to be added, the above is only an estimate and contractor to confirm with mechanical contractor	All	All	All	All	All	All	All	All	All
All signals from the Ozone system shall be connected to network. The Ozone vendor system supplied by the mechanical and HMI and SCADA System. The Ozone vendor package system shall be displayed on the SCADA and local HMI. The Engineer has made allowance of I/O to be catered for during tender stage on the network which be incorporated and programmed into the SCADA and local HMI, see the allowance below: Digital Inputs – 40 Digital Outputs – 40 Analogue Inputs – 16 Analogue Outputs – 4							100	100	100
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.D RGS FILTERS BUILDING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
4	4Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Filter Console Feeders
6	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-15" TFT graphic Terminals" colour touch screen with sufficient flash	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.D SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR FILTER MOTOR CONTROL CENTRE PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Blowers No.1 & No.2 Manual – off – Auto				2			2	2	2
Backwash No.1 & No.2 Manual – off – Auto				2			2	2	2
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.E RGS FILTERS CONTROL CONSOLES NO.1 - NO.4 PLC (X4)

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: Remote I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS Incomer
1	6Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	NTU
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	Remote I/O Cubicle
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial 100/1000Mb managed switch which suits the application, switch shall be from the same manufacturer: Plus	Communications with PLC
All	Remote High performance Remote signal modules for digital and analog I/O plus provide 5% Spare I/O capacity for plant: Plus	Input and Output modules

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interposing relays for surge protection of field statuses: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed) : Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



QTY	DESCRIPTION	IDENTIFICATION
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**PS EPLC-6.E SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR FILTER CONTROL PANEL
MOTOR CONTROL CENTRE [FCP No.1 – No.4] REMOTE I/O**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Filter X and Filter Y Selection				2			2	2	2
Filter X and Filter Y Auto – Manual – Off				4			4	4	4
Backwash Pump No.1 – No.2 Stop							2	2	2
Backwash Pump No.1 – No.2 Running							2	2	2
Backwash Pump No.1 – No.2 Tripped							2	2	2
Blower No.1 – No.2 Stop							2	2	2
Blower No.1 – No.2 Running							2	2	2
Blower No.1 – No.2 Tripped							2	2	2
Inlet sluice gate valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Inlet sluice gate valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Inlet sluice gate valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Clearwater outlet Modulating valve actuator Filter X and Filter Y Open / Close		4	4				8	8	8
Clearwater outlet Modulating valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Clearwater outlet Modulating valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Backwash water inlet valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Backwash water inlet valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Backwash water inlet valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Backwash water outlet valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Backwash water outlet valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Backwash water outlet valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Air scour valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Air scour valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Air scour valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Filter X and Filter Y level		2					2	2	2
Filter X and Filter Y Turbidity		2					2	2	2
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.F DAF PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet or c) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
6	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
8	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Industrial Communication No.1 – No.8
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	<p>The Contractor shall allow for the complete removal of the existing PLC, I/O, surge arrestors, UPS, industrial managed switch, back plane, termination system in the existing Main MCC at Bospoort WTW. A provisional Sum has been allowed for all Electrical work required to refurbish the existing tier. The new backplane will be built and tested off site while the installation and commission will occur on site [Bospoort Water Treatment Plant]. The contractor will backup and download the existing PLC program at Bospoort WTW and convert the existing PLC program and deploy it into the new PLC. Complete re-commissioning of the old program must be done after the conversion. All required conversion software must be supplied by the contractor.</p> <p>The existing Input and Outputs are as follows: Digital Input – 50 Digital Output – 20 Analogue Input – 10 Analogue Output – 6</p> <p>The contractor shall allow all necessary work on site to complete and integrate the new / old PLC on site.</p>	Existing Tier
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed) : Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for HMI unit; Plus	Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.F SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR DAF MOTOR CONTROL CENTRE PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Sump Pump No.1 – No.2 motor run/stop				2	4		6	6	6
Sump Pump No.1 – No.2 motor healthy				2			2	2	2
Sump Pump No.1 – No.2 auto				1			2	2	2
Sump Pump No.1 – No.2 motor trip				2			2	2	2
Washwater Pump No.1 – No.2 motor run/stop				2	4		4	4	4
Washwater Pump No.1 – No.2 motor healthy				2			4	4	4
Washwater Pump No.1 – No.2 man-off-auto				2			2	2	2
Washwater Pump No.1 – No.2 motor trip				2			2	2	2
Washwater Common Pressure		1					1	1	1
Washwater Pump No.1 – No.2 No-Flow				2			2	2	2
Washwater Water Flow		1					1	1	1
Washwater Water Level Tank in Dewatering Building		1					1	1	1
Sludge Pump No.1 – No.2 motor run/stop				2	4		6	6	6

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Sludge Pump No.1 – No.2 motor healthy				2			2	2	2
Sludge Pump No.1 – No.2 man-off-auto				2			2	2	2
Sludge Pump No.1 – No.2 motor trip				2			2	2	2
Sludge Pump No.1 – No.2 variable speed control		2	2				4	4	4
Sludge Pump No.1 – No.2 E-Stop				2			2	2	2
Sludge Pump No.1 – No.2 Common Pressure		1					1	1	1
Sludge Flow		1					1	1	1
DAF Mixers No.1 – No.2 motor run/stop				2	4		6	6	6
DAF Mixers No.1 – No.2 motor healthy				2			2	2	2
DAF Mixers No.1 – No.2 man-off-auto				2			2	2	2
DAF Mixers No.1 – No.2 motor trip				2			2	2	2
DAF Compressors No.1 – No.2 motor run/stop				2	4		6	6	6
DAF Compressors No.1 – No.2 motor healthy				2			2	2	2
DAF Compressors No.1 – No.2 man-off-auto				2			2	2	2
DAF Compressors No.1 – No.2 motor trip				2			2	2	2
Desludging valve actuator Open / Close				16	16		32	32	32
Desludging valve actuator Remote – Off – Manual				16			16	16	16
Outlet actuator Modulating valve actuator Open / Close		4	4				8	8	8
Outlet actuator Modulating valve actuator Remote – Off – Manual				4			4	4	4
The Contractor must account for all necessary signals required for the system's proper functioning. While the Engineer has made preliminary allowances, these are subject to change as the project progresses. The Contractor should be prepared to adjust and accommodate any additional signals or modifications that may arise to ensure full compliance with the final design and operational requirements.	All	All	All	All	All	All	All	All	All
Contractor to allow for additional 10% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.G DEWATERING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	0.17 μ s double-length words 0.25 μ s single-length words 1.16 μ s floating points <ul style="list-style-type: none"> Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied: Plus	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

**PS EPLC-6.G SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR DEWATERING,
CLARIFLOCCULATOR AND DAF MOTOR CONTROL CENTRE [MCC NO.7] PLC**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Sump Pump No.1 – No.2 motor run/stop				2	4		6	6	6
Sump Pump No.1 – No.2 motor healthy				2			2	2	2
Sump Pump No.1 – No.2 auto				1			2	2	2
Sump Pump No.1 – No.2 motor trip				2			2	2	2
Washwater Pump No.1 – No.2 motor run/stop				2	4		4	4	4
Washwater Pump No.1 – No.2 motor healthy				2			4	4	4
Washwater Pump No.1 – No.2 man-off-auto				2			2	2	2
Washwater Pump No.1 – No.2 motor trip				2			2	2	2
Washwater Common Pressure		1					1	1	1
Washwater Pump No.1 – No.2 No-Flow				2			2	2	2
Washwater Water Flow		1					1	1	1
Washwater Water Level Tank in Dewatering Building		1					1	1	1
Sludge Pump No.1 – No.2 motor run/stop				2	4		6	6	6
Sludge Pump No.1 – No.2 motor healthy				2			2	2	2
Sludge Pump No.1 – No.2 man-off-auto				2			2	2	2
Sludge Pump No.1 – No.2 motor trip				2			2	2	2
Sludge Pump No.1 – No.2 variable speed control		2	2				4	4	4
Sludge Pump No.1 – No.2 E-Stop				2			2	2	2
Sludge Pump No.1 – No.2 Common Pressure		1					1	1	1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Sludge Flow		1					1	1	1
Desludging valve actuator Open / Close				16	16		32	32	32
Desludging valve actuator Remote – Off – Manual				16			16	16	16
Outlet actuator Modulating valve actuator Open / Close		4	4				8	8	8
Outlet actuator Modulating valve actuator Remote – Off – Manual				4			4	4	4
Washwater No.1 - No.2 healthy				1			2	2	2
Washwater No.1 - No.2 trip					2		2	2	2
Washwater No.1 - No.2 run/stop					2		2	2	2
Washwater No.1 - No.2 E-Stop				2			2	2	2
Washwater No.1 - No.2 Manual / Auto / Off				6			6	6	6
Washwater valve open/close				2	2		4	4	4
Washwater Faulty				1	1		2	2	2
Washwater No.1 - No.2 Pressure		2	2		2		6	6	6
Washwater Flow		1	1		1		1	1	1
Poly No.1-No.4 Mixer healthy				4			4		4
Poly No.1-No.4 Mixer trip				4			4		4
Poly No.1-No.4 Mixer run/stop				8	8		16		16
Poly No.1-No.4 Mixer E-Stop				4			4		4
Poly No.1-No.4 Mixer Manual / Auto / Off				12			12		12
Poly No.1-No.4 Tank Level		4	4		4		8		8
Belt Filter Press Actuator No.1 –No.10 healthy				10			10		10
Belt Filter Press Actuator No.1 –No.10 trip				10			10		10
Belt Filter Press Actuator No.1 –No.10 open / close				10	10		20		20
Belt Filter Press Actuator No.1 –No.10 Remote / Manual				10	10		20		20
Conveyor No.1 - No.2 healthy				1			2		2
Conveyor No.1 - No.2 trip					2		2		2
Conveyor No.1 - No.2 run/stop				2	2		4		4
Conveyor No.1 - No.2 E-Stop				2			2		2
Conveyor No.1 - No.2 Manual / Auto / Off				6			6		6
Sludge Flow Meter		1	1		1		1		1
Sludge Density Meter No.1 & No.2		2	2		2		2		2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
<p>All signals from the Dewatering system shall be connected to network. The Dewatering system vendor system supplied by the mechanical shall be connected to main PLC, HMI and SCADA System. The Dewatering system vendor package system shall be displayed on the SCADA and local HMI. The Engineer has made allowance of I/O to be catered for during tender stage on the network which be incorporated and programmed into the SCADA and local HMI, see the allowance below:</p> <p>Digital Inputs – 40 Digital Outputs – 40 Analogue Inputs – 16 Analogue Outputs – 4</p>							100	100	100

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.H DEWATERING BELT FILTER CONTROL PANELS NO.1 & NO.2 PLC (X2)

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: Remote I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS Incomer
All	Continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
All	Continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
All	Continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
All	Continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instruments to be on UPS Supply
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	Remote I/O Cubicle
1	Continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial 100/1000Mb managed switch which suits the application, switch shall be from the same manufacturer: Plus	Communications with PLC
All	Remote High performance Remote signal modules for digital and analog I/O plus provide 5% Spare I/O capacity for plant: Plus	Input and Output modules

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interposing relays for surge protection of field statuses: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	Continuous current rated SP door interlocked protection MCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



QTY	DESCRIPTION	IDENTIFICATION
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**PS EPLC-6.H SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR MASTER CONTROL PANEL
MOTOR CONTROL CENTRE [MCP NO.7 A] REMOTE I/O**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
All signals from the Dewatering system shall be connected to network. The Dewatering system vendor system supplied by the mechanical shall be connected to main PLC, HMI and SCADA System.	All	All	All	All	All	All	All	All	All
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.I GAC FILTERS BUILDING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
4	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Filter Control Panels
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-15" TFT graphic Terminals" colour touch screen with sufficient flash	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.I SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR FILTER MOTOR CONTROL CENTRE [MCC NO.2] PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
Blowers No.1 & No.2 Manual – off – Auto				2			2	2	2
Backwash No.1 & No.2 Manual – off – Auto				2			2	2	2
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.J GAC FILTERS CONTROL PANEL NO.1 - NO.6 PLC (X6)

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: Remote I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS Incomer
1	6Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	NTU
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	Remote I/O Cubicle
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial 100/1000Mb managed switch which suits the application, switch shall be from the same manufacturer: Plus	Communications with PLC
All	Remote High performance Remote signal modules for digital and analog I/O plus provide 5% Spare I/O capacity for plant: Plus	Input and Output modules

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interposing relays for surge protection of field statuses: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed) : Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



QTY	DESCRIPTION	IDENTIFICATION
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**PS EPLC-6.J SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR FILTER CONTROL PANEL
MOTOR CONTROL CENTRE REMOTE I/O**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Filter X and Filter Y Selection				2			2	2	2
Filter X and Filter Y Auto – Manual – Off				4			4	4	4
Backwash Pump No.1 – No.2 Stop							2	2	2
Backwash Pump No.1 – No.2 Running							2	2	2
Backwash Pump No.1 – No.2 Tripped							2	2	2
Blower No.1 – No.2 Stop							2	2	2
Blower No.1 – No.2 Running							2	2	2
Blower No.1 – No.2 Tripped							2	2	2
Inlet sluice gate valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Inlet sluice gate valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Inlet sluice gate valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Clearwater outlet Modulating valve actuator Filter X and Filter Y Open / Close		4	4				8	8	8
Clearwater outlet Modulating valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Clearwater outlet Modulating valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Backwash water inlet valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Backwash water inlet valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Backwash water inlet valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Backwash water outlet valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Backwash water outlet valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Backwash water outlet valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2
Air scour valve actuator Filter X and Filter Y Open / Close				4	4		8	8	8
Air scour valve actuator Filter X and Filter Y Remote – Off – Manual				4			4	4	4
Air scour valve actuator Filter X and Filter Y Healthy [Reaching limits]							2	2	2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Filter X and Filter Y level		2					2	2	2
Filter X and Filter Y Turbidity		2					2	2	2
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.K HYDROGEN PEROXIDE BUILDING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: e) Profibus-DP f) Profinet g) Industrial Ethernet h) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	8.1 Kinst/ms 100% Boolean <ul style="list-style-type: none"> Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-15" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.16.K SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR HYDROGEN PEROXIDE BUILDING PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.	All	All	All	All	All	All	All	All	All
UPS Normal/Fail				2			2	2	2
UPS Low Battery				1			1	1	1
UPS DC voltage below 190 Volt				1			1	1	1
UPS Main Supply / UPS Power				2			2	2	2
Hydrogen peroxide No.1-No.2 healthy				2			2	2	2
Hydrogen peroxide Pump No.1-No.2 trip				2			2	2	2
Hydrogen peroxide Pump No.1-No.2 run/stop				2	2		4	4	4
Hydrogen peroxide Pump No.1-No.2 E-Stop				2			2	2	2
Hydrogen peroxide Pump No.1-No.2 Manual / Auto / Off				6			6	6	6
Hydrogen peroxide Pump No.1-No.2 Flow Meter		2	2		2		6	6	6
Hydrogen peroxide Pump No.1-No.2 dosing rate control / speed		2	2				4		4
Hydrogen peroxide Pump No.1-No.2 Actuator healthy				2			2		2
Hydrogen peroxide Pump No.1-No.2 Actuator trip				2			2		2
Hydrogen peroxide Pump No.1-No.2 Actuator open / close				2	2		4		4
Hydrogen peroxide Pump No.1-No.2 Actuator Remote / Manual				2	2		4		4
Poly Pump Flow Rate		1	1		1		1		1
Filtrate Pump No.1 - No.2 healthy				1			2		2
Filtrate Pump No.1 - No.2 trip					2		2		2
Filtrate Pump No.1 - No.2 run/stop					2		2		2
Filtrate Pump No.1 - No.2 E-Stop				2			2		2
Filtrate Pump No.1 - No.2 Manual / Auto / Off				6			6		6
Filtrate Pump valve open/close				2	2		4		4
Filtrate Pump Faulty				1	1		2		2
Filtrate Pump No.1 - No.2 Pressure		2	2		2		6		6
Filtrate Pump Flow		1	1		1		1		1
Filtrate Pump Level		1	1		1		1		1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Hydrogen peroxide No.1-No.2 Mixer healthy				2			2		2
Hydrogen peroxide No.1-No.2 Mixer trip				4			4		4
Hydrogen peroxide No.1-No.2 Mixer run/stop				4	4		8		8
Hydrogen peroxide No.1-No.2 Mixer E-Stop				2			2		2
Hydrogen peroxide No.1-No.2 Mixer Manual / Auto / Off				6			6		6
Hydrogen peroxide No.1-No.2 Tank Level		2	2		2		6		6
Contractor to allow for additional programming for configuring plant to original status & Spare		10	10	20	20	20	80		80

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.L PRE-OZONE BUILDING PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	0.17 μ s double-length words 0.25 μ s single-length words 1.16 μ s floating points <ul style="list-style-type: none"> Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.L SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR PRE-OZONATION MOTOR CONTROL CENTRE [MCC NO.6] PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
All signals from the Pre-Ozonation system shall be connected to network. The Ozone vendor system supplied by the mechanical and HMI and SCADA System. The Ozone vendor package system shall be displayed on the SCADA and local HMI. The Engineer has made allowance of I/O to be catered for during tender stage on the network which be incorporated and programmed into the SCADA and local HMI, see the allowance below: Digital Inputs – 10 Digital Outputs – 10 Analogue Inputs – 6 Analogue Outputs – 4							30	30	30
Inlet Flow		1					1	1	1
Inlet pH		1					1	1	1
Inlet Turbidity		1					1	1	1
Inlet pH		1					1	1	1
Process Pump Run / Stop					2		2	2	2
Process Pump E / Stop				1			1	1	1
Process Pump Trip				1			1	1	1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Contractor to allow for additional 5% spare capacity	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC 6.M TELEMETRY OUTSTATION CONTROL ROOM PLC [BOSPOORT NORTH TO: THLABANE PIPELINE; BOITEKONG PIPELINE AND BOITEKONG NETWORK CHAMBER]

The Bospoort North to Thlabane Pipeline, Boitekong Pipeline and Boitekong Network Chamber PLC, supplied and installed under this contract, shall communicate via telemetry to the Bospoort Water Treatment Works.

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O, Alarm System modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS supply
1	10Amp sized continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval); Plus	Main Circuit Breaker UPS
2	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Single Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor plus signals
1	Selector switch for normal/UPS power selection: Plus	Maintenance purposes
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<p>complete with communication interface and shall comply with either of the following:</p> <ul style="list-style-type: none"> e) Profibus-DP f) Profinet g) Industrial Ethernet h) Modbus TCP/IP <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p> <p>Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus</p>	years. With minimum of Lead acid batteries.
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Alarm system supply
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	PLC processor unit complete with CPU, base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following specifications: <ol style="list-style-type: none"> 1024 I/O Multi-rack configuration capability, 256 I/O multi-rack configuration capability, The minimum communication service: bandwidth management, Ethernet TCP/IP Data Editor, Ethernet TCP/IP Modbus TCP messaging, Ethernet TCP/IP Rack Viewer, Ethernet TCP/IP SNMP network administrator, Ethernet TCP/IP Network management (NMT) CANopen Process Data Object (PDO) CANopen Service Data Object (SDO) CANopen Special functions (SYNC, EMCY, TIME) CANopen, Ethernet port, Memory description: 4096 kB internal RAM, 256 kB internal RAM for data, 3584 kB internal RAM for program constants and symbols and shall be supplied with additional memory, and Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	Equal and similar to BMXP3420302 M340 from Schneider Electric. Provide 35% Spare CPU capacity for plant (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	All signals shall be protected with digital and analog Surge arrester modules equal or similar to Blitzductor from DEHNguard.	Surge Protection for all signals
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI
1	6Amp continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Ethernet field bus connections: Plus	Connections

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Human machine interface with 7.5" Inch advanced touchscreen panel 320 x 240 pixels LCD colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required must be provided: Plus	HMI
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath. All mimics will supplied for the Engineer for approval.	Programing
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All motors, blowers and pumps information protected settings, control and monitoring functions: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	8. All valves, actuators and control valves open / close / trip conditions settings, monitoring and control functions: Plus	Displays
All	9. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays
One	Panel comprising the following: (Panel door shall be purple powder coated)	Alarm System
1	6Amp continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	Stabilized transformer / power supply for (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power / transformer Supply
All	Big metal box enclosure box from equal and similar Paradox including including Mirco SD card loaded with Paradox TM50 keypad software and all accessories to complete the installation: Plus	Accessories
1	Backup battery 7Amp Hour ,12 volt lead acid	Back-up battery
1	Alarm control panel unit complete with base plate, bus terminators, Ethernet communication, dual SMS module that will satisfy the application with at least the following specifications:	Control Panel
	StayD Mode, Built-in transceiver (433MHz), 32 zones (any of which can be wireless), 32 users and 32 remote controls (one per user), 2 partitions, 4-wire communication bus (connect up to 15 keypads), Supports REM3 hand-held remote keypad, Supports up to 8 K32RF / K37 wireless keypads, Supports up to 2 RPT1 wireless repeaters, Supports PCS100, PCS200	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	and PCS250 series SMS modules, Supports IP100, IP150 Internet Module, Supports VDMP3 Plug-in voice dialer, Supports 16 PGMs (any of which can be wireless), Supports Insite Gold application, In-field firmware upgrade via 307USB and Babyware, Menu-driven programming for the Installer, Master and Maintenance codes, Multiple telephone numbers for event reporting: 3 monitoring, 5 for Personal Dialing and 1 for pager, Patented 2 opto coupler dialer circuit - the most reliable dialer in the industry (US Patents 5751803, RE39406), Calendar with Daylight savings Time, New Sleep arming method, Push button power reset, RF Jamming Supervision, 9.6k baud communication with Babyware and 256 events buffered Equal or similar to Paradox MG5050 including Paradox PCS250 SMS module connects directly to the control panel.: Plus	
1	Keypad equal or similar to Paradox K32: Plus	Keypads
1	Wireless Passive equal or similar PMD75 from Paradox: Plus	Keypads
All	Wireless door open / close contact: Plus	All panel doors, gate and main control room door.
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Contractor will be responsible for the application for sim card and contract made out to client and applications fees which will be able to send all the required info and data for 1 year subscription.	Sim card

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

**PSEPLC 6.16.M SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR TELEMTRY OUSTATION
CONTROL ROOM PLC [BOSPOORT NORTH TO: THLABANE PIPELINE;
BOITEKONG PIPELINE AND BOITEKONG NETWORK CHAMBER]**

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
UPS Normal/Fail				2			2	2	2
UPS Low Battery				1			1	1	1
UPS DC voltage below 190 Volt				1			1	1	1
UPS Main Supply / UPS Power				2			2	2	2
Power Mains Live / Off					2		2	2	2
Alarm System Normal/Fail				2			2	2	2
Alarm System Low Battery				1			1	1	1
Alarm System DC voltage below 190 Volt				1			1	1	1
Alarm System Main Supply / Battery Power				2			2	2	2
Remote Activating Alarm System				1	1		2	2	2
Control Room Alarm Triggered				1		1	2	2	2
Control Room Door Open / Close						2	2	2	2
Panel Doors Open / Close						10	10	10	10
Gate Open / Close						1	1	1	1
Actuator No.1 Healthy				1			1	1	1
Pressure Relief Valve No.1 – No.3 Trip				3			3	3	3
Pressure Relief Valve No.1 – No.3 Open / Close				3	3		6	6	6
Pressure Relief Valve No.1 – No.3 Remote / Manual				6			6	6	6
Pressure Relief Valve No.1 – No.3 Modulating Control			3				3	3	3
Turbine Flow Meter No.1 – No.3		3					3	3	3
Tamper Outstation Door Cubicles						5	5	5	5

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Turbine Flow meter Totalized flow measurement [captured every day at selectable / programmable predetermined / time]		3					3	3	3
Contractor to allow 10% Spare capacity for future	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC 6.N TELEMETRY OUSTATION CONTROL ROOM PLC [BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER]

The Bospoort to Vaalkop / Bospoort North HLPL Link Chamber PLC, supplied and installed under this contract, shall communicate via telemetry to the Bospoort Water treatment Works.

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O, Alarm System modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	UPS supply
1	10Amp sized continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval); Plus	Main Circuit Breaker UPS
2	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Single Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
1	Selector switch for normal/UPS power selection: Plus	Maintenance purposes
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following:	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	10Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Alarm system supply

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	PLC
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	PLC processor unit complete with CPU, base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following specifications: <ol style="list-style-type: none"> 1024 I/O Multi-rack configuration capability, 256 I/O multi-rack configuration capability, The minimum communication service: bandwidth management, Ethernet TCP/IP Data Editor, Ethernet TCP/IP Modbus TCP messaging, Ethernet TCP/IP Rack Viewer, Ethernet TCP/IP SNMP network administrator, Ethernet TCP/IP Network management (NMT) CANopen Process Data Object (PDO) CANopen Service Data Object (SDO) CANopen Special functions (SYNC, EMCY, TIME) CANopen, Ethernet port, Memory description: 4096 kB internal RAM, 256 kB internal RAM for data, 3584 kB internal RAM for program constants and symbols and shall be supplied with additional memory, and Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>Equal and similar to BMXP3420302 M340 from Schneider Electric. Provide 35% Spare CPU capacity for plant (Estimated and shall be confirmed by contractor and all</p>	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	calculations shall be supplied to Engineer for approval): Plus	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	All signals shall be protected with digital and analog Surge arrester modules equal or similar to Blitzductor from DEHNguard.	Surge Protection for all signals
One	Panel comprising the following: (Panel door shall be purple powder coated)	HMI
1	6Amp continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Ethernet field bus connections: Plus	Connections
1	Human machine interface with 7.5" Inch advanced touchscreen panel 320 x 240 pixels LCD colour touch screen with sufficient flash memory, soft function and static function	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	keys and Ethernet communication port. Software as may be required must be provided: Plus	
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath. All mimics will supplied for the Engineer for approval.	Programing
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All motors, blowers and pumps information protected settings, control and monitoring functions: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All valves, actuators and control valves open / close / trip conditions settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	9. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays
One	Panel comprising the following: (Panel door shall be purple powder coated)	Alarm System
1	6Amp continuous current rated SP door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	Stabilized transformer / power supply for (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power / transformer Supply
All	Big metal box enclosure box from equal and similar Paradox including including Mirco SD card loaded with Paradox TM50 keypad software and all accessories to complete the installation: Plus	Accessories
1	Backup battery 7Amp Hour ,12 volt lead acid	Back-up battery
1	Alarm control panel unit complete with base plate, bus terminators, Ethernet communication, dual SMS module that will satisfy the application with at least the following specifications:	Control Panel
	StayD Mode, Built-in transceiver (433MHz), 32 zones (any of which can be wireless), 32 users and 32 remote controls (one per user), 2 partitions, 4-wire communication bus (connect up to 15 keypads), Supports REM3 hand-held remote keypad, Supports up to 8 K32RF / K37 wireless keypads, Supports up to 2 RPT1 wireless repeaters, Supports PCS100, PCS200 and PCS250 series SMS modules, Supports IP100, IP150 Internet Module, Supports VDMP3 Plug-in voice dialer, Supports 16 PGMs (any of which can be wireless), Supports Insite Gold application, In-field firmware upgrade via 307USB	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
	and Babyware, Menu-driven programming for the Installer, Master and Maintenance codes, Multiple telephone numbers for event reporting: 3 monitoring, 5 for Personal Dialing and 1 for pager, Patented 2 opto coupler dialer circuit - the most reliable dialer in the industry (US Patents 5751803, RE39406), Calendar with Daylight savings Time, New Sleep arming method, Push button power reset, RF Jamming Supervision, 9.6k baud communication with Babyware and 256 events buffered Equal or similar to Paradox MG5050 including Paradox PCS250 SMS module connects directly to the control panel.: Plus	
1	Keypad equal or similar to Paradox K32: Plus	Keypads
1	Wireless Passive equal or similar PMD75 from Paradox: Plus	Keypads
All	Wireless door open / close contact: Plus	All panel doors, gate and main control room door.
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Contractor will be responsible for the application for sim card and contract made out to client and applications fees which will be able to send all the required info and data for 1 year subscription.	Sim card

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PSEPLC6.16.N SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR TELEMTRY OUSTATION CONTROL ROOM PLC [BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER]

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
UPS Normal/Fail				2			2	2	2
UPS Low Battery				1			1	1	1
UPS DC voltage below 190 Volt				1			1	1	1
UPS Main Supply / UPS Power				2			2	2	2
Power Mains Live / Off					2		2	2	2
Alarm System Normal/Fail				2			2	2	2
Alarm System Low Battery				1			1	1	1
Alarm System DC voltage below 190 Volt				1			1	1	1
Alarm System Main Supply / Battery Power				2			2	2	2
Remote Activating Alarm System				1	1		2	2	2
Control Room Alarm Triggered				1		1	2	2	2
Control Room Door Open / Close						2	2	2	2
Panel Doors Open / Close						10	10	10	10
Gate Open / Close						1	1	1	1
Actuator No.1 Healthy				1			1	1	1
Pressure Relief Valve No.1 – No.3 Trip				3			3	3	3
Pressure Relief Valve No.1 – No.3 Open / Close				3	3		6	6	6
Pressure Relief Valve No.1 – No.3 Remote / Manual				6			6	6	6
Pressure Relief Valve No.1 – No.3 Modulating Control			3				3	3	3
Turbine Flow Meter No.1 – No.3		3					3	3	3
Tamper Outstation Door Cubicles						5	5	5	5
Turbine Flow meter Totalized flow measurement [captured every day at		3					3	3	3

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
selectable / programmable predetermined / time]									
Contractor to allow 10% Spare capacity for future	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.O EXISTING DAF PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 4 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	0.17 μ s double-length words 0.25 μ s single-length words 1.16 μ s floating points <ul style="list-style-type: none"> Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS EPLC-6.16.0 SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR EXISTING MCC PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
UPS DC voltage below recommended voltage [Allowance]							All	All	All
The Contractor shall allow for the complete removal of the existing PLC, I/O, surge arrestors, UPS, industrial managed switch, back plane, termination system in the existing MCC at Bospoort WTW. A provisional Sum has been allowed for all Electrical work required to refurbish the existing tier. The new backplane will be built and tested off site while the installation and commission will occur on site [Bospoort Water Treatment Plant]. The contractor will backup and download the existing PLC program at Bospoort WTW and convert the existing PLC program and deploy it into the new PLC. Complete re-commissioning of the old program must be done after the conversion. All required conversion software must be supplied by the contractor. The contractor shall allow all necessary work on site to complete and integrate the new / old PLC on site.	0	12	10	30	30		82	82	82

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.P GENERATOR PLC

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS supply
1	16Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	Change over switch from Normal / UPS power selection: Plus	Maintenance purposes
1	10Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker
1	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval). Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Under no circumstances, shall the use of proprietary protocols be allowed: Plus Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus	UPS with 3-hour back-up to cater for all instrumentation, HMI and PLC. Warranty shall be a minimum of 2 years. With minimum of Lead acid batteries.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Relays and contactors for automatic transfer to UPS power once the UPS power is restored: Plus	Automatic change over
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	UPS monitoring functions as specified: Plus	UPS
1	6Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	4Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Remote RMU Supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	All instrumentation shall be on UPS: NTU, pH, FIT, PIT and LIT.[Allowance]
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	PLC Cubicle
1	6Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial layer No.1 100/1000Mb managed switch which suits the application, complete with at least 2 x fiber optic ports, PLC, switch shall be from the same manufacturer: Plus	Communications with Fiber Optic cable
1	PLC processor unit complete with CPU base plate, bus terminators, Ethernet communication with I/O modules that will satisfy the application with at least the following minimum specifications: <ul style="list-style-type: none"> Discrete I/O processor capacity 1024 I/O Multi-rack configuration capability, 	PLC CPU

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<ul style="list-style-type: none"> Analogue I/O processor capacity 256 I/O multi-rack configuration capability, Execution time per instruction 0.12 μs Boolean 0.17 μs double-length words 0.25 μs single-length words 1.16 μs floating points Number of instructions per ms 6.4 Kinst/ms 65 % Boolean + 35 % fixed arithmetic 8.1 Kinst/ms 100% Boolean Embedded communication service: Bandwidth management & Ethernet TCP/IP Application structure 1 cyclic/periodic master task 1 periodic fast task System overhead 0.13ms for fast task 0.7ms for master task Shall comply with the following standards: IEC 61131-2 UL 508 EN 61131-2 CSA C22.2 No 142 CSA C22.2 No 213 Class I Division 2 <p>The CPU selected shall be provided with 50% additional spare capacity for the plant: Plus</p>	
All	High performance signal modules for digital and analog I/O plus provide 10% Spare I/O capacity for plant: Plus	Input and Output modules
All	Interposing relays for surge protection of field statuses to PLC: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
All	Tenderers shall allow 10% of I/O specified [see list below] to be protected with digital and analog Surge arrestor modules. All Digital and Analogue signals leaving the main structure lighting and earthing protection must be protected via signal arrestors: Plus	Surge Protection for all signals
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed): Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash	HMI

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath: Plus	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.16.P SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR GENERATOR PLC

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
Generator healthy No.1 – No.3				3			3	3	3
Generator trip No.1 – No.3				3			3	3	3
Generator run/stop No.1 – No.3					18		18	18	18
Generator E-Stop No.1 – No.3					3		3	3	3
Generator bulk fuel tank level Analogue Monitor / Alarm / Trip No.1 – No.3 and External Tank		4					4	4	4
Generator Engine and Alternator temperature	3						3	3	3
Generator Engine and Alternator temperature Trip / Alarm	3						3	3	3
Generator Engine water level Alarm / Trip		3			3		6	6	6
Generator Engine Oil Level Alarm / Trip		3			3		6	6	6
Generator Alternator Charging Operational		3					3	3	3
Generator Engine Temperature	3						3	3	3
Generator Normal/Fail				3			3	3	3
Generator Low Battery				3			3	3	3
Generator DC voltage below 12 Volt				3			3	3	3
Generator Low Oil level		4					4	4	4
Generator Overload				3			3	3	3
Generator circulation Pump Run / Stop / Healthy Statuses				3	6		9	9	9
All Generator information shall be displayed on HMI in Main MCC							All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

PS EPLC-6.Q REMOTE I/O RMU

Type: The motor control center panel builder shall allow a minimum of a full tier for programmable logic controller equipment as specified below. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions, and proper functioning of the system.

Colour: Purple powder coated

Equipment: UPS, CPU, I/O modules and a HMI.

Commination Medium: Ethernet

Protocol: Equal or similar to either of the following a) Modbus, b) DeviceNet, c) Profinet or d) Profibus

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	UPS Incomer
1	6Amp sized continuous current rated SP + N door interlocked protection MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker UPS
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	PLC supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	HMI supply
1	2Amp continuous current rated SP MCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	NTU
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	Remote I/O Cubicle
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Main Circuit Breaker PLC
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval): Plus	Power Supply
1	Industrial 100/1000Mb managed switch which suits the application, switch shall be from the same manufacturer: Plus	Communications with PLC
All	Remote High performance Remote signal modules for digital and analog I/O plus provide 5% Spare I/O capacity for plant: Plus	Input and Output modules

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interposing relays for surge protection of field statuses: Plus	Surge Protection
All	Termination blocks necessary for signal cable connections from all motors and instrumentation: Plus	All Terminals
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	All
One	Cubicle comprising the following: (Cubicle door shall be purple powder coated)	HMI
1	2Amp continuous current rated SP door interlocked protection MCCB (Estimated and should be confirmed) : Plus	Main Circuit Breaker PLC UPS
1	230V/24DC stabilized power supply for 24V DC inputs to PLC input modules. (Power supply shall have adequate capacity for the application) (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) : Plus	Power Supply
1	Human machine interface advanced touchscreen panel HD pixels VGA-10" TFT graphic Terminals" colour touch screen with sufficient flash memory, soft function and static function keys and Ethernet communication port. Software as may be required shall be provided: Plus [Contractor to allow for flap Infront of screen which is UV resistant and can prevent all UV rays to damage to the screen]. UV flap or cover shall have design life of 10 years and guarantee shall be supplied.	HMI
All	Software programming for indication of the following monitoring functions on the HMI display and all I/O as indicated in schedule of supervisory and control I/O's underneath.	
All	1. Alarm history page: Plus	Alarm history
All	2. Alarm setup page: Plus	Setup page
All	3. Graphic displays shall be used for variable parameter indications: Plus	Displays
All	4. Animated mimic displays shall be used for equipment displays: Plus	Displays
All	5. Password protected settings: Plus	Protection
All	6. All information protection settings, control and monitoring functions shall be displayed: Plus	Displays
All	7. All Instrumentation settings, monitoring and control functions: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025



QTY	DESCRIPTION	IDENTIFICATION
All	8. All monitoring and control functions as indicated schedule of supervisory and control I/O's underneath: Plus	Displays

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-6.16.Q SCHEDULE OF SUPERVISORY AND CONTROL I/O'S FOR REMOTE I/O RMU

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
Power Analyzer values to be captured in PLC and displayed on plant and SCADA, HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.							All	All	All
UPS healthy [Allowance]							All	All	All
UPS trip [Allowance]							All	All	All
UPS Normal/Fail [Allowance]							All	All	All
UPS Low Battery [Allowance]							All	All	All
Eskom Breaker Open / Close					2		2	2	2
Eskom Breaker Trip				1			1	1	1
Generator Breaker Open / Close					2		2	2	2
Generator Breaker Trip				1			1	1	1
Plant Breaker Open / Close					2		2	2	2
Plant Breaker Trip				1			1	1	1
Once the timer is set, the generator will automatically start and switch over to generator power, maintaining the plant's operation until Eskom power is restored. Upon restoration of Eskom power, the system will automatically switch back to Eskom supply, ensuring a seamless transition and protecting the equipment from potential damage during shutdown and startup sequences. The following functions will be programmed by the designated programmer: <ul style="list-style-type: none"> Controlled Stop of All Motors: Ensuring that all running motors are stopped in a controlled manner to prevent damage. Controlled Stop of All Processes: Gradually stopping all processes to avoid abrupt shutdowns and potential issues. 	All	All	All	All	All	All	All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

DESCRIPTION	RTD IN	ANALOG IN	ANALOG OUT	24V DC IN	24V DC OUT	VOLT FREE OUT	NETWORK LINK		
							SCADA	HMI	PLANT
<ul style="list-style-type: none">Controlled Start Sequence of the Plant: The contractor shall detail the start-up sequence for the plant and submit it for approval. This sequence will be crucial for ensuring the plant starts up efficiently and safely.Sequence Upon Eskom Power Restoration: The same controlled start sequence will be performed once Eskom power is restored, ensuring a smooth transition back to the primary power source.									
All Generator information shall be displayed on HMI in MCC							All	All	All

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EPLC-15 OPERATION OF PLANT

PS EPLC-15.A RAPID GRAVITY SAND FILTER

Four (4) rapid gravity sand filters will be constructed under the civil contract. Each filter box contains two (2) filter floors. Contractor will be expected to design, supply, deliver and install a complete filter control system that complies with Mechanical Scope of Work.

The backwash process must be interlocked to prevent the backwash of more than one filter at any stage. A reset backwash push button must be provided to restart a back wash cycle in the event of wash cycle malfunction.

The air blowers and wash water pumps will be interlocked to prevent simultaneous operation at any stage and either the Rapid Gravity Filters or Granular Activated Carbon Filter can be back washed at a time.

The filter back wash sequence must be continuously displayed on the HMI system and the event that caused a back wash failure must be displayed.

A selector switch must be made available on the filter control panel; the selector switch must contain two (2) options to select; a) “automatic mode” and b) “manual mode” of operation.

The following is a description of the filter backwash process in the automatic and manual mode of operation:

AUTOMATIC MODE OF OPERATION (PLC)

The filters will be operated as ‘varying-head’ filters i.e. once washed, the outlet and inlet valves will open and water discharged into the filter and through the media. As the media get clogged by trapped suspended matter, the level in the filter box will gradually increase until a pre-determined high level is reached (as recorded by an ultrasonic level transmitter located in each filter box), which will trigger an alarm on the filter control panel. Once the alarm is displayed on the HMI the operator will have to trigger automatic backwash cycle:

The programmable logic controller (PLC) must go through all the necessary checks to determine that filter is healthy; only when healthy status is obtained can a backwash continue on a filter. Healthy indication can only be achieved when actuators, level, backwash pump sets and blower’s sets have healthy signal and this will trigger “filter healthy” indication on the HMI.

- a) First the inlet sluice will close to prevent any further water from entering the filter box (“Inlet sluice close” must be indicated”).
- b) The filtered water outlet valve will remain open until the water level in the filter has reached a pre-determined low level as recorded by the level transmitter (“Level must be indicated”). The ultrasonic level sensor must be set during commissioning by the Contractor.
- c) Once the low level has been reached, the outlet valve will close, the wash water outlet valve will open and after a couple of seconds, one of the two blowers will start (The “blower run” indication will now be on) to scour the media with air and run for a number of minutes (exact time period will be determined during commissioning and will be adjustable on the HMI);

<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

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- d) After the air scour cycle, the wash water inlet valve will open and one of the two backwash pumps started (The “backwash pump run” indication will now be on) to wash the media for a number of minutes (exact time period will be determined during commissioning and will be adjustable on the HMI).
- e) After the wash cycle, the backwash pump will stop, the wash water inlet and outlet valves will close. (“wash water inlet and outlet close must be indicated”), the filtered water outlet valve will open as well as the inlet sluice and the filter will be put back in operation .(“filtered water outlet and Inlet Sluice open must be indicated”).
- f) The PLC will be programmed to initiate a graphic alarm on the HMI to indicate to the operator that a filter requires a wash cycle. The graphic alarm will be a separate mimic display; the mimic display will “pop up” in the event that a filter requires a wash cycle. The mimic display will “pop up” in the event of two cases:
 - As the media get clogged by trapped suspended matter, the level in the filter box will gradually increase until a pre-determined high level is reached (as recorded by an ultrasonic level transmitter located in each filter box), which will trigger and alarm on the filter control panel.
 - To initiate an automatic wash should a high level not be reached within a specified time frame, say 48 hours. This parameter will also be adjustable on the HMI.

The filter system shall be fully automated with the SCADA functionality included in the table below.

Function	Detail
Filtration mode	In service, backwash, out of service
Step in filter mode (filter, backwash out of service)	Indicate step in mode sequence, time since start of step, step duration to completion, interlocks, faults and status
Valve position	Open, close, % open, trip
Water level in filter	% full, low and high limits
Media level in filter	m
Flow rate into each filter	MI/d
Filter bed volumes treated	Number
Outlet turbidity	NTU

MANUAL MODE OF OPERATION

The Contractor shall write a checklist and procedure for manual mode operation for the filter plant, training for procedure and manual must supplied to the operator of the plant. Manual mode of operation can only be achieved when selector switch is placed into “manual mode” of operation.

The Contractor shall ensure that operator understand manual mode of operation and the process to follow.

- a) Select filter on selector switch and press push button “start wash cycle”.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- b) Blinking “close inlet sluice” shall be indicted, when pressed the inlet sluice will close to prevent any further water from entering the filter box water from entering the filter box (“Inlet sluice close” must be indicated”).
- c) Blinking “close filtered water outlet valve” shall be indicted, when pressed the the filtered water outlet valve will close (“filtered water outlet valve close” must be indicated”).
- d) Blinking “open wash water outlet valve” shall be indicted, when pressed the wash water outlet valve will open (“wash water outlet valve open” must be indicated”).
- e) Blinking “start blower” shall be indicted, when pressed (The “blower run” indication will now be on) to scour the media with air and run for a number of minutes (exact time period must be determined by the Contractors manual)
- f) Blinking “start backwash pump” shall be indicted, when pressed (The “backwash pump run” indication will now be on) to wash the media for a number of minutes (exact time period must be determined by the Contractors manual)
- g) Blinking “close wash water and outlet valve” shall be indicted, once pressed the wash water inlet and outlet valves will close (“wash water inlet and outlet close must be indicated”).
- h) Blinking “open inlet sluice” shall be indicted, when pressed the inlet sluice will open to allow water from entering the filter box water from entering the filter box (“Inlet sluice open” must be indicated”).

In the manual mode of operation the blower as well as the backwash pump must be manually activated from the HMI or push buttons which is on the filter control desk. The opening and closing of valves will be controlled at the filter control console by means or selector switch, push button, timers and relays when in manual mode of operation.

OPERATOR INITIATED BACK WASH

With all systems healthy the Operator can manually initiate the back wash process on the HMI. After pressing the “back wash” digital button or push button, the PLC will automatically complete the back wash process.

PS EPLC-15.B GRANULAR ACTIVATED CARBON FILTERS

Six (6) granular activated carbon filters will be constructed under the civil contract. Each granular activated filter box contains two (2) filter floors. Contractor will be expected to design, supply, deliver and install a complete filter control system that complies with Mechanical Scope of Work.

The backwash process must be interlocked to prevent the backwash of more than one filter at any stage, this include the rapid gravity sand filter. A reset backwash push button must be provided to restart a back wash cycle in the event of wash cycle malfunction.

The air blowers and wash water pumps will be interlocked to prevent simultaneous operation at any stage and either the Rapid Gravity Filters or Granular Activated Carbon Filter can be back washed at a time.

The filter back wash sequence must be continuously displayed on the HMI system and the event that caused a back wash failure must be displayed.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

A selector switch must be made available on the filter control panel; the selector switch must contain two (2) options to select; a) “automatic mode” and b) “manual mode” of operation.

The following is a description of the filter backwash process in the automatic and manual mode of operation:

AUTOMATIC MODE OF OPERATION (PLC)

During normal operation the water will enter the filter via the inlet penstock, fill the inlet/backwash trough and overflow into the filter box. The water level in the filter box will be controlled by modulating the filter outlet valve based on a signal received from a level transmitter installed in the filter box. The control of the outlet valve shall be programmed such that the level in the filter does not vary by more than 5% from the set point selected via the SCADA system.

If the level in the filter box rises above the maximum level an alarm will be generated on the SCADA indicating to the operator that the filter is due for a backwash.

Each filter will be equipped with an on-line low range turbidity meter. Should the turbidity increase above a certain value an alarm will be generated on the SCADA system. Once the alarm is displayed on the HMI the operator will have to trigger automatic backwash cycle:

The programmable logic controller (PLC) must go through all the necessary checks to determine that filter is healthy; only when healthy status is obtained can a backwash continue on a filter. Healthy indication can only be achieved when actuators, level, backwash pump sets and blower’s sets have healthy signal, and this will trigger “filter healthy” indication on the HMI.

- a) First the inlet penstock will close to prevent any further water from entering the filter box (“Inlet sluice close” must be indicated”).
- b) The filtered water outlet valve will remain open until the water level in the filter has reached a pre-determined low level as recorded by the level transmitter (“Level must be indicated”). The ultrasonic level sensor must be set during commissioning by the Contractor.
- c) Once the low level has been reached, the outlet valve will close, the wash water outlet valve will open and after a couple of seconds, one of the two blowers will start (The “blower run” indication will now be on) to scour the media with air and run for a number of minutes (exact time period will be determined during commissioning and will be adjustable on the HMI);
- d) After the air scour cycle, the wash water inlet valve will open and one of the two backwash pump started (The “backwash pump run” indication will now be on) to wash the media for a number of minutes (exact time period will be determined during commissioning and will be adjustable on the HMI).
- e) After the wash cycle, the backwash pump will stop, the wash water inlet and outlet valves will close .(“wash water inlet and outlet close must be indicated”), the filtered water outlet valve will open as well as the inlet sluice and the filter will be put back in operation .(“filtered water outlet and Inlet Sluice open must be indicated”).

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- f) The PLC will be programmed to initiate a graphic alarm on the HMI to indicate to the operator that a filter requires a wash cycle. The graphic alarm will be a separate mimic display; the mimic display will “pop up” in the event that a filter requires a wash cycle. The mimic display will “pop up” in the event of two cases:
- As the media get clogged by trapped suspended matter, the level in the filter box will gradually increase until a pre-determined high level is reached (as recorded by an ultrasonic level transmitter located in each filter box), which will trigger and alarm on the filter control panel.
 - To initiate an automatic wash should a high level not be reached within a specified time frame, say 48 hours. This parameter will also be adjustable on the HMI.

The different modes of filter operation shall be as described in the Particular Specification PTTG. The filter system shall be fully automated with the SCADA functionality included in the table below.

Function	Detail
Filtration mode	In service, backwash, out of service
Step in filter mode (filter, backwash out of service)	Indicate step in mode sequence, time since start of step, step duration to completion, interlocks, faults and status
Valve position	Open, close, % open, trip
Water level in filter	% full, low and high limits
Media level in filter	m
Flow rate into each filter	MI/d
Filter bed volumes treated	Number
Outlet turbidity	NTU

MANUAL MODE OF OPERATION

The Contractor shall write a checklist and procedure for manual mode operation for the filter plant, training for procedure and manual must supplied to the operator of the plant. Manual mode of operation can only be achieved when selector switch is placed into “manual mode” of operation.

The Contractor shall ensure that operator understand manual mode of operation and the process to follow.

- Select filter on selector switch and press push button “start wash cycle”.
- Blinking “close inlet sluice” shall be indicted, when pressed the inlet sluice will close to prevent any further water from entering the filter box water from entering the filter box (“Inlet sluice close” must be indicated”).

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- c) Blinking “close filtered water outlet valve” shall be indicted, when pressed the the filtered water outlet valve will close (“filtered water outlet valve close” must be indicated”).
- d) Blinking “open wash water outlet valve” shall be indicted, when pressed the wash water outlet valve will open (“wash water outlet valve open” must be indicated”)
- e) Blinking “start blower” shall be indicted, when pressed (The “blower run” indication will now be on) to scour the media with air and run for a number of minutes (exact time period must be determined by the Contractors manual)
- f) Blinking “start backwash pump” shall be indicted, when pressed (The “backwash pump run” indication will now be on) to wash the media for a number of minutes (exact time period must be determined by the Contractors manual)
- g) Blinking “close wash water and outlet valve” shall be indicted, once pressed the wash water inlet and outlet valves will close (“wash water inlet and outlet close must be indicated”).
- h) Blinking “open inlet sluice” shall be indicted, when pressed the inlet sluice will open to allow water from entering the filter box water from entering the filter box (“Inlet sluice open” must be indicated”).

In the manual mode of operation the blower as well as the backwash pump must be manually activated from the HMI or push buttons which is on the filter control desk. The opening and closing of valves will be controlled at the filter control console by means or selector switch, push button, timers and relays when in manual mode of operation.

OPERATOR INITIATED BACK WASH

With all systems healthy the Operator can manually initiate the back wash process on the HMI. After pressing the “back wash” digital button or push button, the PLC will automatically complete the back wash process.

PS EPLC-15.C DISSOLVED AIR FLOATATION

The process upgrade at the Bospoort WTW includes the addition of an additional 1 flotation tank.

One saturator will provide air saturated water to flotation tank through pipes fitted with nozzles which distribute the micro bubbles to float the particles. Separate recycle pumps for the new flotation tank is located in the pump station that will supply water to the saturator.

This section of the Contract covers the supply, delivery, transport, handling, storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period of equipment for the control of the flotation clarification plant comprising:

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- a) Equipment for flotation tanks,
- b) Air saturation pressure vessel with air receiver, compressor and pumps

SATURATORS

One (duty) free standing mild steel saturator consisting of a rubber lined pressure vessel shall be supplied by others.

The Mechanical Contractor shall supply maximum pressure of 700 kPa (7 atmospheres) and the electrical will supply a pressure transmitter to monitor the saturator. The Mechanical Tenderer will describe fully the operation of the pressure vessel in terms of time of retention, means of achieving the maximum saturation levels, the guaranteed percentage saturation to be achieved and means of controlling the air level in the saturation vessel and the Electrical will coordinate with the Mechanical to ensure all the required signals is obtained from the system.

Electrical portion of the contract shall provide and install the following equipment:

- pressure transmitter (4 — 20 mA output signal)
- level transmitter on top of vessel (protected against accidental damage)
- drain valves and water level control
- isolating valves

Tenderers shall provide for automatic control equipment and instrumentation of the saturation vessel which will allow complete automatic control and operation of the plant.

AIR COMPRESSOR FOR DAF

One compressor shall be supplied by the Mechanical Tenderer for the saturator. The compressor shall be sized for maximum duty with only one compressor operating at 100% of maximum air duty and the Electrical will coordinate with the Mechanical Tenderer to supply the correct starting equipment.

The compressor must be automatically controlled but have the capability can be manually controlled from the starter panel at the DAF Building MCC, SCADA system or HMI. Automatic control of the pump sets will be performed by the PLC.

During automatic mode and manual mode of operation the compressor will be interlocked to operate on the predetermined pressure. A predetermined low pressure will start the compressor and a predetermined high pressure the compressor must stop. The pressure transducer shall be interlocked during manual and automatic mode of operation.

DAF RECYCLE PUMPS

The existing Three (2 duty, 1 stand-by) units will be changed to operate as Four (3 duty, 1 stand-by) and are required to feed the saturator at the new and existing DAF tanks.

The DAF recycle pumps must be automatically controlled but have the capability to be manually controlled from the starter panel at the DAF Building MCC, SCADA system or HMI. Automatic control of the pump sets will be performed by the PLC.

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During automatic mode and manual mode of operation the compressor will be interlocked to predetermined pressure. A predetermined low pressure will stop the recycle pump sets and a predetermined high pressure the compressor must also stop the recycle pump sets. The pressure transducer shall be interlocked during manual and automatic mode of operation.

Automatic and manual mode of operation all interlocks shall be added to the panel, the recycle pumps deliver water to the saturator while the compressor delivers air to the saturator at a constant flow rate. The water level in the saturator will be maintained between two predetermined levels by means of a magnetic level indicator and a solenoid valve positioned on the air supply pipeline. When the water reaches the bottom level, the solenoid valve will close, thus shutting off the air supply to the saturator. The water level will then rise until it reaches the top level, at which point the solenoid valve will open to again admit compressor air. A second solenoid valve, fitted between the air supply solenoid valve and the saturator, must open when the recirculation pumps are switched off so as to release air from the saturator.

Interlocking in automatic and manual mode of operation with saturator at pump station to trip pump set in the event of a high saturator level and start pump set for a low-level indication.

PS EPLC-15.D OZONE EQUIPMENT

The Electrical Tenderer shall submit with his tender the proposed layout of the above ozone systems and coordination to all the sub-systems. The Electrical Tenderer to coordinate with the Mechanical Contractor to ensure all sub-systems and components shall be complete and will include all the control and monitoring of it.

Tenderers shall indicate in their submissions any items that are required in addition to the equipment specified.

- Oxygen production sub-system, from liquid oxygen (LOX) offloading connector to Gaseous Oxygen (GOX) supply point (only applicable to LOX installation).
- Nitrogen bleed sub-system, from air intake and preparation to the point where air is mixed with GOX (only applicable to LOX installation).
- Feed gas production sub-system, from air compressor to feed gas supply point (only applicable to Air installation)
- Ozone generation sub-system, from GOX/air supply point to ozone supply pipes feeding dosing points outside of ozone generator building.
- Ozone bubble diffusion sub-system, from the ozone supply pipe outside of the ozone generator building up to and including dosing points at the bubble diffuser system.
- Pre-ozone side stream diffusion and degassing sub-system, from the ozone supply pipe outside of ozone generator building up to and including the dissolved ozone dosing point and inlet chamber gas vent.
- Vent off-gas destruction sub-systems, from outlet flange on main ozone contact tank/pre-ozone degassing chamber to the outlet of each destructing unit.

COOLING WATER PUMP SETS

The cooling water pumps shall be sized to suite the cooling requirements of the ozone generation equipment under all operating conditions. The Electrical Tenderer shall also size the starter panels to suite the Mechanical Tenderer.

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The low lift pumps will have to be started before the cooling water pumps will be able to start. A suitable interlock shall be hardwired manually and automatic mode of operation. An ozone contact tank level transmitter shall be provided for this purpose. The Electrical portion of the contract shall ensure that the low lift pumps are commissioned before the ozone commissioning can commence.

VENT OFF-GAS DESTRUCTION EQUIPMENT

Ozone destructor units shall be supplied by the Mechanical Tenderer and the Electrical Tenderer and starting equipment shall be suitably sized for the required ozone dose at each dosing point. The Electrical Tenderer shall coordinate the size of the destructing units with the Mechanical Tenderer.

SCADA AND DISPLAY

In addition to the requirements of the Particular Specification – PTO and SCADA specification the following information shall be displayed additional on the SCADA system:

- Ozone production rate (per ozone generator and total production)
- Ozone dosing rate at each dosing point
- Ozone concentration at destructor outlet
- Ozone transfer efficiency at each dosing point
- UV254 at pre-ozone and main ozonation dosing points as indicated on the process flow diagram
- GOX mass flow rate
- Energy consumption at each ozone generation unit and each sidestream injection system.

LOW LIFT PUMPS

The low lift pump speed shall be controlled by means of a fuzzy logic controller and a level transmitter measuring the level in the low lift pump sump. Two permanent weir plates shall be installed on the overflow into the ozone contact tank and together with a level transmitter be used to calculate the flow rate into the ozone contact chamber.

All pump sets must be interlocked with the water level in the ozone contact tank. The pump set must start against a closed delivery valve the valve shall only start to open once the pump motor is running with the soft starter bypass contactor in closed position. To stop the pump set, the delivery valve must first close and then the pump set must stop. All protection devices dependant on flow and pressure must be bypassed during the starting and stopping process.

A pre-determined low level must stop the pump set in the automatic as well as in the manual mode of operation. The starting of the pump set must be prevented until a predetermined high level in the sump is reached.

Only three starts per hour must be possible and shall be PLC controlled as well as timer controlled in the manual mode of operation.

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PS EPLC-15.E GRANULAR ACTIVATED CARBON AND RAPID GRAVITY SAND FILTERS

WASH WATER PUMP SETS

The two wash water pump sets are to be variable speed units with one duty and one standby unit and can be manually controlled from the starter panel in the existing pump station or from the filter plant. Automatic control of the pump sets will be performed by the PLC.

The pump sets must be interlocked to prevent both pump sets to be in operation simultaneously. The blowers must also be interlocked with the wash water pump sets to prevent simultaneous operation of these units even in the manual mode of operation.

The rapid gravity sand filter and granular activated carbon filter sizes differ and it therefore part of this contract that the wash water flow rates must differ. The pump sets must be interlocked with predetermined speed for granular activated carbon filters and predetermined speed for gravity sand filters. This shall be confirmed with the Engineer.

The duty cycle of these pump sets must be rotated after each duty cycle.

The pump sets must be interlocked with the water level in the relevant section of the clear water reservoir next to the pump station.

BLOWERS

The two blowers will be variable speed units with one duty and one standby unit and can be manually controlled from the starter panel in the pump station or from the filter plant. Automatic control of the blowers will be performed by the PLC.

The blowers must be interlocked to prevent both blowers to be in operation simultaneously. The blowers must also be interlocked with the wash water pump sets to prevent simultaneous operation of these units even in the manual mode of operation.

The rapid gravity sand filter and granular activated carbon filter sizes differ and it therefore part of this contract that the blower flow rates must differ. The blower set must be interlocked with predetermined speed for granular activated carbon filters and predetermined speed for gravity sand filters. This shall be confirmed with the Engineer.

The duty cycle of these blowers must be rotated after each duty cycle.

The blowers shall always start against an open, air blow-off valve. The air blow off valve will close after the blowers have been in operation for a pre-determined period of time. After stopping of the blowers the air blow off valve shall open and remain open until the next duty cycle.

PS EPLC-15.F SLUDGE DEWATERING EQUIPMENT

This specification, read together with the applicable Particular Specifications included under section C3.4.2.2 covers the performance specifications, design parameters, manufacture, supply and delivery to site, installation, testing, adjustment and commissioning of the new sludge dewatering plant to be provided under this Contract.

However, in terms, the responsibility for the final design shall rest with the Contractor, who shall ensure that the installed system shall suit and meet the objectives of the installation in terms of

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the Employer's Requirements. Any/all items deemed necessary for the effective and safe operation of the system and which are not specifically measured in the respective schedules shall be included in the tender offer and clearly highlighted.

Electrical Tenderers shall take note that offers from at least three suitable dewatering plant suppliers shall be included in the tender submission, any of which may be chosen by the Employer during the tender evaluation process. The dewatering equipment with the highest tendered rate for manufacturing and installation shall be used to determine the Tenderer's financial offer and the overall tendered amount for the Contract.

The Employer reserves the right to, after conducting a full life cycle costing, choose any one of the two offers and the guaranteed figures related to the chosen system shall be binding on the Electrical Contractor. The cost for each system must be coordinated with the Mechanical Contractor.

ELECTRICAL DESIGN REQUIREMENTS

- Process and Instrumentation Diagrams (P&ID's) for the system as a whole.
- Technical and dimensional drawings of mechanical equipment.
- Electrical design documents and wiring diagrams;
- Functional Design Specification (FDS) for the system as a whole;
- As built drawings and Operation and Maintenance Manuals

POLY-ELECTROLYTE

Poly-electrolyte dosing pumps shall be positive displacement pumps, either peristaltic or progressive cavity pumps equipped with variable speed drives to adjust the amount of poly being dosed into the thin sludge stream as controlled by the thin sludge flow meter/solids density instrument installed on the sludge supply main. They shall be suitably sized by the Mechanical Tenderer and the starting equipment must be suitable rated for the system.

OPERATION

The proposed system is based on a constant hydraulic loading being maintained to the dewatering plant and the dose of polyelectrolyte being varied according to changes in the feed solids concentration.

The following parameters shall be set by the Operator on the local HMI:

- The duty press/filter(s) to be used in cases where there are more than one unit;
- Polyelectrolyte dosing rate in kg/ton DS;
- Flow rate of the feed sludge in m³/hr;
- Time that the plant must start and run time e.g. 09h00 am & 10 hours.

The automatic control system of the master PLC provided for the plant shall then:

- Calculate the required polyelectrolyte pumping rate in accordance with the polyelectrolyte solution concentration and the required dose rate;
- Initiate the start-up sequence for each of the selected units (master PLC to initiate start-up only, after which individual PLC's will start-up the units);

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- Open the washwater lines;
- Open the suction and delivery valves of the selected polyelectrolyte dosing pumps;
- Open the dilution water supply valves (if applicable);
- Start the sludge feed pump;
- Adjust the speed of the polyelectrolyte dosing pumps to maintain the pre-set dose. This shall be calculated from the concentration of the dosing solution, sludge feed rate (which should be constant) and the sludge concentration as measured by in-line solids density meters. Two meters shall be provided on the main sludge incoming manifold and calculations shall be based on an average measurement of the two meters.

Once the pre-set period for dewatering has been reached:

- Polyelectrolyte dosing pumps shall be stopped and suction/delivery valves closed;
- Stop sludge feed pump;
- Stop dilution water supply (if applicable);
- Stop washwater supply
- Stop filter/press unit(s)

PS EPLC-15.G CHEMICAL DOSING EQUIPMENT

HYDROGEN PEROXIDE DOSING

All the dosing pumps will be fitted with variable speed drives part of the Mechanical contract in order to maintain a fixed dosage with varying flows through the plant as specified in the electrical particular specification. The set point will be controlled by means of a PLC.

POLY DOSING

All the dosing pumps will be fitted with variable speed drives part of the Mechanical contract in order to maintain a fixed dosage with varying flows through the plant as specified in the electrical particular specification. The set point will be controlled by means of a PLC.

STORAGE TANKS

All tanks shall be fitted with ultrasonic level transmitters.

The final control philosophy of the plant will be the responsibility of the Contractor. The operation description of the plant below only services as brief description of the works and minimum requirement in terms of the Contract.

PS EPLC-15.H HIGH LIFT PUMP STATION

The existing Bospoort high lift pump system consists of four pumps configured in two series duty and two series standby configurations. This contract involves upgrading the current high

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lift pump sets, increasing their capacity from 12 million liters per day to 24 million liters per day.

As part of this upgrade, the existing soft starters will be replaced, increasing their capacity from 225 kW to 355 kW. The exact specifications of the new motor starters should be confirmed by the electrical contractor in coordination with the mechanical contractor.

Control Modes:

- a) Manual: Timers and relays**
- b) Automatic: PLC control**

An electronic pre-start warning siren will be installed and activated for five seconds before starting a pump in either manual or automatic mode. The siren will be placed to ensure it provides an audible warning to maintenance staff for safety purposes, specifically for the high lift pump sets.

Motor Starting Sequence for Series Set:

The suction motor starts and reaches full speed.

The delivery motor starts and, upon reaching full speed, the actuator opens.

The variable frequency drive will be programmed in both manual and automatic modes to ramp up motor speed, minimizing the starting current. If a stop command is issued, the delivery motor will ramp down first to reduce water surge, followed by the suction motor, after which the actuator will close.

The pump sets will be interlocked to prevent simultaneous operation of both sets in either manual or automatic mode. In manual mode, the operator must select which pump set to use, with start pressures identical to those in automatic PLC mode.

Pump set options:

- Pump Set No.1 (Pump No.1-No.2)
- Pump Set No.2 (Pump No.3-No.4)

Automatic Mode

The duty cycle of the pump sets must rotate after each cycle in both manual and automatic modes. The pump sets will also be interlocked with the water level in the relevant section of the clear water reservoir adjacent to the pump station.

The contractor must provide wiring for the following protection devices, to be used in both manual and automatic modes, as supplied under the mechanical contract for each high lift pump set:

- 3 x Winding RTDs (Red, White, and Blue phase)
- NDE Bearing RTD on the motor

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- NDE Bearing RTD on the pump
- DE Bearing RTD on the motor
- DE Bearing RTD on the pump
- Thrust Bearing RTDs on the pump
- Vibration sensors (x, y, and z axes)
- Anti-condensation heater
- No-flow switch in suction lines
- Pressure sensor in common delivery pipelines

No-flow sensors (similar to Endress and Hauser) will be installed in the suction pipeline of each of the four high lift pump sets as part of the electrical scope. These sensors will monitor no-flow conditions and be interlocked with the pump sets for protection. The mechanical contractor will provide sockets for these sensors, with coordination between the electrical and mechanical contractors.

Electronic pressure transducers will monitor the common suction pipe and the delivery pressure of the high lift pump sets. These transducers will provide alarms at predetermined high/low pressures and will trip the pump sets via the PLC at high-high/low-low pressures.

All protection devices must be interlocked with the pump set control circuitry and must trip or prevent the pump from starting if a protection device is in a trip condition. These conditions will be displayed on the HMI unit and SCADA system, with possible causes for fault conditions included on the SCADA system for maintenance assistance.

PS EPLC-15.I BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER AND BOSPOORT NORTH TO: THLABANE PIPELINE; BOITEKONG PIPELINE AND BOITEKONG NETWORK CHAMBER

Civil Contractor will construct the valve chambers while the mechanical Contractor will install the following equipment at the locations below listed:

Bospoort to Vaalkop / Bospoort North HLPL Link Chamber

- a) Four flow control valves [all accessories will be included with the valves to control] and
- b) Three turbine flow meters [only turbine].

The Bospoort North to: Thlabane Pipeline; Boitekong Pipeline and Boitekong Network Chamber

- c) Three pressure relief valves [all accessories will be included with the valves to control] and
- d) One turbine flow meter [only turbine].

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Part of this contract will be to control the flow control valves via the flow meters and transfer all information to Bospoort Water Treatment Works. Bospoort North reservoir will be built in the future and the control of those valves will form part of this contract:

Now:

- a) Bospoort Water Treatment Works to Bospoort Reservoirs [Megalties Water] until predetermined full level.
- b) When the Bospoort Reservoirs [Megalties Water] are at predetermined full level then the valves must close and then water must be diverted to the existing Bospoort pipeline.

Future:

- a) Bospoort Water Treatment Works to Bospoort North Reservoirs until predetermined full level.
- b) When Bospoort North Reservoirs are at a predetermined full level then valves will close and divert the water to Bospoort Reservoirs [Megalties Water] until at a predetermined full level.
- c) When the Bospoort Reservoirs [Megalties Water] are at predetermined full level then the valves must close and then water must be diverted to the existing Bospoort pipeline.

Also:

- a) Should Bospoort Reservoirs [Megalties Water] be at a predetermined full level then the control valve must open to pump to Bospoort North Reservoirs.

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PS EPTM TELEMETRY SYSTEM (PARTICULAR SPECIFICATION PTM)

PSEPTM-1 SCOPE OF WORKS

The standard Conditions of Contract is a FIDIC Yellow book and the contractor shall design, execute the complete the works in accordance with the contract.

Drawing 1890.11.00.WPA.21.U001 shows the proposed locations of the masts including the control rooms. Earthing and lightning protection, palisade fence, masts, telemetry systems and control room form part of this Contract. The bulk earth works will be done under the civil contract.

The scope of work for the Telemetry entails Point-to-Point (PTP) and Point-to-Multipoint (PMP) links. All the PTP and PMP links shall be designed utilizing the latest equipment technologies available. It must also be noted that the equipment selected shall conform to the rugged terrain requirements of the greater Rustenburg area.

These PTP links transmit large amounts of data and voice in both directions between links. These types of links also place a high requirement on data encryption, which provides a certain level of comfort to the end user. These types of links therefore conform to both the stringent data encryption and high-speed data transmission requirements of secure and reliable Microwave Radio Network design philosophy.

The design of the PTP Radio Network shall be done according to the particular specification and all international standards referenced in particular specification.

PSEPTM-6 OUTSTATION CABINETS

All outstation cubicles shall comply with the requirements for motor control centres and distribution boards in the Particular Specifications.

Outdoor outstations shall be constructed from 3CR12 stainless steel, powder coated frame mounted and with front access. The lockable front door shall be equipped with a tamperproof lock protection cover.

The telemetry equipment cubical shall be of sufficient size to accommodate double the number of I/O modules installed under this contract.

Battery termination box with LED voltage indicators. Sufficient space shall be provided for a second battery installation in future,

Field junction box with all field cables and wiring connected to DYN rail mounted termination blocks.

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The field termination box shall be of sufficient size for termination of all hard-wired field equipment, monitoring and control requirements. At least 20% spare terminals for future connections shall be provided.

All of the Telemetry links to Networks shall conform to the following minimum technical requirements.

PSEPTM-6.A TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER]

- Type:** Outdoor outstation shall be constructed from 3CR12 stainless steel, powder coated frame mounted and with front access only. All outstation cubicles shall comply with the requirements for motor control centres and distribution boards in the Particular Specifications.
- Supply:** 1 x 16mm² 3 core Cu PVC SWA PVC cable plus 1 x 10mm² Bare copper earth cable from the Eskom connection.
- Colour:** Electric orange
- Fault level:** 5kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising of the following:	Incomer Section
1	60Amp continuous current rated SP distribution MCB with electronic trip, monitoring relays with automatic reset and all accessories: Plus	Main Circuit Breaker
Set	80/1Amp continuous current rated current transformer: Plus	Current inputs
1	Ammeter scaled 0-80Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The	Power Analyser

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QTY	DESCRIPTION	IDENTIFICATION
	<p>communication interface must comply with either of the following:</p> <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP <p>Equal or similar to Power Logic PM800: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	
4	80Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to DV M TT 2P 255 with remote indicator panel & remote signalling contacts connected to the SCADA: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker: Plus	Indicators for 3 Phase (Red, White and Blue Indications)
1	20Amp SP + N earth leakage with overload protection: Plus	Earth Leakage
1	10Amp continuous current rated SP MCB: Plus	Area Lighting
1	16Amp continuous current rated SP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Digital Timer Switch

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QTY	DESCRIPTION	IDENTIFICATION
All	Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	All valves which must be coordinated with the mechanical contractor
All	Continuous current rated SP MCB: Plus	All flow meters which must be coordinated with mechanical contractor
1	10Amp continuous current rated SP MCB: Plus	Lighting
1	Continuous current rated SP MCB that will satisfy the application: Plus	UPS Feeder
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry equipment as specified below
All	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

PSEPTM-6.B TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT RESERVOIRS [MEGALIES WATER]

Type: Outdoor outstation shall be constructed from 3CR12 stainless steel, powder coated frame mounted and with front access only. All outstation cubicles shall comply with the requirements for motor control centres and distribution boards in the Particular Specifications.

Supply: 1 x 16mm² 3 core Cu PVC SWA PVC cable plus 1 x 10mm² Bare copper earth cable from the Eskom connection.

Colour: Electric orange

Fault level: 5kA

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Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising of the following:	Incomer Section
1	60Amp continuous current rated SP distribution MCB with electronic trip, monitoring relays with automatic reset and all accessories: Plus	Main Circuit Breaker
Set	80/1Amp continuous current rated current transformer: Plus	Current inputs
1	Ammeter scaled 0-80Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following: a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP Equal or similar to Power Logic PM800: Plus Under no circumstances, shall the use of proprietary protocols be allowed: Plus	Power Analyser
4	80Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to DV M TT 2P 255	Surge arrestor plus signals

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
	with remote indicator panel & remote signalling contacts connected to the SCADA: Plus	
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker: Plus	Indicators for 3 Phase (Red, White and Blue Indications)
1	20Amp SP + N earth leakage with overload protection: Plus	Earth Leakage
1	10Amp continuous current rated SP MCB: Plus	Area Lighting
1	16Amp continuous current rated SP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Digital Timer Switch
All	Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	All valves which must be coordinated with the mechanical contractor
All	Continuous current rated SP MCB: Plus	All flow meters which must be coordinated with mechanical contractor
1	10Amp continuous current rated SP MCB: Plus	Lighting
1	Continuous current rated SP MCB that will satisfy the application: Plus	UPS Feeder
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry equipment as specified below
All	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

PSEPTM-6.B TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT WATER TREATMENT PLANT]

Type: Outdoor outstation shall be constructed from 3CR12 stainless steel, powder coated frame mounted and with front access only. All outstation cubicles shall comply with the requirements for motor control centres and distribution boards in the Particular Specifications.

Supply: 1 x 16mm² 3 core Cu PVC SWA PVC cable plus 1 x 10mm Bare copper earth cable from the Eskom connection.

Colour: Electric orange

Fault level: 5kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising of the following:	Incomer Section
1	32Amp continuous current rated SP + N distribution MCB with electronic trip, monitoring relays with automatic reset and all accessories: Plus	Main Circuit Breaker
Set	32/1Amp continuous current rated current transformer: Plus	Current inputs
1	Ammeter scaled 0-80Amp: Plus	Ammeter
1	3 Position Selector switch	R-W-B phase indication
3	2Amp HRC fuse holders and fused links: Plus	Voltage inputs

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	<p>Front panel mounted LCD digital display supply network analyser comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with Communications module must be provided, communication links with PLC/DCS Units. The communication interface must comply with either of the following:</p> <p>a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP</p> <p>Equal or similar to Power Logic PM800: Plus</p> <p>Under no circumstances, shall the use of proprietary protocols be allowed: Plus</p>	Power Analyser
4	80Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase combined class 1&2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to DV M TT 2P 255 with remote indicator panel & remote signalling contacts connected to the SCADA: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker: Plus	Indicators for 3 Phase (Red, White and Blue Indications)
1	20Amp SP + N earth leakage with overload protection: Plus	Earth Leakage
1	10Amp continuous current rated SP MCB: Plus	Area Lighting
1	16Amp continuous current rated SP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Coil Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Digital Timer Switch
All	Continuous current rated thermal magnetic motor circuit breakers with adjustable current setting and auxiliary contact (monitor trip condition): plus	All valves which must be coordinated with the mechanical contractor
All	Continuous current rated SP MCB: Plus	All flow meters which must be coordinated with mechanical contractor
1	10Amp continuous current rated SP MCB: Plus	Lighting
1	Continuous current rated SP MCB that will satisfy the application: Plus	UPS Feeder
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals
All	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry equipment as specified below
All	Panel comprising the following: (Panel door shall be purple powder coated)	UPS for PLC Equipment as specified under PLC

PSEPTM-19 OUTSTATIONS HARDWARE

An outdoor-type enclosure as specified above shall be provided for each telemetry outstations. Hardware shall be as follows:

PSEPTM-19.A TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER]

The telemetry equipment shall be installed in a separate panel inside the outstation cabinet.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Protocol:Ethernet

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry Hardware
1	10Amp continuous current rated SP door interlocked protection MCCB: Plus	Main Circuit Breaker PLC
All	230V/24DC stabilized power supply for 24V DC inputs to telemetry system. (Power supply shall have adequate capacity for the application): Plus	
All	Ethernet communication with I/O modules that will satisfy the application: Plus	All communications
All	Interposing relays for surge protection of field statuses to Telemetry, equipment and mast: Plus	Interposing relays
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	Termination blocks
All	Ethernet radios transceivers supporting 360–512 MHz, shall be 5.0 W RF power. The Ethernet radios shall be robust/secure two-way wireless communications in extremely challenging outdoor industrial environments. The Ethernet Radios shall have the following features: Multi-hop repeater and gateway functionality Gather-scatter and block mapping Modbus TCP and RTU I/O gateway DNP3 remote I/O and DNP3 TCP gateway Internal programmable data and event logging with remote access Configurable digital, pulse, and analog I/O to 14-bit resolution 360–512 MHz frequency licensed bands 10 mW to 5 W RF power (Shall be set to 5W) Radio data rates from 4800 bps to 19.2 kbps 12.5 kHz and 25.0 kHz channel bandwidth options: Plus	Radio transceiver
All	Ethernet communication cable link: Plus	Communication

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
June 2025

QTY	DESCRIPTION	IDENTIFICATION
All	All equipment leaving the control room Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Antenna adequate capacity for the application. Antenna shall be designed, calculated, supplied, installed and commissioned by the Contractor. The antenna communication shall have protected with surge arrestor.	Antenna
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals

PSEPTM-19.B TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT RESERVOIRS [MAGALIES WATER]]

The telemetry equipment shall be installed in a separate panel inside the outstation cabinet.

Protocol: Ethernet

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry Hardware
1	10Amp continuous current rated SP door interlocked protection MCCB: Plus	Main Circuit Breaker PLC
All	230V/24DC stabilized power supply for 24V DC inputs to telemetry system. (Power supply shall have adequate capacity for the application): Plus	
All	Ethernet communication with I/O modules that will satisfy the application: Plus	All communications

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Interposing relays for surge protection of field statuses to Telemetry, equipment and mast: Plus	Interposing relays
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	Termination blocks
All	<p>Ethernet radios transceivers supporting 360–512 MHz, shall be 5.0 W RF power. The Ethernet radios shall be robust/secure two-way wireless communications in extremely challenging outdoor industrial environments. The Ethernet Radios shall have the following features:</p> <p>Multi-hop repeater and gateway functionality Gather-scatter and block mapping Modbus TCP and RTU I/O gateway DNP3 remote I/O and DNP3 TCP gateway Internal programmable data and event logging with remote access Configurable digital, pulse, and analog I/O to 14-bit resolution 360–512 MHz frequency licensed bands 10 mW to 5 W RF power (Shall be set to 5W) Radio data rates from 4800 bps to 19.2 kbps 12.5 kHz and 25.0 kHz channel bandwidth options: Plus</p>	Radio transceiver
All	Ethernet communication cable link: Plus	Communication
All	All equipment leaving the control room Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Antenna adequate capacity for the application. Antenna shall be designed, calculated, supplied, installed and commissioned by the Contractor. The antenna communication shall have protected with surge arrestor.	Antenna
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PSEPTM-19.C TELEMETRY OUTSTATION CONTROL ROOM [BOSPOORT WATER TREATMENT PLANT]

The telemetry equipment shall be installed in a separate panel inside the outstation cabinet.

Protocol: Ethernet

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
One	Panel comprising the following: (Panel door shall be purple powder coated)	Telemetry Hardware
1	10Amp continuous current rated SP door interlocked protection MCCB: Plus	Main Circuit Breaker PLC
All	230V/24DC stabilized power supply for 24V DC inputs to telemetry system. (Power supply shall have adequate capacity for the application): Plus	
All	Ethernet communication with I/O modules that will satisfy the application: Plus	All communications
All	Interposing relays for surge protection of field statuses to Telemetry, equipment, and mast: Plus	Interposing relays
All	Termination blocks necessary for signal cable connections from motors and instrumentation: Plus	Termination blocks
All	Ethernet radios transceivers supporting 360–512 MHz, shall be 5.0 W RF power. The Ethernet radios shall be robust/secure two-way wireless communications in extremely challenging outdoor industrial environments. The Ethernet Radios shall have the following features: Multi-hop repeater and gateway functionality Gather-scatter and block mapping Modbus TCP and RTU I/O gateway DNP3 remote I/O and DNP3 TCP gateway Internal programmable data and event logging with remote access Configurable digital, pulse, and analog I/O to 14-bit resolution 360–512 MHz frequency licensed bands 10 mW to 5 W RF power (Shall be set to 5W)	Radio transceiver

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	Radio data rates from 4800 bps to 19.2 kbps 12.5 kHz and 25.0 kHz channel bandwidth options: Plus	
All	Ethernet communication cable link: Plus	Communication
All	All equipment leaving the control room Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Antenna adequate capacity for the application. Antenna shall be designed, calculated, supplied, installed and commissioned by the Contractor. The antenna communication shall have protected with class surge 1 & 2 surge arrestor.	Antenna
All	Halogen free wiring ducts, covers, fix-O-Rapid, rapid clip for din rails, rapid clip for base plate shall be used: Plus	Wiring ducts
All	Termination blocks necessary for signal cable connections from motors and instrumentation equal and similar to Weidmuller: Plus	All Terminals

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESCA SCADA SYSTEM

PSESCA-1 Design Philosophy

The SCADA system shall be designed to withstand temperature fluctuations, vibrations, and voltage fluctuations.

The existing Adroit Classic Version 7 are redundant and not operational. It is therefore required under this contract to install the latest SCADA system. It is the Contractor responsibility to supply, install and commission new system, latest version. Existing mimics and TAGS must be redesigned and added to the new SCADA.

Existing Tags used was:

The Contractor will allow in his price to rename all the existing TAG's at Bospoort WTW, with new TAG's numbers which will be confirmed by the Engineer after the awarding of the Tender.

DESCRIPTION	MASTER S/N	STANDBY S/N	ADROIT VERSION	SCAN POINTS	USED SCAN POINTS	REMOTE NODES	USED REMOTE NODES
Bospoort WTP	Not known	No applicable	7	1500	916	2 shall be added [Bigen Office and one to be confirmed] Remote nodes are full licenses on the entire SCADA System, Also allow for all additional licenses for the system hardware as required below.	None

The above-mentioned tags [the existing plants total tag count] do not include the new plant tag amount and the Contractor must allow for additional above-mentioned tags to be added to the new SCADA. Please refer to PSEPLC section for all the additional TAG's.

Operator Stations will be at the at the following locations:

Control Room No.1	– High Lift Pump Station Building control room,
Remote Node One	– Additional SCADA license for Bigen Pretoria,
Operator PC	– Additional SCADA license for, To be determined,
Engineering PC	– Additional SCADA license,

PSESCA-2 Interface Requirements

The design shall thus allow for the viewing and controlling of the Bospoort WTW.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESCA-2 Technical Requirements

The SCADA System package shall be selected based on the following criteria:

Complying with all the technical requirements in the SCADA particular specification document

- a) The SCADA have open based SCADA protocols and platforms,
- b) The ease of using the SCADA package's engineering platform and tools,
- c) The engineering track record of the SCADA package in the medium voltage system (feedback from past and current clients)
- d) The after-sales service track record of the SCADA system package vendor (feedback from past and current clients)
- e) The average engineering time the SCADA package takes building a typical graphics page versus the average engineering time any of its competitor SCADA packages takes building the same typical graphics page (related to the ease of use of engineering tools and user friendly interface).
- f) The costing structure of the post-installation maintenance requirements. Includes future software requirements, fixes, automatic library updates, licences, tag allocations, etc.

PSESCA-3 SCADA Hardware Requirements

PSESCA-3-1 Ethernet Network Switches (Managed)

Industrial type Ethernet Network Switches (Managed) shall be installed at the following as identified in PSPLC section.

PSESCA-4-3 Technical Requirements

The Managed Ethernet Network Switches shall have the following minimum key features:

- a) **Security Features** - shall include the following:
 - User Passwords on multiple levels
 - SSH/SSL 128 Bit encryption
 - The Enable/Disable function of ports
 - Port based network access control (802.1x)
 - VLAN (802.1Q) for segregation of Network traffic
 - Centralized password management
 - SNMPv3 authentication and 56-bit encryption
- b) **Operating System Features** – shall include the following:
 - “Plug and Play” simplicity for negotiation and cross-over detection
 - Rapid Spanning Tree functionality with typical recovery time of <5ms for RSTP Proposal-Agreement handshaking between two switches
 - Link Aggregation or Port Trunking functionality (802.3ad)
 - IGMP snooping functionality for multicast filtering
 - Port rate limiting and Broadcast storm limiting
 - Industrial automation protocol support, e.g. Modbus, PROFIBUS
- c) **Hardware Features** - shall include the following:
 - Shall be of a fan-less design
 - Shall be of an industrial hardened design
 - Shall have diagnostic ability with alarm logging

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- Shall have a galvanized steel enclosure (available with conformal coating option, if required)

PSESCA-4-3 Topology Design Requirements

The industrial network design shall be based on a redundant ring network topology. RSTP (Rapid Spanning Tree Protocol - IEEE 802.1D-2004) shall be employed to ensure no traffic loops occur in the ring network. The “worst case” recovery time allowed for network communication recovery after a link failure shall depend on numerous factors. These are as follows:

Single Link Failures
Root Bridge Failure

For Information: The analytical method to calculate the single link failure time for a ring network is as follows:

TL + (N-3)*TPA, if the number of switches is an even number

TL + (N-2)*TPA, if the number of switches is an odd number

For Information: The analytical method to calculate the worst case failover of a root bridge failure for a ring network is as follows:

TL + (2*N-5)*TPA, if the number of switches is an even number

TL + (2*N-4)*TPA, if the number of switches is an odd number

Where:

N – Number of switches in ring network

TL – Time it takes a switch to detect a link failure

TPA – Time required by a pair of switches to perform RSTP Proposal-Agreement “handshaking”. This equals the sum of the BPDU processing times in both switches

These RSTP parameters shall be setup in the management software in the network switch, so that the root bridge failure time can be reduced to that value of a single link failure value. TPA and TL values are vendor and product specific. However, the following values shall be used as guideline to ensure that the switch proposed by the contractor is very similar in performance.

TPA = +/- 5ms

TL = +/- 4-6ms for 100Base-TX and 100Base-FX Links

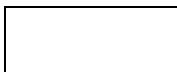
+/- 20ms for 1000Base-X Links

+/- 700ms for 1000Base-T Links

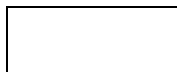
PSESCA-4-4 Link Aggregation

Link Aggregation/Port Trunking shall also be done in conjunction with RSTP.

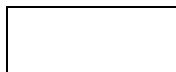
In order to achieve Link Aggregation/Port Trunking, two SFP transceiver units shall be utilized per uplink and two per downlink. Below is a typical diagram of the setup required to achieve Link Aggregation/Port Trunking:



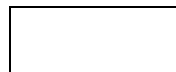
Contractor



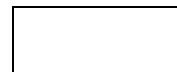
Witness 1



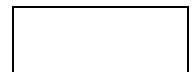
Witness 2



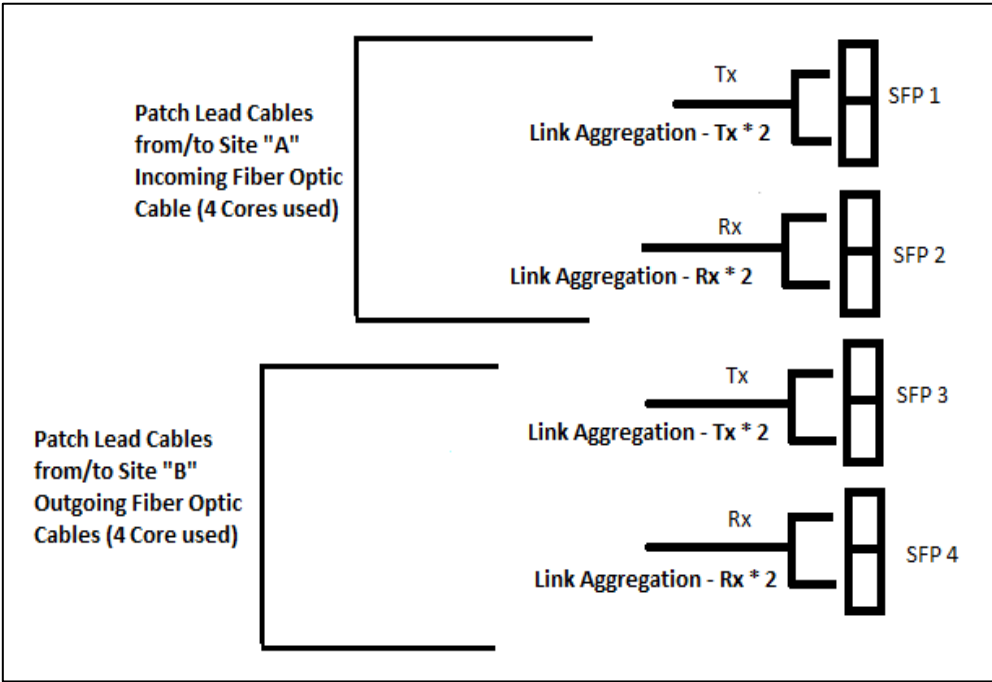
Employer



Witness 1



Witness 2



Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Note: This shall be required for areas where a higher bandwidth throughput is required due to data intensive communication requirements. The contractor shall ensure that the bandwidth requirements between each link are completely understood, so that link aggregation can be implemented if and when required.

This shall however have an effect on the required SFP quantities and these quantities shall have to be determined before the Ethernet Network Switches are procured to prevent any of the Network Switches not complying with the project requirements. Any costs for the delivery of the incorrect equipment shall be for the contractor's account.

PSESCA-4-5 Operator Station [SCADA SERVER, OPERATORS AND ENGINEERING PC]

Workstations servers and personal Computers shall be state of the art while the main server will have the minimum specifications as listed below. Latest Editions Windows Server package professional operating system software and latest edition complete Windows Office professional software shall be supplied with the server and PC.

PSESCA-4-5.A SCADA SERVER

Qty	Description
All	Hardware shall be Recommended from SCADA Supplier: Plus
All	Processor Hardware shall be Recommended from SCADA Supplier: Plus
All	All housed inside 42U server case Server Tower: Plus
All	Solid State Drive [Main Drives] to keep 1 year full historian data and all required software: Plus
2	Hard Drives for Raid Back-Up: Plus
All	Power supply suitable for the application: Plus
All	H330 Integrated Raid Controller: Plus
Standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3ab: Plus
All	Dual 100/1000 Gigabit Ethernet Managed Fibre Switch suitable for the application: Plus
All	All cable work and accessories to complete the installation.
All	42U 600mm(w) x 1000mm(d) x 2055mm(h) Cabinet with perforated front & back door which include all shelves, distribution, blanking panels, cable management, cage nuts and plinths which will complete the installation.
All	8 port KVM Switch (Console), Rack Mount 1U or similar
3	Robust industrial 4G router with an integrated WiFi Supported External USB equal or similar to Tosibox lock 250. All equipment shall come complete with 4G arial for communication, Sim card with 1 year of data shall be added and all cabling requirements: Plus, Remote login from two locations. Contractor to allow all cables, connections and labour to add the remote logins from the remote locations.
All	Estimated Industrial 3kVA Pure Sine Wave UPS equal or similar to APC line, the UPS shall provide battery standby power for at least 3-hour back-up. The UPS (Estimated and shall be confirmed by contractor and all calculations shall be supplied to Engineer for approval) . Batteries shall be rated at 60% load during a power failure. The UPS shall come complete with communication interface and shall comply with either of the following: <ul style="list-style-type: none"> a) Profibus-DP b) Profinet c) Industrial Ethernet d) Modbus TCP/IP

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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Qty	Description
	Under no circumstances, shall the use of proprietary protocols be allowed: Plus
	Contractor to allow for powder coated mild steel cage and locks to be supplied and installed under this contract. The cage shall be lockable and protect the UPS from theft. It can be Inside or outside the PLC, both options are acceptable: Plus
	SCADA Users shall be allowed for the main server.

PSESCA-4-5.B OPERATORS PC

Qty	Description
All	Hardware shall be Recommended from SCADA Supplier: Plus
All	Processor Hardware shall be Recommended from SCADA Supplier: Plus
All	Operators PC shall be housed inside 42U server case Server Tower as specified above : Plus
All	Solid State Drive [Main Drives] all required software: Plus
All	KVM extenders (Senders and Receivers) to suite the application [x4]: Plus
All	Graphic Cards required to remote display divert sections of the plant on all screens
All	Power supply suitable for the application: Plus
2	27" Inch Samsung LED Screens: Plus
2	65" Inch 4k equal or similar to LG LED TV's: Plus
Standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3ab: Plus
All	All cable work and accessories to complete the installation.
All	Graphic Cards required to remote display divert sections of the plant on all screens

PSESCA-4-5.C ENGINEERS PC

Qty	Description
All	Hardware shall be Recommended from SCADA Supplier: Plus
All	Processor Hardware shall be Recommended from SCADA Supplier: Plus
All	Engineering PC shall be housed inside 42U server case Server Tower as specified above: Plus
3	Robust industrial 4G router Key from the Site with an integrated WiFi Supported External USB equal or similar to Tosibox lock 250. All equipment shall come complete with 4G arial for communication, Sim card with 1 year of data shall be added and all cabling requirements: Plus Remote login from two locations. Contractor to allow all cables, connections and labour to add the remote logins from the remote locations.
All	Solid State Drive [Main Drives] all required software: Plus
All	Graphic Card required to display all PLC information: PLus
All	Power supply suitable for the application: Plus
All	Cable connection to KVM switch in server cabinet
Standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3ab: Plus
All	All cable work and accessories to complete the installation.

The contractor will allow data rack to store both the UPS, server and both PC's and shall be locked inside a 42U case enclosure specially designed for the application. The enclosure shall come complete with temperature probe which shall regulate the temperature inside of the batteries manufacturer temperature. The Engineers PC shall be placed at Bospoort while the other must be allowed to placed at Bigen Offices.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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PSESCA-4-5.D ENGINEERS PC [Remote Sites x 2]

Qty	Description
All	Hardware shall be Recommended from SCADA Supplier: Plus
All	Processor Hardware shall be Recommended from SCADA Supplier: Plus
All	Engineering PC shall be housed inside 42U server case Server Tower as specified above: Plus
All	Robust industrial 4G router Keys from the Site with an integrated WiFi Supported External USB equal or similar to Tosibox lock 250. All equipment shall come complete with 4G arial for communication, Sim card with 1 year of data shall be added and all cabling requirements: Plus Remote login from two locations. Contractor to allow all cables, connections and labour to add the remote logins from the remote locations.
All	Solid State Drive [Main Drives] all required software: Plus
All	Graphic Card required to display all PLC information: PLus
All	Power supply suitable for the application: Plus
1	27" Inch Samsung LED Screens: Plus
1	65" Inch 4k equal or similar to LG LED TV's: Plus
Standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3ab: Plus
All	All cable work and accessories to complete the installation.

The contractor will allow data rack to store the PC's and shall be locked inside a 42U case enclosure specially designed for the application. The Engineers PC shall be placed at placed at Bigen Offices.

PSESCA-18 Configuration Of SCADA Software

An uninterruptable power supply shall be supplied and installed at the SCADA Server and PC's as specified under the particular specification [SCADA] and shall provide at least 3 hours standby capacity.

Tenderers shall allow for the configuration of the SCADA System with all the available information on the specified plant Modules. Due allowance shall be made for all necessary drivers that may be required for proper communication between all plant devices Alarm and other reports as may be required must be provided for and all alarm conditions shall be provided with a utility to view possible causes and remedies for the relevant alarm condition in a detail window.

A plant overview shall be provided to include all relevant plant processes. A plant section shall be selectable on the overview mimic screen. When selected a pop-up mimic of the relevant plant area shall appear.

The following functions and information shall be available on a typical pop-up mimic screen:

a) Modes of operation

The following modes of operation shall be used and displayed on the mimic screen:

- Field selection – Auto/Remote and Operator/local
- SCADA selection – PLC control and Operator control

b) Field selection

Field selection shall be done in the field on the device.

The "Remote-Manual-Auto" selection will allow the following control functions:

- "Remote" selection indicates that the control of this device will be done from the SCADA.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- “Manual” selection indicates that the control of this device will be done locally from the control panel in the field (this selection will disable PLC control).
- “Auto” selection will allow PLC control of the device.

SCADA control of the field device shall only be possible with the field control selection set on “Auto or Remote” control at the field device.

c) SCADA selection

This operating mode selection shall be done on the SCADA system.

The “Operator-PLC” selection on the SCADA will allow the following control functions:

“Operator” selection will allow the operator to control the device from the SCADA system e.g. starts or stops pump sets. In this mode some PLC interlocks are disabled and it is the responsibility of the operator to monitor and control the functionality of the device from the SCADA.

“PLC” selection will grant the PLC the control of the device. The PLC controls the device according to a defined sequence and interlocks.

d) Typical Device Mimic

Each field device shall be displayed in a popup mimic in the following manner:

The typical mimic displays all the available monitoring and control functions of a particular field device. Pop-up screens shall be created for the various field devices in a similar manner.

- A.** Shall be animated and indicates the status of the device graphically. Two sub areas shall be used for this purpose.

Foreground – The running status of the device, where:

- Green - indicates running or open
- Red - indicates stopped or closed

Background – The health status of the device, where:

- No colour - indicates healthy
- Red - indicates running in alarm mode
- Purple - indicates not able to operate
- Yellow - indicates tripped

- B.** Indicates the foreground and background status in words.

- C.** Indicates PLC outputs.

- Green – Start or open signal for the device
- Red – Stop or close signal for the device
- Yellow – Reset signal for the device

- D.** Mode selection

- E.** Feedback readings from the device

- F.** Device control area for “Operator control” mode

- G.** Displays all interlock, alarm and trip messages

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

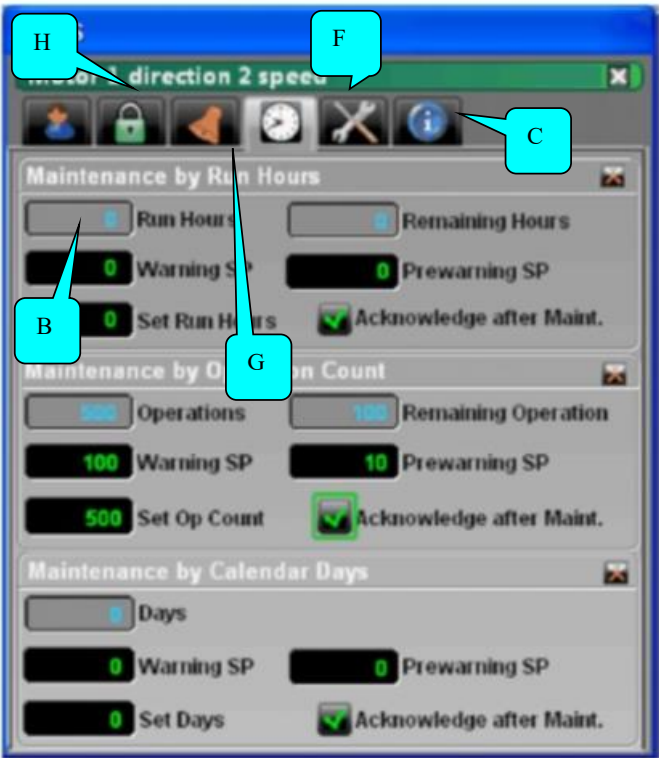
H. Device reset button to reset trip conditions

I. Process Sequence

The complete backwash process sequence shall continuously be displayed during the backwash process indicating valve, level, blower and back wash pump statuses. Failure of the backwash process shall indicate the exact step failure in the backwash process.

J. Toolbar

A toolbar shall be available on the main overview that will display all sections of plant. Depressing a toolbar button will open the relevant pop-up screen.



Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSECIS CONTROL INSTRUMENTATION SYSTEM

PS ECIS-1 SCOPE OF WORKS

Equipment shall be provided as specified.

PS ECIS-2 PRESSURE SENSORS

Electronic pressure transducers reading the suction or delivery pressure of a pipeline shall be supplied and installed under this contract where specified. The pressure transducers will serve the dual function of producing an alarm at low delivery pressure and trip the pump-set via the PLC and will be **hardwired** to the motor panel. The alarm will be triggered when the pump suction pressure drops to 1,3 times the 3% NPSH of the pump and will power the pumps down through the normal shut down procedure when the pressure drops to 1,1 times the 3% head loss at cavitation level.

Pressure transmitters shall be equal or similar than that described in the relevant Particular Specification.

PS ECIS-2.A PRESSURE SENSORS [X20]

Type: Pipe mounted

Supply: 1.5mm² x 2pr twisted PVC SWA PVC (individually and overall screened).

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
All	Supply and install absolute and gauge pressure sensor and probes. The transmitter shall be equal or similar to Cerabar PMC51 from Endress and Hauser with extended probes to the pipeline. The transmitter will be installed inside the enclosure.: Plus	Controller
All	Pipe connections to pipeline and coordination with mechanical contractor: Plus	Mechanical coordination Contractor
All	10mm ² PVC Earthing and bonding across the probe.	Earthing

PS ECIS-3 FLOW METER EQUIPMENT

Magnetic and turbine type flow meters will be supplied and installed by the mechanical or civil contractor. The above mentioned flow meter controllers will be an free issue items will have to be installed under this contract in flow meter kiosks complete with a supply of electricity, surge protection and earthing system.

Clamp on flow meters will be supplied and installed under this contract. The Contractor shall coordinate with the mechanical contractor if all requirements are met regarding the clamp on flow meters.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-3.A TURBINE FLOW METER INSTALLATION [X3] [WALL MOUNTED KIOSK]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP+ N MCB: Plus	Main
All	Single phase class 2 surge arrestor unit connection type 2: Plus	Surge arrestor
1	Meinecke type FM1 D/K frequency converter complete with opto-pulser at flow meter position: Plus	Conversion
1	Din-rail mounted LCD instantaneous flow display in l/s: Plus	Additional Display Unit
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Earthing and bonding across the probe [across the turbine].	Earthing

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-3.B TURBINE FLOW METER INSTALLATION [X2] [PEDESTAL MOUNTED KIOSK]

Type: Outdoor powder coated 3CR12 steel frame mounted kiosk with lockable front door and transparent window for meter reading purposes. Transparent window must be covered with top hinged powder coated 3CR12 cover for ultraviolet protection of controller. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 2pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP+ N MCB: Plus	Main
All	Single phase class 2 surge arrestor unit connection type 2: Plus	Surge arrestor
1	Meinecke type FM1 D/K frequency converter complete with opto-pulser at flow meter position: Plus	Conversion
1	Din-rail mounted LCD instantaneous flow display in l/s: Plus	Additional Display Unit
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Earthing and bonding across the probes [across the turbine].	Earthing

PS ECIS-3.C MAGNETIC FLOW METER INSTALLATION [X4]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2: Plus	Surge arrestor
All	Front panel mounted LCD display for instantaneous flow and totalized flow counter.	Display
All	Mag-Flow Controller supplied by mechanical contractor. Free issue item which must be installed in enclosure: Plus	Mag-flow
All	All connections to pipeline and coordination with mechanical contractor: Plus	Mechanical Contractor coordination
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection
All	Earthing and bonding across the entire magflow and connected to the earth of the kiosk.	Earthing

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-3.D ULTRASONIC FLOW METER INSTALLATION [X4]

Type: Outdoor powder coated 3CR12 steel frame mounted with lockable front door and transparent window for meter reading purposes. Transparent window must be covered with top hinged powder coated 3CR12 cover for ultraviolet protection of controller. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor
All	Ultrasonic flow controller equal and similar to FMU90 and Flow transducer sensor unit. Flow transducer shall be mounted with a mounting structure. The mounting structure shall be made from grade 304 stainless steel L-bracker secured to concrete. The transducer shall be secured inside a ventilated grade 304 stainless steel enclosure [protection against UV and the weather. The transducer mounting L-bracket and enclosure shall be mounted on top of the weir as per manufacturer recommendations for flow measurement including cabling and all accessories: Plus	Level Controller & Transducer [weir type flow meter]
All	Weir type flow meter transducer. The Contractor to allow for 5m cable to be to including cabling and all accessories.	Transducer
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard..	Signal & Data Surge Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-3.E ULTRASONIC – CLAMP ON FLOW METER INSTALLATION [X4]

This portion includes the instrument, the kiosk/ enclosure and bracket for the transducer.

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

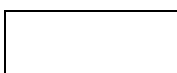
Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

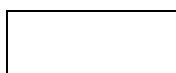
QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor



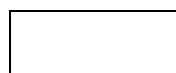
Contractor



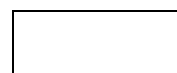
Witness 1



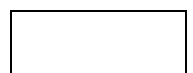
Witness 2



Employer



Witness 1



Witness 2

QTY	DESCRIPTION	IDENTIFICATION
All	Ultrasonic flow controller equal and similar to Proline Prosonic Flow 91W and flow transducers complete with side brackets unit. Flow transducer shall be mounted on the pipeline as recommended by the supplier with a mounting structure complete. The controller shall be mounted within the kiosk [described above]. The Contractor shall ensure that transducer mounting is strictly accordance as per the manufacturer recommendation. All cabling, glands, necessary equipment and all accessories shall be included: Plus	Level Controller & Transducer [weir type flow meter]
All	The transducer must be ordered with 10m cabling. All accessories and equipment must be included in the orde: Plus.	Transducer
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection

PS ECIS-4 ELECTRONIC LEVEL CONTROL

An electronic intelligent level transducers shall be supplied and installed on a grade 3CR12 stainless steel brackets and a ball type level sensor as indicated.

Field mounted level sensors shall be installed complete with local surge protection and earthing system. The level controllers shall be installed inside kiosk and mounted as specified. Stainless steel brackets, onto which the level sensors shall be screwed, shall be bolted to the wall; their mounting brackets being modified accommodate the insertion of the level sensors.

PS ECIS-4.A POINT LEVEL SWITCH [X6]

Type: Wall or Tank mounted

Supply: 1.5mm² x 2pr twisted PVC SWA PVC (individually and overall screened).

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor
All	Point level switch equal and similar to liquifloat FTS20 mounted inside the cubicle for high level measurement.	Point level switch

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
	<p>The Endress+Hauser Nivotester FTL325N shall included within the PLC cubicle. All cabling and all accessories shall be included.</p> <p>The floating switch shall be inserted into the tank – through a tapped hole G1A – and screwed into place with IP68 compression gland. All shall be completed as per manufacturer recommendations for point level measurement including cabling and all accessories: Plus</p>	
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring

PS ECIS-4.B ULTRASONIC LEVELS [X30]

Type: Wall or Tank mounted

Supply: 1.5mm² x 2pr twisted PVC SWA PVC (individually and overall screened).

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
All	Ultrasonic level transducer equal and similar to FMU30 mounted on grade 304 stainless steel bracket inside a ventilated grade 304 stainless steel enclosure on top of the structure as per manufacturer recommendations for level measurement including cabling and all accessories: Plus	Level Controller & Transducer [weir type flow meter]
All	Level type transducer. The Contractor to allow for 2m cable to be to including cabling and all accessories. The cable shall be connected into IP68 enclosure and from the enclosure to the PLC twisted PVC SWA PVC (individually and overall screened) shall be used.	Transducer

PS ECIS-4.C RADAR LEVELS [X4]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor
All	n ultrasonic level controller equivalent to the FMU90, paired with a radar-type transducer sensor unit, should be mounted on a Grade 304 stainless steel bracket. This setup will be housed within a ventilated Grade 3CR12 stainless steel enclosure, in accordance with the manufacturer's recommendations for level monitoring. The installation should include all necessary cabling and accessories: Plus	Level Controller & Transducer
All	Weir type flow meter transducer. The Contractor to allow for 10m cable to be to including cabling and all accessories.	Transducer
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard..	Signal & Data Surge Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-4.D BALL TYPE LEVEL CONTROL [x3]

Type: The float switch equal or similar to FTS20 Endress and Hauser for point level detection, all accessories, 304 stainless steel clamp, wall bracket, float switch hanger, weight, cable and all bolts and nuts to complete the installation: Plus

Supply: 1mm² x 2pr twisted PVC SWA PVC (individually and overall screened) to all applicate MCC, all cable work shall be added in schedule of quantities.

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
All	Ball-type level sensor equal and similar to K FTS20 Endress and Hauser made from high impact and shock resistant material. All accessories, 304 stainless steel clamp, wall bracket, float switch hanger, weight, cable and all bolts and nuts to complete the installation: Plus	Ball type level for manual stop
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard..	Signal & Data Surge Protection

PSECIS-5 NO-FLOW SENSORS

The electromagnetic flow monitor shall be pipe socket mounted and shall be easy to calibrate for specific no-flow conditions and shall be reliable in service.

The no-flow sensor shall be steel pipe mounted and shall be supplied complete with a weld stub to ensure correct immersion into the measuring liquid. The weld stub shall be adapted according to the flow measuring pipe diameter.

Pressure transmitters shall be equal and similar as specified under the particular specification.

PS ECIS-5A NO-FLOW SENSORS [X12]

Type: Pipe mounted

Supply: 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened) from Main MCC.

Equipment will be the following:

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	Supply and install No-flow sensor on the pipe suction. The no-flow sensor shall be equal and similar to Magphant Electromagnet flow meter from Endress and Hauser: Plus	Controller
All	Pipe connections to pipe line and coordination with mechanical contractor: Plus	Mechanical Contractor coordination
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring

PS ECIS-6 FREE CHLORINE ANALYZER [X2]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 5kA

Equipment will be the following:

Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

QTY	DESCRIPTION	IDENTIFICATION
1	15Amp + Neutral Continues Rated SP + N MCB mounted: Plus	Main
1	Supply and install free chlorine meter equal and similar Endress and Hauser chlorine analyser: Plus	Free Chlorine Analyser
All	Pipe connections to pipe line and coordination with mechanical contractor to allow all pipe connections: Plus	Mechanical Contractor coordination
1	Verification module for calibration: Plus	Calibration purposes
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring

PS ECIS-7 PH ANALYSER

pH meters shall be provided at the in positions as indicated on the construction drawings. The pH meters shall be provided complete with sensor support and support brackets secured to structures. Cables shall be installed in grade galvanised steel pipes or galvanised cable trays secured to the structure walls.

PS ECIS-7.A PH ANALYZER [X2]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 10mm² bare copper earth plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 5kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to Dehnguard. DVMTT255 with remote indicator panel & remote signalling contacts connected to the SCADA: Plus	Surge arrestor
All	Controller equal and similar to Endress and Hauser Controller including cabling and all accessories: Plus	Controller
2	Transducer equal and similar to Endress and Hauser pH Sensors unit mounted on grade 304 stainless steel bracket inside a ventilated grade 304 stainless steel enclosure: Plus	Transducer
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Pipe connections to pipe line and coordination with mechanical contractor to allow all pipe connections: Plus	Mechanical Contractor coordination
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection

PS ECIS-8 TURBIDITY ANALYSER FOR LOW TO MEDIUM RANGE TURBIDITY MEASUREMENTS

Turbidity analysers shall be provided complete with sample water piping, calibration certificates from the manufacturer, glands, fixings, cables, transducers, flow fit, communication cables, LV cables and all necessary accessories to complete the installation.

PS ECIS-8.A TURBIDITY ANALYSER DUAL TRANSDUCERS DUAL TRANSDUCERS [X16 – RGS & GAC FILTERS]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp SP + N Continues Rated SP + N MCB mounted: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to Dehnguard: Plus	Surge arrestor
2	Supply and install turbidity analyser equal and similar Endress and Hauser Liquiline CM442 Controller [CM442-3U26/0] with dual E+H Turbimax CUS52D turbidity sensors - with Flowfit CPA250 CPA250. The installation shall come complete with flow fit, cables, accessories, glands, fixings and all necessary equipment to complete the installation: Plus	Turbidity Analyser
1	Supply and install of Endress and Hauser controller complete with communication: Plus	Controller unit
All	Calibration module for Endress and Hauser: Plus	Calibration purposes
All	Calibration cylinder	Calibration purposes
All	Pipe connections to pipe line and coordination with mechanical contractor to allow all pipe connections: Plus	Mechanical Contractor coordination
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ECIS-8.B TURBIDITY ANALYSER DUAL TRANSDUCERS [X2 – ONE AT INLET [RAW WATER MEASUREMENT] ONE AT OUTLET OF PLANT]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C
- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp SP + N Continues Rated SP + N MCB mounted: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to Dehnguard: Plus	Surge arrestor
2	Supply and install turbidity analyser equal and similar Liquiline CM442 Controller [CM442-3U26/0] with dual sensors - E+H CPS31D-7AS21 Digital pH sensor with Flowfit CPA250 and E+H Turbimax CUS52D sensor with Flowfit CPA250 The installation shall come complete with flow	Turbidity Analyser

Contractor

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QTY	DESCRIPTION	IDENTIFICATION
	fit, cables, accessories, glands, fixings, and all necessary equipment to complete the installation: Plus	
1	Supply and install of Endress and Hauser controller complete with communication: Plus	Controller unit
All	Calibration module for Endress and Hauser: Plus	Calibration purposes
All	Calibration cylinder and calibration certificate after completion: Plus	Calibration purposes
All	Pipe connections to pipe line and coordination with mechanical contractor to allow all pipe connections: Plus	Mechanical Contractor coordination
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNgard.	Signal & Data Surge Protection

PS ECIS-12 SLUDGE DEWATERING SYSTEM INSTRUMENTATION

The performance specification as detailed in the Mechanical Project Specification shall be applicable to control the system and Contractor shall include all monitoring, control and programming required to address all the control as specified in the Electrical as well as the Mechanical Project Specification. The Sludge Dewatering vendor package system shall be displayed on the SCADA and local HMI. The Engineer has made allowance for the inputs and outputs [refer to PSEPLC] for the vendor system in its conceptual design as a minimum requirement, but the Contract shall ensure that all process requirements are monitored and controlled to ensure the entire system are fit for purpose:

- Polyelectrolyte handling, including all tank levels, dosing rate and make-up equipment.
- Liquid level, flow and solids density meters shall be allowed for under respective schedules in schedule of quantities.
- Electrical installation and instrumentation system.

Reference shall be made to the proposed process and instrumentation diagram (P&ID). However, in terms of clause C3.4.1.13, the responsibility for the final design shall rest with the Contractor, who shall ensure that the installed system shall suit and meet the objectives of the installation in terms of the Employer's Requirements. Any/all items deemed necessary for the effective and safe operation of the system, and which are not specifically measured in the respective schedules shall be included in the tender offer and clearly highlighted. All Instrumentation shall be allowed for.

The Engineer has allowed for additional panels / cubicles within the MCC to cater for additional surrounding equipment outside the dewatering building, however the dewatering system including cables, instrumentation and all PLC / SCADA integration shall be allowed fully by the contractors.

PS ECIS-13 OZONE SYSTEM INSTRUMENTATION

The performance specification as detailed in the Mechanical Project Specification shall be applicable to control the system and Contractor shall include all monitoring, control and programming required to address all the control

Contractor

Witness 1

Witness 2

Employer

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as specified in the Electrical as well as the Mechanical Project Specification. The Ozone vendor package system shall be displayed on the SCADA and local HMI. The Engineer has made allowance for the inputs and outputs [refer to PSEPLC] for the vendor system in its conceptual design as a minimum requirement, but the Contract shall ensure that all process requirements are monitored and controlled to ensure the entire system are fit for purpose:

- Polyelectrolyte handling, including all tank levels, dosing rate and make-up equipment.
- Liquid level, flow and solids density meters shall be allowed for under respective schedules in schedule of quantities.
- Electrical installation and instrumentation system.

Reference shall be made to the proposed process and instrumentation diagram (P&ID). However, in terms of clause C3.4.1.13, the responsibility for the final design shall rest with the Contractor, who shall ensure that the installed system shall suit and meet the objectives of the installation in terms of the Employer's Requirements. Any/all items deemed necessary for the effective and safe operation of the system, and which are not specifically measured in the respective schedules shall be included in the tender offer and clearly highlighted. All Instrumentation shall be allowed for.

The Engineer has allowed for additional panels / cubicles within the MCC to cater for additional surrounding equipment outside the dewatering building, however the dewatering system including cables, instrumentation and all PLC / SCADA integration shall be allowed fully by the contractors.

PS ECIS-14 THERMAL MASS FLOW METER KIOSK [X2 – EXISTING BLOWER LINE AND NEW BLOWER LINE FLOW]

Type: Outdoor powder coated 3CR12 kiosk. The kiosk shall be steel frame mounted with lockable front door and transparent window for meter reading purposes. The enclosure / kiosk shall be designed and submitted for approval to the Engineer and will be so designed to easily accommodate the equipment described below. The controller, surge arrestor, terminals shall be mounted inside the enclosure. The transparent window must be covered with a top hinged powder coated 3CR12 cover for ultraviolet protection of the controller display. The enclosure shall be ventilated by means of vent plug. The Contractor shall design and supply a rigid channel iron frame or support structure to lift the kiosk so that the centre of the panel is 1500mm above final floor level. The channel support structure shall be fixed to the precast plinth structure with adequate number of fasteners and the entire support shall be subject to approval by the Engineer. The plinth is part of the entire installation and shall be supplied as complete package.

The vent plug shall incorporate an internal PTFE-membrane, designed to balance internal enclosure temperature with external ambient temperature, avoiding internal condensation without compromising the IP rating of the enclosure.

- Protection degree: IP68-10
- Influent pressure: >5 Bar
- Temperature: -50°C...+120°C

Contractor

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Witness 2

- Nylon or Nickel plated brass

Supply: 2.5mm² x 3 core PVC SWA PVC cable plus 1mm² x 4pr twisted PVC SWA PVC (individually and overall screened).

Colour: Electric orange

Fault level: 6kA

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	10Amp Continues Rated SP MCB: Plus	Main
All	Single Phase class 2 surge arrestor unit connection type 2 as per SANS 10142-1: Plus	Surge arrestor
1	Thermal Mass controller equal and similar to Endress and Hauser t-mass 65l and remote transducer. The transducer shall be remotely mounted the pipeline for flow measurement including cabling and all accessories: Plus	Level Controller & Two Transducers EX rated
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Calibration module for Endress and Hauser: Plus	Calibration purposes
All	Pipe connections to pipeline and coordination with mechanical contractor: Plus	Mechanical Contractor coordination
All	Pipe connections to pipeline and coordination with mechanical contractor: Plus	Mechanical Contractor coordination and implementation
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection

PS ECIS-15 PROXIMITY SWITCHES [X26]

Type: Valve mounted

Supply: 1mm² x 2pr twisted PVC SWA PVC (individually and overall screened) from pratley / CCG Box [with surge arrestor]

Equipment will be the following:

QTY	DESCRIPTION	IDENTIFICATION
1	Supply and install proximity switches IP68 minimum made from stainless steel. The proximity switches shall be equal and similar to IFM: Plus	Proximity Switches
All	Terminals and interconnecting monitoring and control wiring: Plus	Connection and monitoring
All	Connections to valve and coordination with mechanical contractor: Plus	Mechanical Contractor coordination

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



QTY	DESCRIPTION	IDENTIFICATION
All	Signal & Data Surge protection unit suitable for the application equal or similar to Blitzductor XT from DEHNguard.	Signal & Data Surge Protection

Contractor

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Witness 2

Employer

Witness 1

Witness 2

PS EG&M GENERAL AND MISCELLANEOUS

PS EG&M-3 EMERGENCY STOP PUSH BUTTONS AND WEATHERPROOF ISOLATORS

Grade 304 stainless steel pedestal mounted emergency stop stations shall be provided at all motor installations as specified.

Emergency stop pedestals at submersible pump sets shall be installed on a wider than normal grade 304 stainless steel emergency stop pedestal that will house the motor cable terminations as specified in the Particular Specification.

PS EG&M-8 NOTICES AND DANGER PLATES

This specification deals with the provision of Notices and Danger Plates and signage as required in terms of the Occupational Health and Safety Act No. 85 of 1993, as well as any other notices that may be required by law or by the nature of the finished Works.

All building signage on equipment's shall be covered under this contract, it is the Contractor responsibility to familiarize himself with applicable standards referred in particular specification and supply all necessary signage.

PS EG&M-8.2 MATERIALS AND FINISH

Outdoor signs shall be either of vitreous enameled type or of cast aluminum with raised or embossed letters.

The colours and sizes of letters and colours of background shall be in accordance with requirements of SANS 0140 and as approved by the Engineer.

Symbolic signs shall conform to the requirements of SANS 1186.

The following building names shall be added under the Notices and Danger Plates:

- Clear Water Tank (1 sign)
- DAF Tank (2 sign)
- Flocculation Channel (2 sign)
- RGS Filters (1 Sign)
- Ozone Contact Tank (1 Sign)
- Ozone Building (1 Sign)
- Dewatering Building (2 Sign)
- Filtrate Sump (1 Sign)
- Hydrogen Peroxide Building (1 Sign)
- GAC Filter (2 Signs)
- Medium Voltage Substation No.1 (1 Sign)
- Miniature Substation No.1 (1 Sign)
- Bospoort Water Treatment Works (1 sign)
- Bospoort to Vaalkop / Bospoort North HLPL Link Chamber (1 sign)
- Bospoort Reservoirs [Magalies Water] (1 sign)

Contractor

Witness 1

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- Bospoort North to: Thlabane Pipeline; Boitekong Pipeline and Boitekong Network Chamber (1 sign)

PS EG&M-9 FIRE EXTINGUISHERS

5kg CO2 and powder fire extinguishers shall be supplied and installed in all pump stations and treatment plant buildings in accordance with the requirements of the Local Authority. Each fire extinguisher shall have extinguisher cabinet, mounting bracket, tags, seals, inspection label, tags, and double sided signage above the extinguisher.

The following locations shall be fitted with fire extinguishers:

- DAF Tank (1 Unit, mounted next to MCC)
- RGS Filters (5 Units, mounted next to each panel)
- Ozone Contact Tank (1 Unit mounted next to DB)
- Ozone Building (4 Units, mounted next to each panel)
- Dewatering Building (4 Units, mounted next to each panel)
- GAC Filters (5 Units, mounted next to each panel)
- Hydrogen Peroxide Building (1 Units, mounted next to MCC)
- Bospoort Water Treatment Works (1 Unit, mounted next to telemetry cubicle)
- Bospoort to Vaalkop / Bospoort North HLPL Link Chamber (1 Unit, mounted next to telemetry cubicle)
- Bospoort Reservoirs [Magalies Water] (1 Unit, mounted next to telemetry cubicle)
- Bospoort North to: Thlabane Pipeline; Boitekong Pipeline and Boitekong Network Chamber (1 Unit, mounted next to telemetry cubicle)

Contractor

Witness 1

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PS EELS EARTHING AND LIGHTNING PROTECTION

PS EELS-1 SCOPE

This specification, read together with the applicable Particular Specifications included under section C3.4.2.2 covers the performance specifications, design parameters, manufacture, supply and delivery to site, installation, testing, adjustment and commissioning of the earthing and lightning protection to be provided under this Contract.

PS EELS-6 AIR-TERMINATION SYSTEM

The Contractor shall use air-termination system, and shall be composed of the following elements:

- Rods;
- Stretched wires;
- Meshed conductors.
- Any exposed conductors shall be done with anti – theft conductors
- All bonding which are exposed shall be done with anti – theft conductors

PS EELS-10 INTERNAL & EXTERNAL LIGHTNING PROTECTION SYSTEM

Class 4 earthing and lighting protection shall be provided at the following locations:

- a) Clear Water Tank
- b) DAF Tank No.3 extension
- c) RGS Filters
- d) Ozone Contact Tank
- e) Ozone Building
- f) Dewatering Building
- g) Filtrate Sump
- h) Hydrogen Peroxide Building
- i) GAC Filters
- j) Transformer Yard
- k) Miniature Substation
- l) Generator System
- m) Pre-Ozone Tank
- n) Lox Building
- o) Bospoort to Vaalkop / Bospoort North HLPL Link Chamber (1 Unit, mounted next to telemetry cubicle)
- p) Bospoort Reservoirs [Magalies Water] (1 Unit, mounted next to telemetry cubicle)
- q) Bospoort North to: Thlabane Pipeline; Boitekong Pipeline and Boitekong Network Chamber (1 Unit, mounted next to telemetry cubicle)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



The lighting protection shall be done by a qualified specialist who will submit approved SABS drawings and all calculations. Lighting protection certificate (COC) for each building and structure and shall be completed and approved by a registered Professional Engineer..

All exposed external earthing and bonding shall be done with Anti-Theft Cable.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ESLS SITE LIGHTING

PS ESLS-1 SCOPE

This specification, read together with the applicable Particular Specifications included under section C3.4.2.2 covers the performance specifications, design parameters, manufacture, supply and delivery to site, installation, testing, adjustment and commissioning of the site lighting to be provided under this Contract.

PS ESLS-2 15M HIGH MASTS

Supply and install **Ten (x10)** 15m high scissor mast as indicated on the site layout drawing, complete with mast foundation and earthing system, final positions will be determined on site by the engineer or his representative. Provide three (x4) LED type M on top of each mast.

Type M	:	135W Neutral White LED Floodlight. The luminaire consists of an LED engine, power supply and spigot compartment. It shall be secured by stainless steel latches and an access screw. The LED engine, consisting of the LED light source and the power supply, shall be easily replaceable. Both compartments are rated IP66. Electronic temperature monitoring prevents overheating of LEDs and power supply, positioned directly next to LEDs. The luminaire housing shall be manufactured of marine grade aluminium. Equal or similar to Omistar from Beka.
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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESGS STANDBY GENERATOR

PSESGS-1 SCOPE

This specification, read together with the applicable Particular Specifications. The performance specifications, design parameters, manufacture, supply and delivery to site, installation, testing, adjustment and commissioning of the generator to be provided under this Contract.

All components shall correspond with preferred manufacturer .

Equipment shall be as follows:

Controller	–	Yes, equal or similar to Deepsea
Change over shall include	–	Voltage, frequency, undervoltage, phase rotation relay with a timer shall be per the specifications.
AMF & Change Over	–	Motorized Breakers only.
AMF & Change Over panel	–	Shall be built by the MCC manufacturer at the same standard Motor Control Centre particular Specification.
AMF & Changeover	–	Yes, shall build with same equipment as the motor control centre panel builders equipment.
PLC	–	Shall be built by the MCC manufacturer at the same standard PLC specification particular Specification.
Synchronous Panel	–	Yes, total load shall be capable of 2400kVA, 3 x 800kVA generator sets is acceptable.
Additional Diesel Storage	–	Yes, 10000 liters fitted into a container
Exhaust	-	Yes, the exhaust will be extended outside the container, positioned to avoid blowing toward the pump station building, and will be manufactured from 3CR12.

The Programmable Logic Controller (PLC) shall be provided by the contractor responsible for the overall site layout. This ensures that all equipment is sourced from the same manufacturer, maintaining consistency and compatibility across the system. The specific programmer for the PLC has been outlined in the PLC section of the contract.

The generator's PLC and Human-Machine Interface (HMI) shall be programmed with a timer function in manual mode. This feature will allow operators to set the generator start time based on the Eskom load shedding schedule. By pre-starting the generator before the load shedding begins, the plant can continue to operate smoothly without interruption.

Once the timer is set, the generator will automatically start and switch over to generator power, maintaining the plant's operation until Eskom power is restored. Upon restoration of Eskom power, the system will automatically switch back to Eskom supply, ensuring a seamless transition and protecting the equipment from potential damage during shutdown and startup sequences.

Contractor

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Employer

Witness 1

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The following functions will be programmed by the designated programmer:

- Controlled Stop of All Motors: Ensuring that all running motors are stopped in a controlled manner to prevent damage.
- Controlled Stop of All Processes: Gradually stopping all processes to avoid abrupt shutdowns and potential issues.
- Controlled Start Sequence of the Plant: The contractor shall detail the start-up sequence for the plant and submit it for approval. This sequence will be crucial for ensuring the plant starts up efficiently and safely.
- Sequence Upon Eskom Power Restoration: The same controlled start sequence will be performed once Eskom power is restored, ensuring a smooth transition back to the primary power source.

All of the starting and stopping of the entire plant and programming shall be sent for the Engineer for approval.

PSESGS-3 GENERATOR DETAILS

The contractor shall make sure that the space provided for the generator and plinth dimensions are sufficient for the generator offered under this contract, all the generators shall be outdoor type and housed within a container.

An automatic mains failure and change over system shall be provided for and the generator set shall be housed within a container [See Drawings]. All electrical equipment associated with starting and stopping of the set, protection of the set, indications and starting battery charger shall be provided.

Weatherproof Purpose Modified standard ISO container [See drawings], enclosing the generating set completely with its Control Panel, Switch Gear and a Weatherproof Purpose Modified standard ISO container for Fuel Tank. Suitably treated, painted and bolted to the duplex base frame and mounted on concrete plinth.

Suitable openings are provided for fresh air inlet, hot air outlet, all manufactured from steel and screened with wire mesh to prevent the ingress of birds and rodents.

Lockable-hinged doors are provided on both sides fitted with container door camlocks for access to the generating set, the control panel, connection arrangements and service parts.

The size has been determined and the Generator shall be as follows:

Containerized Standby Generator Size	–	3 x 800kVA Generators
Containerized Bulk Fuel Tank	–	1 x 10 000 liter
Primary Voltage	–	400V
Secondary Voltage Through transformer	-	22kV

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESGS-7.2 COMPOSITION OF THE STANDBY GENERATOR SYSTEM

The following additional components shall be incorporated into the system to have a complete containerized standby generator and containerized bulk fuel tank.

Item	Description	Specification
1	Primary filter/water separator	6-micron nominal, 15 micron absolute 40 l/min max. Manual water drain
2	Circulation pump	0.37 kW minimum 3~
3	ALGAE-X	13 – 50 l/min
4	Secondary filter	15 microns 130 l/min max. Water block
5	Flow meter	Yes
6	Globe valve	Yes
7	PLC	Yes, refer to PLC section

Primary filter/water separator

The Primary Filter/Water Separator is located before the pump. The body contains a filter element, which filters the diesel fuel down to 6 micron (nominal) and removes any entrained water. A plug at the bottom of the unit allows separated water, which settles at the bottom of the body, to be drained. A manual air bleed on the flanged lid allows air to be bled from the filter/water separator.

Flow: 40 l/min (max.)
Pressure: 5 bar (max.)
Temperature: -10°C to 70°C

Circulation pump

The circulation pump is located after the primary filter. The pump is a single impeller centrifugal type, driven by a TEFC 2 pole electric motor.

The pump runs on a timer and periodically draws fuel from the bulk tank, circulates it through the series of filters and returns the fuel back into the same tank.

Suction: 1" BSP minimum
Discharge: 1" BSP minimum
P1: 0.63 kW Estimated and must be confirmed by supplier.
P2: 0.37 kW Estimated and must be confirmed by supplier.
Absorbed current: 1.4 A Estimated and must be confirmed by supplier.
Flow: 0 – 90 l/min Estimated and must be confirmed by supplier.
Head: 20 – 10.5 m Estimated and must be confirmed by supplier.

Contractor

Witness 1

Witness 2

Employer

Witness 1

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Algae – X

The Algae – X magnetic fuel conditioner stabilizes and conditions the diesel fuel.

The fuel conditioner has no moving parts, requires no electrical connection and requires no maintenance.

Due to the magnetic internal parts of the fuel conditioner, it is mounted on a non-ferrous bracket.

Secondary Filter

The Secondary Filter assembly is positioned after the fuel conditioner. It shall be made up of 2 parts:

- The filter head
- Spin on filter element

The water block properties of the filter element remove any emulsified and dissolved water.

Globe Valve

A globe valve is positioned at the end of the system. Its function is to throttle the flow of diesel fuel to within the acceptable range of the fuel conditioner.

The valve is set during commissioning and is to be left in this position between filter replacements. It might be necessary to adjust the valve after filter element or other component replacements.

Containers for generator and bulk fuel tank

The shelter is a standard ISO Sea Freight container per ISO 1496 and must be converted for the explicit use of housing a diesel generator set for the proper operating conditions of the equipment. The shelter shall be sealed to resist water ingress to IP54.

The exterior envelope size of the container:

Generator

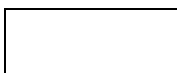
Height	Length	Width
2.7m	6m	2.35m [Estimated refer to supplier]

Bulk Fuel Tank

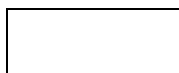
Height	Length	Width
2.7m	6m	2.35m [Estimated refer to supplier]

The interior envelope size of the shelter equipment compartment shall be derived from sufficient insulation thickness to provide a minimum insulating factor of R10 or better.

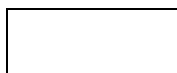
Wall sections: All wall sections must meet an insulation factor of -R10 or better and adhere to ISO 1496-1. Interior walls shall be insulated with suitable material (minimum 50mm thickness) and cover with sonic liner.



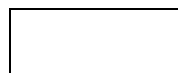
Contractor



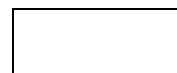
Witness 1



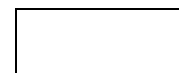
Witness 2



Employer



Witness 1



Witness 2

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Floor: The floor section shall consist of standard ISO flooring. Cover with a commercial grade aluminum plates or equivalent material with easy to clean properties.

Roof: The roof shall have an anti-skid surface; Ceiling must meet an insulation factor of R10 or better.

Generator Access

The generator must be accessible for maintenance from two doors on either side of the container.

Generator Ventilation

The generator requires ventilation to the outside of the container for intake, exhaust and hot air dissipation. Install to suit equipment. The generator ventilation system is to be designed for a maximum rise in temperature of 10°C over the ambient temperature.

Equipment Cutouts

Cutouts for cable feeders, generator air intake and outlet, and exhaust cut-outs will be required. Also, generator supply line feed through is required through the bulkhead. Sizes and locations to suit equipment install.

Exterior Finish

All exterior surfaces including walls, roof, doors, under belly and exposed hardware require a rust inhibitive paint, beige or desert sand in colour. Sign writing or logo application for external finish is *N/A*.

PSESGS-8 GENERATOR SIGNALS

The following additional equipment shall be available in order to monitor the following items from the Generator, however it not only limited to the below referenced items.

The Contractor shall allow for all items to be displayed on the HMI:

Generator healthy
Generator trip
Generator run/stop
Generator E-Stop
Generator bulk fuel tank level Analogue Monitor / Alarm / Trip
Generator Engine and Alternator temperature
Generator Engine and Alternator temperature Trip / Alarm
Generator Engine water level Alarm / Trip
Generator Engine Oil Level Alarm / Trip
Generator Alternator Charging Operational
Generator Engine Temperature
Generator Normal/Fail
Generator Low Battery
Generator DC voltage below 12 Volt

Contractor

Witness 1

Witness 2

Employer

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Generator Low Oil level
Generator Overload
Generator circulation Pump Run / Stop / Healthy Statuses
All Generator information shall be displayed on HMI in Main MCC
Power Analyzer values to be captured in PLC and displayed on plant and HMI and distributed through plant and linked to other power analyzers– Apparent Power, Power, Reactive Power, line and phase Voltages, Line and phase Currents, Power Factor, all billing information.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ESPL ELECTRICAL INSTALLATION IN BUILDINGS AND ON STRUCTURES

PS ESPL-1 SCOPE

The scope for the distribution board sections shall include everything to provide a complete small power distribution and lighting system. The design of the distribution board will allow for single and three phase supplies to equipment on site.

PS ESPL-4 LIGHT FITTINGS

Note: All luminaires must be approved by the Engineers representative prior to the installation of or any order being placed. Only light fittings as well as all light fitting components carrying the SABS mark of approval will be acceptable. All fluorescent light fittings shall be equipped with electronic control gear.

The contractor submission process mandates that each of the skilled laborers and the contractor undergo comprehensive training to acquire certification in the precise installation procedures outlined in the contract documents. As an integral component of the technical submission, the contractor is obligated to verify that all personnel have successfully completed courses at the supplier's premises, thereby gaining the necessary experience and knowledge to proficiently install and commission all luminaires as specified in the agreement.

A critical facet of this commitment is for the contractor to maintain a meticulous record, detailing the individuals responsible for the installation, along with the specific dates and locations where each luminaire was installed. Quality control measures are imperative to ensure that the designated personnel assume accountability for the luminaires they have installed, thereby upholding the standards outlined in the contract. This comprehensive approach not only guarantees the adherence to installation specifications but also underscores the contractor's commitment to excellence in executing the project. The Contractor shall ensure that the ingress protection of the proposed fittings is not compromised under any circumstances as part of his installation. CCG or Pratley equipment, SABS-certified, shall be used to maintain full compliance with the specifications and proposed equipment. All IP-rated fittings shall come with a minimum of 1.5 meters of double-insulated silicone cable pre-installed by the manufacturer.

Type A	:	55W LED enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 55W LED's lamps. Equal or similar to Roughguard from Beka
Type B	:	55W LED enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 55W LED's lamps. Equal or similar to Roughguard from Beka plus 1hour EMG maintained (emergency).

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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Type C	:	27W fluorescent enclosed dust, moisture, vandal and corrosion proof Zone 2 luminaire. The luminaire shall consist of an Injection-moulded, flame retardant polycarbonate with a robust clear polycarbonate diffuser and shall be designed to operate LED's of up to 65W, and fluorescent lamps up to 80W. Equal or similar to Vapourline from Beka.
Type D	:	27W fluorescent enclosed dust, moisture, vandal and corrosion proof Zone 2 luminaire. The luminaire shall consist of an Injection-moulded, flame retardant polycarbonate with a robust clear polycarbonate diffuser and shall be designed to operate LED's of up to 65W, and fluorescent lamps up to 80W. Equal or similar to Vapourline from Beka plus 1hour EMG maintained (emergency).
Type E	:	55W LED enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 55W LED's lamps. Equal or similar to Roughguard from Beka.
Type F	:	55W LED enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 55W LED's lamps. Equal or similar to Roughguard from Beka plus 1hour EMG maintained (emergency).
Type G	:	18W LED Bulkhead warm white enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 18W LED's lamps. Equal or similar to Bekabulk from Beka.
Type H	:	18W LED Bulkhead warm white enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 18W LED's lamps. Equal or similar to Bekabulk from Beka plus 1hour EMG maintained (emergency).
Type I	:	19W LED Bulkhead warm white enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 19W LED's lamps. Equal or similar to Roughguard Beka.
Type J	:	19W LED Bulkhead warm white enclosed dust, moisture, vandal and corrosion proof luminaire. The luminaire shall consist of a high-pressure die-cast marine grade aluminium body with a robust clear polycarbonate diffuser and shall be designed to operate 19W LED's lamps. Equal or similar to Roughguard Beka plus 1hour EMG maintained (emergency).
Type K	:	100W HPS Street Light robustly constructed, weatherproof, hailproof, corrosion proof and vandal resistant luminaire. The luminaire gear compartment shall be manufactured from high-pressure die-cast aluminium to ensure excellent heat dissipation and optimum strength. It shall be covered by a hinged non-corrosive lid which allows access to the control gear and spigot mounting. The luminaire shall be designed designed to operate 250/400 Watt mercury vapour and 150/250/400 Watt high-pressure sodium lamps .Equal or similar to Bekasun from Beka.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

Type L	:	135W Neutral White LED Floodlight. The luminaire consists of an LED engine, power supply and spigot compartment. It shall be secured by stainless steel latches and an access screw. The LED engine, consisting of the LED light source and the power supply, shall be easily replaceable. Both compartments are rated IP66. Electronic temperature monitoring prevents overheating of LEDs and power supply, positioned directly next to LEDs. The luminaire housing shall be manufactured of marine grade aluminium. Equal or similar to Omistar from Beka.
Type M	:	135W Neutral White LED Floodlight. The luminaire consists of an LED engine, power supply and spigot compartment. It shall be secured by stainless steel latches and an access screw. The LED engine, consisting of the LED light source and the power supply, shall be easily replaceable. Both compartments are rated IP66. Electronic temperature monitoring prevents overheating of LEDs and power supply, positioned directly next to LEDs. The luminaire housing shall be manufactured of marine grade aluminium. Equal or similar to Omistar from Beka.
Type N	:	52W LEDNOVA Zone 2 Surface Mounted luminaire. IP 66 rating is supported by a certified SABS test report. Equal or similar to Lednova from Beka
Type O	:	52W LEDNOVA Zone 2 Surface Mounted luminaire. IP 66 rating is supported by a certified SABS test report. Equal or similar to Lednova from Beka plus 1hour EMG maintained (emergency).

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS ESPL-A OZONE BUILDING

PS ESPL-A.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S3	16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-A.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P4	16Amp surface mounted socket outlets.	1.35m above final floor level

PS ESPL-A.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1-WP4	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-A.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1-L09	Luminaries fitted against concrete	C
L10-L18	Luminaries fitted against concrete	D
L19-L25	Luminaries fitted against concrete 2300mm AFFL	H

PS ESPL-A.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNgard. DG M TT 275: Plus	Surge arrestor plus signals
2	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
6	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	32Amp continuous current rated TP MCB: Plus	Internal Lighting
1	40Amp continuous current rated TP Contactor: Plus	Internal Lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting Coil Protection
3	16Amp continuous current rated SP MCB: Plus	Internal Lighting which is controlled from light switch timer
3	10Amp continuous current rated SP MCB: Plus	Internal Lighting

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors
8	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

PS ESPL-B RGS FILTERS BUILDING

PS ESPL-B.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S4	16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-B.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P4	16Amp surface mounted socket outlets.	0.35m above final floor level

PS ESPL-B.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1-WP4	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-B.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

NUMBER	LOCATION	TYPE
L1 – L6	Luminaries fitted underneath concrete and mounted on L-brackets	A
L7– L12	Luminaries fitted underneath concrete and mounted on L-brackets	B
L13– L17	Luminaries fitted against concrete	A
L18– L25	Luminaries fitted against concrete	B
L26-L40	Luminaries fitted against concrete (not indicated on drawing, this forms part of contract. Engineer will confirm position.	H

PS ESPL-B.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
2	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
6	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	32Amp continuous current rated TP MCB: Plus	Internal Lighting
1	40Amp continuous current rated TP Contactor: Plus	Internal Lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting Coil Protection
8	16Amp continuous current rated SP MCB: Plus	Internal Lighting which is controlled from light switch timer
4	10Amp continuous current rated SP MCB: Plus	Internal Lighting
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors
4	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

PS ESPL-C DEWATERING BUILDING

PS ESPL-C.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S3	Intermediate 16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-C.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P6	16Amp surface mounted socket outlets.	1.35m above final floor level
P7-P13	16Amp power skirting mounted socket outlets.	0.35m above final floor level

Contractor to allow for 25m of 2 tier power skirting in the price, which will be confirmed on site.

PS ESPL-C.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1-WP3	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-C.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1 – L2	Luminaires suspended from ceiling	N
L3 – L6	Luminaires suspended from ceiling	O
L7-L15	Luminaires fitted against concrete (not indicated on drawing, this forms part of contract. Engineer will confirm position.	H

PS ESPL-C.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2
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Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
2	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
6	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	32Amp continuous current rated TP MCB: Plus	Internal Lighting
1	40Amp continuous current rated TP Contactor: Plus	Internal Lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting Coil Protection
3	16Amp continuous current rated SP MCB: Plus	Internal Lighting which is controlled from light switch timer

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors
4	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

PS ESPL-D GAC BUILDING

PS ESPL-D.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S4	Two-way 16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-D.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P14	16Amp surface mounted socket outlets.	1.35m above final floor level

PS ESPL-D.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1-WP6	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS ESPL-D.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1 – L6	Luminaries fitted underneath concrete and mounted on L-brackets	A
L7– L12	Luminaries fitted underneath concrete and mounted on L-brackets	B
L13– L19	Luminaries fitted against concrete	A
L20– L26	Luminaries fitted against concrete	B
L26– L35	Luminaries fitted against concrete	G
L36-L52	Luminaries fitted against concrete (not indicated on drawing, this forms part of contract. Engineer will confirm position.	H

PS ESPL-D.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

June 2025

QTY	DESCRIPTION	IDENTIFICATION
2	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
6	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	32Amp continuous current rated TP MCB: Plus	Internal Lighting
1	40Amp continuous current rated TP Contactor: Plus	Internal Lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting
1	5Amp continuous current rated SP MCB: Plus	Internal Lighting Coil Protection
8	16Amp continuous current rated SP MCB: Plus	Internal Lighting which is controlled from light switch timer
5	10Amp continuous current rated SP MCB: Plus	Internal Lighting
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100-hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors
8	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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PS ESPL-E HYDROGEN PEROXIDE BUILDING

PS ESPL-E.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S2	16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-E.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P3	16Amp surface mounted socket outlets.	1.35m above final floor level

PS ESPL-E.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-E.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1-L2	Luminaries fitted against concrete	C
L3-L6	Luminaries fitted against concrete	D
L7	Luminaries fitted against concrete 2300mm AFFL	H
L8	Luminaries fitted against concrete 2300mm AFFL	G

PS ESPL-E.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
3	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	10Amp continuous current rated TP MCB: Plus	Internal Lighting
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

PS ESPL-F PRE-OZONATION BUILDING

PS ESPL-F.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1	16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-F.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P2	16Amp surface mounted socket outlets.	1.35m above final floor level

PS ESPL-F.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-F.3 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1-L2	Luminaries fitted against concrete	C
L3-L4	Luminaries fitted against concrete	D
L5-L9	Luminaries fitted against concrete 2300mm AFFL	H

PS ESPL-F.4 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
3	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	10Amp continuous current rated TP MCB: Plus	Internal Lighting
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocuter E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocuters
1	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

PS ESPL-G DAF BUILDING

PS ESPL-G.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1-S2	Two-way 16Amp surface mounted light switch with a digital timer and programmable timer to switch of luminaires after predetermined time minimum IP65.	1.35m above final floor level

PS ESPL-G.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P2	16Amp surface mounted socket outlets.	1.35m above final floor level

PS ESPL-G.3 Three Phase and Multi Pin Socket Outlets

NUMBER	DESCRIPTION	LOCATION
WP1	40Amp TP 5-pins, one for each phase, neutral and earth, equal and similar to Waco aluminium die-cast type complete with Socket top.	1.35m above final floor level

PS ESPL-G.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L1-L6	Luminaires fitted against concrete	C
L7-L14	Luminaires fitted against concrete	D

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

NUMBER	LOCATION	TYPE
L15-L19	Luminaries fitted against concrete (not indicated on drawing, this forms part of contract. Engineer will confirm position.	H

PS ESPL-G.5 Wall Mounted Distribution Boards (Surface Mounted Type)

Type: Outdoor wall mounted with front access, shall be as specified under particular specification PEI 4.10 & PEI 4.11 and be built from 3CR12 stainless steel.

The distribution board shall be tested as per the SANS 1973-1, SANS 1973-3, SANS 1973-8, SANS 1473-1, SANS 1765 and SANS 10142-1.

Supply: 16mm² 4core PVC SWA PVC cable plus a 10mm² bare copper earth cable from Ozone Building motor control centre.

Colour: White

Fault level: 10kA

Equipment will be the following;

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following:	Incomer
1	80Amp continuous current rated TP MCCB with electronic trip: Plus	Main
4	100Amp continuous current rated copper bus bars: Plus	3 Phase + N
1	50Amp continuous current rated copper bus bar: Plus	Earth
1	Three Phase Class 2 Surge protection unit connection type 2 as per SANS 10142-1 2009 equal or similar to DEHNguard. DG M TT 275: Plus	Surge arrestor plus signals
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage
3	20Amp continuous current rated SP MCB: Plus	Socket Circuit
1	20Amp continuous current rated TP MCB: Plus	Area Lighting
1	32Amp continuous current rated TP Contactor: Plus	Area lighting contactor
1	5Amp continuous current rated SP MCB: Plus	Area Lighting
1	5Amp continuous current rated SP MCB: Plus	Area lighting Coil Protection

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity.	Area Lighting Digital Timer Switch
1	10Amp continuous current rated TP MCB: Plus	Internal Lighting
1	20Amp continuous current rated TP MCB: Plus	Electrocutor E1-E4
1	25Amp continuous current rated TP contactor: Plus	Electrocutor E1-E4
1	5 Amp continuous current rated SP MCB: Plus	Control Circuit
1	5Amp continuous current rated SP MCB: Plus	Bypass Switch
1	Digital time switch with a 100 hour standby capacity: Plus	Electrocutor E1-E4 Day/Night control
4	20Amp continuous current rated SP MCB: Plus	Feeders: Electrocutors
1	40Amp TP earth leakage with overload protection: Plus	Earth Leakage For Welding Sockets WP1

PSESPL-H BOSPOORT TO VAALKOP / BOSPOORT NORTH HLPL LINK CHAMBER

PSESPL-A.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1	One lever 16Amp surface mounted light. Manufactured from tough impact resistant thermoplastic which provides strength and durability The light switch will be housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.25m above final floor level

PSESPL-G.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P3	20Amp surface mounted Double switch socket outlet. Manufactured from tough impact resistant thermoplastic which provides strength and durability. The switch socket outlet will be housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.35m above final floor level

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESPL-G.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L01	Luminaries fitted against roof	A
L02 – L05	Luminaries fitted against concrete against structure 2300mm AFFL	I

PSESPL-G.6 Bosal Conduit

QTY	DESCRIPTION	MOUNTED
All	25mm Bosal conduit including all accessories: Plus	Surface mounted
All	25mm conduit saddles and all accessories: Plus	Surface mounted
All	Solid Coupling Galvanized & Female Threaded Adaptor Galvanized & Male Threaded Adaptor Galvanized	Surface mounted
All	Round Conduit box plus cover and all accessories	Surface mounted

PSESPL-G.7 Pratley Junction Boxes or GCC Boxes

QTY	DESCRIPTION	MOUNTED
All	Pratley Ex e/n Ezee-Fit Junction Box plus corrosion resistant cover which will suite the application.	Surface Mounted

PSESPL-G.8 Wiring Cable

QTY	DESCRIPTION	MOUNTED
All	The Engineer will not reference all the cables. It is the responsibility of Contractor to allow for all wiring for all the equipment as specified above. Single core and multicore cable shall be 600 / 1000V SANS 1011 complaint. These cables are only a guide and Contractors must make due allowance for all cabling to complete the works in its entirety.	Surface and flush mounted

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESPL-H BOSPOORT RESERVOIRS [MEGALIES WATER]

PSESPL- H.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1	One lever 16Amp surface mounted light. Manufactured from tough impact resistant thermoplastic which provides strength and durability The light switch will housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.25m above final floor level

PSESPL-H.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P3	20Amp surface mounted Double switch socket outlet. Manufactured from tough impact resistant thermoplastic which provides strength and durability. The switch socket outlet will be housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.35m above final floor level

PSESPL-H.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L01	Luminaries fitted against roof	A
L02 – L05	Luminaries fitted against concrete against structure 2300mm AFFL	I

PSESPL-H.6 Bosal Conduit

QTY	DESCRIPTION	MOUNTED
All	25mm Bosal conduit including all accessories: Plus	Surface mounted
All	25mm conduit saddles and all accessories: Plus	Surface mounted
All	Solid Coupling Galvanized & Female Threaded Adaptor Galvanized & Male Threaded Adaptor Galvanized	Surface mounted
All	Round Conduit box plus cover and all accessories	Surface mounted

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESPL-H.7 Pratley Junction Boxes or GCC Boxes

QTY	DESCRIPTION	MOUNTED
All	Pratley Ex e/n Ezee-Fit Junction Box plus corrosion resistant cover which will suite the application.	Surface Mounted

PSESPL-H.8 Wiring Cable

QTY	DESCRIPTION	MOUNTED
All	The Engineer will not reference all the cables. It is the responsibility of Contractor to allow for all wiring for all the equipment as specified. Single core and multicore cable shall be 600 / 1000V SANS 1011 complaint. These cables are only a guide and Contractors must make due allowance for all cabling to complete the works in its entirety.	Surface and flush mounted

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSESPL-I STANDBY GENERATOR AND BULK FUEL

PSESPL-I.1 Light Switches

NUMBER	DESCRIPTION	LOCATION
S1 – S4	One lever 16Amp 2-way surface mounted light. Manufactured from tough impact resistant thermoplastic which provides strength and durability The light switch will be housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.25m above final floor level

PSESPL-I.2 Socket Outlets

NUMBER	DESCRIPTION	LOCATION
P1-P4	20Amp surface mounted Double switch socket outlet. Manufactured from tough impact resistant thermoplastic which provides strength and durability. The switch socket outlet will be housed inside weatherproof protection IP55 rated enclosure. The enclosure shall have protective membrane, which will allow the operator to comfortably operate the switch through the membrane. Equal or similar to Schneider Electric IP55 weatherproof range.	1.35m above final floor level

PSESPL-I.4 Light Fittings

Light fittings shall be equal and similar to the requirements of the general technical specification as specified under.

NUMBER	LOCATION	TYPE
L01 – L10	Luminaries fitted against concrete against structure 2300mm AFFL	C [8 lights in generator and 2 lights for fuel]
L011 – L020	Luminaries fitted against concrete against structure 2300mm AFFL	D [8 lights in generator and 2 lights for fuel]

PSESPL-I.6 Bosal Conduit

QTY	DESCRIPTION	MOUNTED
All	25mm Bosal conduit including all accessories: Plus	Surface mounted
All	25mm conduit saddles and all accessories: Plus	Surface mounted

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

All	Solid Coupling Galvanized & Female Threaded Adaptor Galvanized & Male Threaded Adaptor Galvanized	Surface mounted
All	Round Conduit box plus cover and all accessories	Surface mounted

PSESPL-I.7 Pratley Junction Boxes or GCC Boxes

QTY	DESCRIPTION	MOUNTED
All	Pratley Ex e/n Ezee-Fit Junction Box plus corrosion resistant cover which will suite the application.	Surface Mounted

PS ESPL-I.8Wiring Cable

QTY	DESCRIPTION	MOUNTED
All	The Engineer will not reference all the cables. It is the responsibility of Contractor to allow for all wiring for all the equipment as specified above. Single core and multicore cable shall be 600 / 1000V SANS 1011 complaint. These cables are only a guide and Contractors must make due allowance for all cabling to complete the works in its entirety.	Surface and flush mounted

PSESPL-I. 6.2 Local Wall Mounted Distribution Board (Surface Mounted Type)

Type: Theses specification shall be considered as minimum design requirement in terms of the Contractor's Tender offer. The Electrical and Electronic Contractor(s) shall coordinate with the Civil Contractor to ensure sufficient allowance is made in their tender offer to provide a fit for purpose unit/system.

The distribution board shall be manufactured accordance to Particular Specification. The equipment referenced below does not relieve the contractor of his responsibilities in terms of quality, dimensions and proper functioning of the system.

The motor control centre board or distribution board shall be of the surface mounted type with a minimum IP rating of 42 (insect proofed enclosure). The motor control centre or distribution board shall be constructed with a minimum of 2mm 3CR12 stainless steel and shall be bolted into position by means of M16 high tensile stainless-steel bolts grouted into the wall, the bolts shall be inside the board.

The panel door shall be provided with a locking system suitable for padlocking. The locking system shall consist of a 3CR12 stainless steel 3-way locking mechanism locking the door at the top, middle and bottom. The unit doors shall be capable of being opened at least 110 degrees.

The board shall be provided with readily removable, sectionalized, rigidly supported unpainted 316 cable end support gland plates along the entire length of the board.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Sufficient provision for ventilation and heat dissipation as per the equipment ratings and manufacturers requirements shall be allowed for. Screwed-on engraved labels in English shall be provided below all switchgear and equipment on and in the panels, to facilitate identification. All unpainted parts shall be plated for corrosion resistance.

- Supply Normal:** 35mm² 4C Cu PVC SWA PVC cable plus 25mm² Bear Copper Earth Cable from the Main MCC.
- Colour:** Painted Light Orange – B26 (SANS 1091:2012) external, White arc-free internal (see Painting and Finishing).
- Fault Level:** 6kA [45kA Main MCC] – Cascading Distribution Breakers shall be added in MCC to reduce at DB to 6kA.
- Sectioning:** Multi-section, Form 3b or Form 4 to SANS IEC 60439.
- Future:** 30% for future extensions space.
- Cable Entry:** Incoming and Outgoing – Top and Bottom 3CR12 Unpainted.

QTY	DESCRIPTION	IDENTIFICATION
One	Panels comprising the following [Orange]	Incomer
1	60Amp continuous current rated TP (triple pole) MCCB circuit breaker complete sufficient auxiliary contacts to monitor if open or closed position. Equal or similar to Schneider Electric: Plus	Main Circuit Breaker
Set	80/1 Amp current transformer: Plus	Current inputs
3	2 Amp HRC fuse holders and fused links: Plus	Voltage inputs
1	Front panel mounted LCD digital display supply network analyzer comprising of combined voltage, current, maximum demand power measurement and power factor correction measurement complete with network card: Plus	Network analyser
4	80Amp tint copper bus bars [appearance shall be aluminium], suitable clamps shall be used, and no drilling shall be allowed on the busbars [cubic system shall be used]: Plus	3 Phase + N
1	40Amp tint copper bus bars [appearance shall be aluminium], suitable clamps shall be used, and no drilling shall be allowed on the busbars [cubic system shall be used]: Plus	Earth

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
4	125Amp continuous current rated HRC fuse holders and fused links: Plus	Surge arrestors connection fuses
1	Three Phase Class 2 surge arrestor unit connection type 2 as per SANS 10142-1 equal or similar to DEHNguard DG M TT 275 FM: Plus	Surge arrestor plus signals
3	2Amp continuous current rated HRC fuse holders and fused links: Plus	Indicator Lamp Protection
3	Robust LED indicator lamps connected load side of the circuit breaker.	Indicators for 3 Phase (Red, White and Blue Indications)
1	Relay for under voltages, phase sequence, and phase loss in three phases Plus	Protection relay
One	Panels comprising the following [Orange]	Distribution Section
1	63Amp SP + N earth leakage without overload protection: Plus	Earth Leakage for each phase [one for each phase]
2	20Amp continuous current rated SP MCB: Plus	Socket Circuits
1	63Amp TP + N earth leakage with overload protection: Plus	Earth Leakage for welding socket [one for each phase]
2	10Amp continuous current rated SP MCB: Plus	Lighting Circuit allowances
1	16Amp continuous current rated TP MCB: Plus	Electrocutor Circuit
1	30Amp continuous current rated TP Type2 Coordinated Contactor: Plus	Electrocutor Circuit contactor, type 2 coordination

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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QTY	DESCRIPTION	IDENTIFICATION
1	6Amp continuous current rated SP MCB: Plus	Electrocutor Circuit
1	6Amp continuous current rated SP MCB: Plus	Electrocutor Circuit Coil Protection
1	Time switch equal and similar Schneider electric ITA digital with 100 hour standby capacity: Plus	Electrocutor Circuit Digital Timer Switch
3	10Amp continuous current rated SP MCB: Plus	Electrocutor Circuits
1	20Amp continuous current rated SP + N MCB: Plus	Access Control Feeder
1	20Amp continuous current rated SP + N MCB: Plus	Fire Detection Feeder

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PS EMCA MULTICORE CABLES AND EARTHWIRES

PS EMCA-1 SCOPE

Schedules of cables associated with sections of works are listed below under the relevant sections.

1. All earth wires shall be bare copper conductors, unless otherwise specified and cables shall be of the type as specified.
2. These cables are only a guide and Contractors must make due allowance for all cabling to complete the works in its entirety.
3. Before ordering cables the contractor shall obtain the correct cable lengths by measuring required cable lengths on site.

PS EMCA-8 CABLE TRAYS AND CABLE LADDERS

All cable trays and cable ladders shall be grade Hot Dipped Galvanised type. Cable trays will only be acceptable for cable supports where small cables are involved.

Vertically installed cable ladders shall be used for floor mounted cable support purposes.

PS EMCA-9 INSTALLATION OF CABLES

It is the responsibly of the contractor, as a design and build contract, to ensure the correct supply and signal cabling is specified and utilized for the relevant electrical and electronic equipment.

In order to support the cable sections, the following information and documentation should be supplied before project implementation;

1. Equipment schedules (motor, valves, etc.);
2. Instrumentation list;
3. Motor List
4. Cable Schedules;

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

RUSTENBURG WATER SERVICES TRUST

BID No RLM/RWST/OMM/0103/2024/25

RE-ADVERT: UPGRADE AND EXTENSION OF BOSPOORT WATER TREATMENT WORKS – MECHANICAL AND ELECTRICAL WORKS

C3.4 CONSTRUCTION SPECIFICATIONS

C3.4.4 CONSTRUCTION OF CIVIL WORKS

Contractor

Witness 1

Witness 2

Employer

Witness 1

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C3.4.4.2 VARIATIONS AND ADDITIONS TO THE STANDARD AND PARTICULAR SPECIFICATIONS FOR CIVIL WORKS (PROJECT SPECIFICATIONS)

INDEX

PSA	GENERAL
PSAB	ENGINEER’S OFFICE
PSC	SITE CLEARANCE
PSD	EARTHWORKS
PSDB	EARTHWORKS (PIPE TRENCHES)
PSDK	GABIONS AND PITCHING
PSG	CONCRETE (STRUCTURAL)
PSL	MEDIUM PRESSURE PIPELINES
PSLB	BEDDING
PSPPG	CONTRACTOR’S ESTABLISHMENT ON SITE AND GENERAL CHARGES

C3.4.4 CONSTRUCTION OF CIVIL WORKS

C3.4.4.2. VARIATIONS AND ADDITIONS TO THE STANDARD AND PARTICULAR SPECIFICATIONS FOR CIVIL WORKS (PROJECT SPECIFICATIONS)

The Clauses under section C3.4.4.1 (referred to as Project Specifications) are numbered “PS” and refers to the clauses in the Standard or Particular Specifications for civil works. New clauses not covered by clauses in the Standard or Particular Specifications, if included here, are also designated “PS” followed by a number.

The full extent of the civil works is shown on the Drawings included in Volume 3, the General Clauses provided under Section C3.4.1 and the Specifications included under C3.4.4.1 (project specifications for civil works) and C3.4.4.2 (Particular specifications for civil works).

In addition, the project specifications for the mechanical works have been included under C3.4.2.1 with the mechanical particular specifications included under C3.4.2.2. Also the project specifications for the electrical and electronic works have been included under C3.4.3.1 with the electrical particular specifications included under C3.4.3.2

The various documents listed under section C3.4.4 shall be treated as mutually explanatory. However, should any requirement of section C3.4.4.2 conflict with any requirement of the Standard Specification or with any requirement of the Particular Specifications, then the requirement of section C3.4.4.1 shall prevail.

<div></div> <div>Contractor</div>	<div></div> <div>Witness 1</div>	<div></div> <div>Witness 2</div>	<div></div> <div>Employer</div>	<div></div> <div>Witness 1</div>	<div></div> <div>Witness 2</div>
<div>04_Vol2_ME_June25_Part C3.4.4.2</div> <div>June 2025</div>					

PSA GENERAL

PSA1 QUALITY (Clause 3.1)

All material used in the Works shall, where such mark has been awarded for a specific type of material, bear the SABS mark. Alternatively, the Contractor shall furnish the Engineer with certificates of compliance of materials, which bear the official mark of the appropriate standard.

Also refer to Section C3.5 for additional requirements regarding quality assurance and control.

PSA2 SETTING OUT OF THE WORKS (Clause 5.1.1)

Add the following:

Benchmarks are available on Site and shall be used for construction purposes. The positions of the permanent survey beacons are shown on the Drawings with the relevant position (X/Y coordinates) as well as the elevation (Z coordinate).

The Contractor shall be responsible for the setting out of the works.

If at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall at this own expense rectify such error to the satisfaction of the Engineer.

The Contractor shall take special precautions to protect all survey beacons or pegs such as benchmarks, stand boundary pegs and trigonometrical beacons, regardless whether such beacons or pegs were placed before or during the execution of the Contract. If any such beacons or pegs have been disturbed by the Contractor or his employees, the Contractor shall have them replaced by a registered land surveyor at his own cost.

PSA3 CONSTRUCTION (Clause 5)

Add the following sub-clauses:

PSA3.1 Care of the Site

At all times during construction of the Works and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store all materials and equipment for which he is responsible in an orderly manner and shall keep the Site free from debris and obstructions.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSA3.2 Contractor’s Representative and Superintendence

The Contractor shall submit to the Employer and Engineer within 14 days of the Commencement Date a list of addresses and telephone numbers of its Representative and key personnel who may be contacted both during and outside normal working hours in connection with the Works.

PSA3.3 Safety and security

The Contractor shall operate a security system at all the areas of the Site on a 24 hour per day basis to the satisfaction of the Engineer. He shall co-operate with the local Police and comply with the Engineer’s requirements on all matters relating to security of the Works and persons entering the site. Such a system shall include full and effective security control of all accesses to each area including appropriate identification procedures for all persons and vehicles entering and leaving.

Refer to C3.4.1.33 and PSPPG 8.4.14 regarding the provision of specialised security.

The Contractor shall also provide Personnel Protective Equipment (PPE) for the staff of the Engineer.

Security of the site shall include all construction camps and depots and the offices of the Engineer. The Contractor shall allow at all times for the necessary security and watching to prevent theft or damage to materials, plant and contractor’s equipment, and to ensure the safety of both the Contractor’s personnel, Employer’s personnel and the Engineer’s personnel.

It is in the interest of the Contractor to establish and maintain healthy community liaison and employment structures throughout the duration of the Contract as healthy structures will serve to elicit the support of affected communities in detecting and prosecuting criminal activity.

The Contractor shall take adequate preventative measures to mitigate the effect of the influx of construction personnel into the local community.

Such measurements shall include the implementation of a code of conduct, disciplinary procedure, access control, Contractor identification measures and safety and security forums.

The Contractor shall include within the safety and security forum community leaders, the South African Police Services (SAPS), local emergency services, Councillors and interested and affected parties. The forum shall set about guidelines and mechanisms to deal with and communicate project related issues between the local community and the Contractor.

In addition, the Contractor shall take adequate measures to restrict personnel movement outside the boundaries and shall provide safe transport to and from the workplace.

The Contractor shall strictly adhere to the following requirements in the Employer’s security areas:

<div></div> <p>Contractor</p>	<div></div> <p>Witness 1</p>	<div></div> <p>Witness 2</p>	<div></div> <p>Employer</p>	<div></div> <p>Witness 1</p>	<div></div> <p>Witness 2</p>
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- Only persons with valid entry-permits will be allowed in the security area.
- Movement of employees will be restricted to particular areas. Trespassers will forthwith be suspended from the premises.
- Employees shall not be allowed on the premises between the hours of 17h00 – 07h00 without previously obtaining permission.
- When the Contractor finds it necessary to exceed this restriction, arrangements must be made at least 12 hours in advance, with the Chief Security Services or his duly authorised representative.
- Should the Contractor wish to leave a night-watchman on the work premises, he must submit a written application to the Chief Security Officer.

PSA3.4 General environmental requirements

All chemicals, lubricants and fuels shall be stored in secondary containment units that are capable of storing 110% of the contents stored. These secondary containment units must be impermeable, fireproof and constructed to the approval of the Engineer.

Washing of tools and/or equipment shall take place at dedicated washing facilities within the construction camps. Suitable wash facilities must be provided at all construction camps and all wastewater must be treated before discharge into any natural watercourse.

The Contractor shall prevent discharge of any pollutants, such as cement, concrete, lime, chemicals and fuels into any water sources. Runoff from fuel storage areas/ workshops/vehicle washing areas and concrete swills shall be directed via an oil separator into a settlement pond and this will be disposed of at a site approved by the Engineer. Appropriate measures to prevent water pollution at/from batching plants must be implemented.

The Contractor shall be responsible to safeguard the plant and areas adjacent to the Contractor's camp against fire caused in any way by the construction activities on Site. The Contractor shall be responsible for any damage or loss suffered in this regard.

PSA4 SITE FACILITIES

PSA4.1 SITE FACILITIES AVAILABLE

PSA4.1.1 Housing

The Contractor shall not be permitted to house Personnel within his camp site(s) or on Site for this contract.

The Contractor shall at all times conform to all requirements contained in law or bylaws, as well any other requirements set by the controlling local authority.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSA5 TESTING (Clause 7)

- PSA5.1 All test results obtained by the Contractor in the course of his process control of the Works shall be submitted to the Engineer or his Representative prior to requesting inspection of the relevant portions of the Works. Any request for inspection shall be submitted on the prescribed forms that will be issued once the Contract has been awarded.
- PSA5.2 The Contractor shall make suitable arrangements for process control prior to commencement with the Works. Should he intend using site personnel for this purpose he shall ensure that suitably trained and competent personnel take charge of the necessary test work, and that the necessary equipment is at their disposal prior to commencement of the Works. Failure to comply with these requirements shall be just cause for the Engineer to order suspension of the Works without additional remuneration, or for him to recommend termination to the Employer in terms of the Conditions of Contract.
- PSA5.3 The Contractor shall deliver to the Engineer, for his consideration, quality assurance programmes (as obtained from all the Contractor's proposed suppliers of pipes, valves and specials) prior to the Contractor's appointment of any suppliers.

PSA6 ADJUSTMENT OF PRELIMINARY AND GENERAL TIME-RELATED ITEMS (Clause 8.2.2)

- PSA6.1 Replace the note on the end of the clause with the following:

Note: An approved extension of time will qualify the Contractor to receive additional payment for each relevant time related item at the original tendered unit rate for such item. The additional payment will be calculated pro rata to the extension of time in relation to the time for achieving Practical Completion for the Works at the date when the agreement came into effect.

- PSA6.2 Should the Time for Completion be automatically extended due to abnormal weather conditions occurring during execution of the Contract as provided for in the Conditions of Contract, adjustment to the total for time-related preliminary and general items will be applicable as specified in Clause PSA7.1.

PSA7 HEALTH AND SAFETY

The Works to comply with the Occupational Health and Safety Act (Act 85 of 1993), the Construction Regulations GNR.84 of 7 February 2014 and the Employer's Safety Specifications.

The maintenance of safe work practice at all times and in all sections of the execution of the works shall form part in the day-to-day site activities of all the Contractor's management, staff and workforce on the contract.

The Construction Regulations requires from the Employer to ensure that the Contractor has made adequate provision for the execution of the works within the Act, Regulations and Specifications. The

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

items listed below have been identified as critical towards ensuring the minimum standards of safe work practice. It must however be noted that the list below is not exhaustive and that it is the Contractor's responsibility to allow for all costs involved to comply with the requirements in terms of the Contract.

Also refer to health and safety requirements in Section 3.5.B (Management).

PSA8 SUMS STATED PROVISIONALLY (Clause 8.5)

PSA8.1 Contingencies

If applicable, a Provisional Sum has been included in the Summary of Schedules for contingencies. No percentage mark-up will be applicable to any payments made using contingency money other than the mark-up included in prices for variations determined in terms of the Conditions of Contract.

PSA8.2 Contract Price Adjustment

If applicable, a Provisional Sum has been included for Contract Price Adjustment in the Summary of Schedules to make provision for contract price adjustment in terms of the Conditions of Contract. The value of the Provisional Sum shall be based on the percentage of the subtotal value as specified in the Summary of Schedules. No percentage mark-up will be applicable to any payments made in this regard.

PSA8.3 Artisans and skills training

If applicable, a Provisional Sum has been included in Schedule 2 for payments to be made to specialists for the training of unskilled or semi-skilled persons in industry accredited management and generic skills.

Payment to the Contractor will be based on invoices certified by the Engineer and issued by training specialists to the Contractor for work undertaken in terms of this item.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA8.4 Locating existing services

A Provisional Sum has been included in Schedule 2 for the location/identification of existing services in terms of the Specifications where required and agreed with the Engineer (e.g., Ground Penetrating Radar (GPR) survey).

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the

Contractor

Witness 1

Witness 2

Employer

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amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for the Conditions of Contract.

PSA8.5 Relocation of existing Services

If applicable, a Provisional Sum has been included in Schedule 2 for the relocation of existing services by specialists where required and agreed with the Engineer.

The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA9 PRIME COST ITEMS (Clause 8.6)

PSA9.1 Materials for Dayworks

A Provisional Sum has been included in Schedule 2 for materials to be used during the execution of dayworks. In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the materials used during the execution of the dayworks by the Contractor. Payment made shall be regarded as full compensation for overheads, charges and profit on the materials that are used when executing dayworks.

PSAB ENGINEER'S OFFICE

PSAB1 TESTING

PSAB1.1 General

A laboratory is not required by the Engineer on Site. At the request of the Engineer, the Contractor shall arrange separately with an independent commercial laboratory and/or designated specialists to carry out additional acceptance control tests, over and above the normal quality control testing required for the construction of the Works. A provisional sum is included in the contract for the additional control tests ordered by the Engineer.

The Contractor shall remain responsible to carry out the process control testing required by the Standardized, Particular and Project Specifications.

PSAB1.2 Laboratory Equipment

The Contractor shall supply, insure and maintain the following equipment for use by the Engineer's Representative's personnel for the duration of the Contract:

- (a) A Troxler nuclear system Model 3440, complete with accessories and stored in a suitable transit case as supplied by the manufacturer. A detailed description of the unit and principals

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of operation should be given in the manual for the nuclear instrument. Calibration test certificates shall be provided for such instrument.

- (b) Six concrete cube moulds, 150mm nominal size, as well as a suitable concrete cube curing basin to keep all concrete cubes submerged in water for at least 28 days.

PSAB2 SURVEY ASSISTANTS (Clause 5.5)

One suitably educated Survey Assistant shall be made available for the sole use of the Engineer's Representative personnel for the duration of the Contract. Transport shall be supplied for the Survey Assistant by the Contractor for the duration of the Contract should he be requested to do so. In such event payment will be made at scheduled daywork rates.

PSAB3 SURVEY EQUIPMENT

The survey equipment listed below shall be made available and be maintained in good condition for the exclusive use of the Engineer or his Representative for the duration of the Contract.

- | | |
|---|---------|
| (a) Automatic surveyor's level complete with tripod and leather carry case such as Zeiss N1-2 or equivalent | 1 No |
| (b) Nylon-coated steel surveyor's tape 100 m long and 10 mm wide | 1 No. |
| (c) 5 m long steel tape | 1 No. |
| (d) 5 m long three-piece telescopic survey staves (metric double-face) complete with angle bracket level | 2 No |
| (e) Survey books: Level | 3 No. |
| (f) 2 kg hammer with rubber handle | 1 No. |
| (g) Steel pegs, 300 mm long and 12 mm dia | 120 No. |
| (h) Aluminium tags, 100 mm long, 15 mm wide and 2 mm thick | 120 No. |
| (i) Reverse polar notation pocket calculator (Hp32SII or similar) | 1 No |
| (j) Change point | 2 No |
| (k) Measuring wheel | 1 No |
| (l) Tripod holders for ranging rods (heavy duty) | 2 No. |
| (m) Optical square (Sokkisha or Wild), complete with telescopic aluminium rod and bubble | 1 No. |
| (n) "Rabone" steel tape 10 m long and 13 mm wide | 1 No. |
| (o) Triangular change plate with chain | 2 No. |
| (p) 100 m long, 50 kg strength fish line | 1 No. |
| (q) One-metre-long spirit level | 1 No. |
| (r) Three metre aluminium straight edge | 1 No. |

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PSAB4 INSURANCE, MAINTENANCE ETC.

The Contractor shall be responsible for the insurance of all facilities and equipment, running costs and costs for other services, including telecommunication, electricity, water, sanitation, etc. to operate and maintain the office efficiently.

PSC SITE CLEARANCE

PSC1 DISPOSAL OF MATERIAL (Sub-clauses 3.1 and 8.2.1)

Materials arising from clearing and grubbing shall be disposed of at a suitable spoil site. The Contractor shall be responsible to make his own arrangements for a suitable spoil site. Trees and stumps necessarily removed shall not be burnt unless authorised by the Engineer but shall be cut and stacked at areas designated by the Engineer.

PSC2 AREAS TO BE CLEARED AND GRUBBED (Clause 5.1)

The areas to be cleared and grubbed will be indicated by the Engineer. Should a portion or the whole of the site have been cleared and grubbed by others prior to the start of construction then no clearing and grubbing will be ordered or payment made with respect to the applicable portion of the site.

PSC3 PRESERVATION OF TREES (Sub-clause 5.2.3)

The penalty in respect of every individual tree, designated as a tree to be preserved, that is damaged or removed unnecessarily by the Contractor, shall be up to R 15 000.00 (amount to be determined by the Engineer). Trees that fall within areas upon which the Works are to be constructed or within areas that the Contractor must occupy for the proper construction of the Works will not be designated for preservation. The identification of trees to be designated for preservation will be subject to the discretion of the Engineer.

PSC4 FREEHAUL AND OVERHAUL

Refer to clause PSD7 in this regard.

PSD EARTHWORKS

PSD1 CLASSIFICATION FOR EXCAVATION PURPOSES (Clause 3.1.2)

Delete clause 3.1.2 (a) and clause 3.1.2 (b) and replace with the following:

3.1.2 (a) Soft excavation:

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“All material that is not classified as hard rock excavation in terms of clause 3.1.2 (c), boulder excavation class A in terms of clause 3.1.2 (d) or boulder excavation class B in terms of clause 3.1.2 (e) shall be classified as soft excavation”

In clause 3.1.2 (c) (1), replace the words “equivalent to that specified in (b) (1) above” with the words “of mass approximately 35 t, fitted with a single-tine ripper suitable for heavy ripping and of fly wheel power approximately 220 kW.”

In the last sentence of clause 3.1.2 (d), replace the words “intermediate excavation” with the words “soft excavation.”

In the last sentence of clause 3.1.2 (e), replace the words “or intermediate excavation, according to the nature of the material” with the word “excavation.”

PSD2 SAFEGUARDING OF EXCAVATIONS (Sub-Clause 5.1.1.2)

Any cost the Contractor may undergo in ensuring the safety of excavations or any additional excavation and backfilling he may have to undertake due to the unstable sides of excavations and trenches shall be held to his account and the various rates for excavation and trenching included in the Schedule of Quantities shall include full compensation therefore.

PSD3 EXPLOSIVES (Sub-Clause 5.1.1.3)

Add the following to the sub-clauses:

Blasting must adhere to the relevant statutes and regulations that control the use of explosives.

Prior to blasting, the Contractor shall submit a method statement to the Engineer including:

- The date, time, location, type of blast, zone of influence of ground and air shockwaves, procedures to limit fly rock and noise and any other information deemed necessary for the safe execution of the activity.
- Details of the dwellings / structures / services within the zones of influence including existing positions, lengths and widths of cracks, as well as the condition of doors, windows, roofing, wells, boreholes etc.
- Procedures for informing affected owners, communities, authorities, road users, sensitive receptors etc.
- Measures to mitigate the effects of blasting. The Contractor shall take special measures to protect existing services and structures during blasting operations which will include controlled blasting. The Contractor shall be responsible to repair damages to existing services and structures immediately, to the approval of the Engineer.

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- Proposed blasting procedures, including the spacing and loading of each blast. The blasting procedures shall be prepared in writing by an explosive expert retained by the Contractor. The expert shall ensure that the approved procedures are met and that vibration readings are taken during blasting. The Contractor is responsible for the appointment and remuneration of its explosives expert and the name of the explosive expert shall be submitted to the Engineer for his prior approval. The Engineer reserves the right to independently review and monitor all blasting plans and procedures.
- The Contractor shall give all residents, authorities or other parties owning buildings, structures and services within an appropriate radius (not less than 500 m) from any point of blasting, a minimum of 48 hours written notice of its intent to execute any blasting work and shall erect sign boards with the time and date of the next blast.
- The Contractor shall record all aspects relevant to the conditions of the affected buildings, structures and services prior to blasting, and shall acquire the signature of the owners, occupants and authorities agreeing with the recorded conditions.
- Within 48 hours after blasting, the Contractor, owners, occupants and authorities shall sign approved forms confirming the condition of the buildings, structures and services. In the event of damage to existing buildings, structures and services as a result of blasting, remedial work shall be done to the satisfaction of the owners, occupants and authorities at the Contractor's expense. Remedial work must be undertaken within 7 days of blasting.
- The Contractor alone shall be responsible for all cost resulting from his activities, including the collection of fly-rock from adjacent lands and fields.
- The Contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures, and for other purposes where explosives are normally required, subject to the following conditions:
 - (a) The Engineer may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Engineer does not entitle the Contractor to additional payment for having to resort to less economical methods of construction.
 - (b) The Engineer's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.
 - (c) The Contractor shall comply fully with the applicable legislation and regulations.
 - (d) Before blasting is undertaken, the Contractor shall satisfy the Engineer that he has established

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whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting.

Should such inspections be required, the Contractor shall, together with the Engineer's representative and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before blasting operations commence.

- (e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (e.g. cover-blasting) to reduce the risk of damage.
- (f) All accidents, injury to persons and animals and damage to property shall be reported to the Engineer in detail and in writing as soon as is practicable.
- (g) The Engineer shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.
- (h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at his own expense, any additional excavation necessitated by the shattering of rock in excess of any over break allowances specified in the Project Specifications or on the Drawings.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations.

PSD4 EXISTING SERVICES (Sub-Clause 5.1.2)

PSD4.1 Add the following under sub-clause 5.1.2.1:
The Contractor shall make himself acquainted with the position of all existing services before any excavation or other work likely to affect the existing services is commenced.

The Contractor will be held responsible for any damage to known existing services caused by or arising out of his operations and any damage shall immediately be repaired at his own expense. Damage to unknown services shall be repaired as soon as possible and liability shall be determined on site when such damage should occur.

The position and details of existing services and structures known to the Engineer are shown on the drawings as site data. The Employer and Engineer take no responsibility as to the accuracy or

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completeness of this information and have provided this information merely as an aid to the tenderers in preparing their bids for construction of the Works.

The Contractor shall protect all known existing services as well as all work being carried out and structures being erected on the Site by other contractors or public authorities. The Contractor must familiarize himself with the various standard regulations of the relevant public authorities and act accordingly. Any damage caused to these services or structures, or any obstructions or hindrance caused to other contractors or public authorities by the Contractor and all claims arising from such damage, obstruction or hindrance shall be the sole responsibility of the Contractor.

All repair work shall be carried out at the Contractor's expense to the entire satisfaction of the Engineer or the owner of the service.

The Contractor shall conduct the necessary search for unknown services as specified in clause PSD4.2. After searching, all services shall be deemed as known. The Contractors' cost of searching for existing services and accommodating all existing services and relocating all services shown on the tender drawings shall be priced into the appropriate work forming part of the Contract.

The Contractor shall record the details of existing services on the as-built drawings.

The Contractor shall maintain and rehabilitate local public roads and private access roads that it uses for construction purposes. Dust suppression, grading, traffic and safety management will be required.

Existing services need to be exposed by the Contractor early during the Contract. The x, y, z coordinates of the exposed services and PI's need to be determined by the Contractor and provided to the Engineer. This information is required to assess the position and longitudinal sections and to make adjustments where necessary. The coordinates need to be provided to the Engineer at least four weeks before excavation along a specific section of pipeline takes place to allow adequate time for potential adjustments to the drawings.

PSD5 STORM WATER AND GROUND WATER (Sub-Clause 5.1.3)

Add the following clauses:

Adequate drainage lines must be put in place to prevent flooding and potential contamination of storm water through the Contractors activities. Storm water outside the site must be channelled away from the site and not allowed to flow through the camp or construction areas. Storm water originating on the site must be channelled off site without damaging other properties. Storm water berms must be put in place to divert water away from the works where channels are not appropriate.

All storm water must be channelled via storm water channels fitted with storm water arrestors to areas where the erosive forces of the water can be contained. In order to prevent storm water

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contamination, fuel, hazardous substances and hazardous wastes must be stored in a bunded, covered area and fitted with a sump. Water collected in the sump will need to be treated before re-use or release.

The Contractor shall not alter or damage existing drainage lines, levees or dams or modify the course or channel of water courses without the prior approval of the Engineer. The Contractor must ensure that all storm water lines are reinstalled or rehabilitated on completion of construction activities.

The Contractor shall be responsible for the prevention of erosion in areas impacted upon by the Contractor's activities. All erosion rehabilitation must be implemented at the first signs thereof and no erosion shall be allowed to develop in a large scale. The Contractor must present the site in an erosion free state before the issuing of the Completion and the Performance Certificates.

Steep slopes and other sections subject to severe erosion/ground slippages, shall be made geotechnical stable. Additional measures may involve:

- Geotechnical works such as gabions, Rheno mattresses, drainage lines and diversion berms;
- Installation of trench breakers prior to backfilling;
- Stone pitching, logging, extra-seeding, etc.

PSD6 DISPOSAL OF SURPLUS MATERIAL (Sub-Clause 5.1.4.3 and 5.2.2.3)

All surplus or unsuitable materials arising from the works shall be spoiled at sites approved by the landowner and relevant authorities or at registered landfill sites. Spoiling shall be in accordance with the specifications, environmental management plan, requirements of the owner of the spoil site and applicable acts, legislations and regulations. Spoiling shall not interfere with future works or disrupt natural flow of storm water run- off.

At spoil areas, rock and soil/clay must temporarily be stockpiled separately. Rock must be placed in the final spoiling position first, followed by soil/clay.

At completion, spoil areas shall be levelled and shaped to gradients not exceeding 1:5 and the areas shall be covered with top soil that were removed prior to commencing with activities.

The Contractor shall be responsible for the rehabilitation of access roads to spoil sites. Spoiling shall comply with the applicable statutory and municipal regulations and requirements of the local or rural authorities and land owners.

The Contractor will be responsible for all costs associated with the opening and development of spoil sites.

For the purpose of tendering it can be assumed that a spoil area will be available within a 15km radius from the middle of the pipeline route.

Where the pipeline is laid within a road reserve the route of the pipeline shall be finished neatly to be

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flush with the natural ground level or finished sidewalk level as may be applicable. Clause 5.6.7 of SANS 1200 DB shall apply to the cleaning of roadways.

PSD7 CONSERVATION OF TOPSOIL (Sub-Clause 5.2.1.2)

Remove the last sentence of this sub-clause.

PSD8 BORROW PITS, SPOIL SITES AND HAUL ROADS (Sub-Clauses 5.2.2.2 and 5.2.2.3)

The Contractor shall be responsible for making his own arrangement regarding the provision of imported material, if required, from commercial borrow pits. The Contractor shall provide in his tender prices for all royalties payable and for the transport of the material to site.

Where applicable, the Contractor shall be responsible for the opening and closing of designated borrow pits and spoil sites and for the associated haul roads. The Employer or the Engineer will obtain the necessary permissions and authority to utilise such borrow pits, where applicable. The Contractor in turn shall in all respect comply with the various requirements of SABS 1200D, the Minerals Act (No 50 of 1991) and the environmental requirements in relation to the opening, closing and utilisation of borrow pits and spoil sites. Except for the crushing or screening of materials in accordance with the written instructions of the Engineer, and for royalties should such become payable, no additional payment will be made for excavating or processing material from designated borrow pits, regardless of the hardness or other properties of the material.

PSD9 TOPSOIL (Sub-Clause 5.2.1.2)

Topsoil shall be removed from all areas where pipelines and structures are to be constructed and shall be stockpiled on the construction servitude and in accordance with the environmental requirements for re-use in rehabilitation.

PSD10 SOILCRETE

Soilcrete backfilling shall be a G5 material (maximum size of 10 mm) as specified in SANS 1200M, stabilised with 5% cement and compacted to 93% modified AASHTO maximum dry density.

PSD 11 FILL MATERIAL FOR PLATFORM (Sub-Clause 8.3.4)

Add the following to the sub-clause:

Fill material for the platform shall be placed and compacted in 150 mm thick layers to 97% MOD AASHTO density.

The G5 material supplied from commercial sources shall be stabilised with Portland cement to form an equivalent C3 layer with UCS of 1 MPa minimum and 2 MPa maximum.

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PSD12 SPOILING HARD ROCK BOULDERS

Add the following to the sub-clause:

During past granite mining activity conducted on site, the un-used granite boulders were spoiled on site, within or in close proximity to the proposed work area. Where these granite boulders create a safety risk during construction, the Contractor may, upon written instruction from the Engineer, spoil these boulders at a spoil site designated by the Engineer.

The quantity of hard rock boulders spoiled will be measured per truck load with a haul distance not exceeding one kilometre.

The rate shall include for loading of hard rock boulders (all sizes) onto trucks, transporting to spoil site, off-loading hard rock boulders and spreading. The rate shall also include full compensation for overheads, charges and profits.

PSDB EARTHWORKS (PIPE TRENCHES)

PSDB1 SPECIAL WATER HAZARDS (Sub-Clause 5.1.2.2)

Where ground water is present during construction to such an extent that, in the opinion of the Engineer, it would hamper the placing and consolidation of granular or concrete bedding, or would cause buoyancy of the pipes, the Engineer may order the provision of a drain in the bottom of the trench to assist with dewatering during the construction and until the trench has been backfilled to such an extent that buoyancy of the pipeline will be prevented.

The drain shall be constructed over the full width of the trench as follows:

Method 1:

300mm thick 19mm stone enclosed in non-woven, needle punched, continuous filament, polyester geotextile (Bidim A5 or similar product approved by Engineer)

or

Method 2:

500mm thick well graded dump rock enclosed within high strength composite (woven and non-woven) geotextile with high modulus characteristics for reinforcement and drainage applications (Rockgrip PC 100/100 or similar product approved by the Engineer)

or

a combination of Method 1 and 2 above with method 1 on top of method 2.

The method of stabilization will be based on the geotechnical conditions and will be subject to the approval of the Engineer.

Sumps shall be formed from which ground water can be pumped to maintain the water table below

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the pipe bedding level. The Contractor shall establish on site, operate and remove on completion dewatering pumps of 10l/s minimum capacity as per the requirements of Item 8.3.4(b) of 1200 DB. Lengths of trench opened at any one stage shall be limited by the dewatering capacity of the pump.

PSDB2 EXISTING SERVICES (Sub-Clauses 5.1.4)

Where any existing service occurs within the specified trench excavation, and the presence of such service is known before being exposed, the protection of the service will be scheduled and measured as provided for in Clause 8.3.5 of 1200DB. Only known services (as defined in Clause 5.4 of 1200A) shall be measured for payment.

Where an unknown existing service is damaged during construction, and the Engineer orders that the Contractor should undertake the repair of such service, then such repair will either be measured and paid as dayworks or alternatively as a contractual variation in terms of the General Conditions of Contract.

No construction activity which may affect the integrity of telephone or electrical poles or stays may be carried out without the prior written approval of the Engineer, which approval shall only be given subject to the acceptance of a method statement that will ensure the integrity of such services during construction.

PSDB3 TRENCH WIDTHS (Sub-Clauses 4.1 and 5.2)

Trenches in general shall not exceed the widths laid down in Sub-Clause 8.2.3. If trenches exceed the specified width the Contractor shall be liable for the associated additional cost (e.g. stronger pipes, higher quality bedding) which may be required as a result of the additional trench width.

PSDB4 EXCAVATION (Sub-Clause 5.4)

The Contractor will be required to follow a procedure, whereby laying, jointing, testing and backfilling for each section of the pipeline will follow soon after trenching, and he will not be permitted to open up lengths of trench far in advance of pipe laying and backfilling operations. If in the opinion of the Engineer, trenching has proceeded too far ahead of pipe laying and backfilling, the Engineer shall have the right to stop trenching until the pipe laying and backfilling has caught up and the Contractor shall not be entitled to any extra payment due to this instruction.

Refer to the limitation in pipeline construction activities specified in section C3.5.

PSDB5 TRENCH BOTTOMS (Sub-Clause 5.5)

Replace the first paragraph of this sub-clause "Material that compacted as directed" with the following:

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“Where a firm foundation cannot be obtained at the grade indicated due to soft or unsuitable material, the Contractor shall remove such unsuitable material and backfill the excess depth with approved selected material or concrete, as directed by the Engineer in each particular case. Backfill other than concrete, shall be placed in layers of 150mm uncompacted thickness, each layer thoroughly compacted to 90% of modified AASHTO maximum density, to provide adequate support for the pipe bedding to be placed on top of it.

Should the Contractor remove more soil than is required to secure the proper grade of the pipeline, the Contractor shall, at his own cost, backfill the excess excavation with approved selected material or concrete, as directed by the Engineer in each particular case.”

PSDB6 FREEHAUL AND OVERHAUL (Sub-Clause 5.6.8)

All haul shall be considered as freehaul and no payment will be made for haul.

PSDB7 AREAS SUBJECTED TO TRAFFIC LOADS (Clause 5.7.2)

The requirements of Clause 5.7.2 shall apply only to pipes and sleeves crossing streets or paved areas and pipes running parallel to the road as described below.

All service trenches running parallel to the road of which the roadside edge of the trench is located less than 1,4 m away from the edge of the road, will be subject to the requirements for the above-mentioned clause.

The measurement and payment will apply to the full trench width. Pipes and sleeves crossing streets or paved areas will be measured and paid for to a length equal to the width of road or length of pavement crossed plus 1,4 m either side of the road edges.

Compaction of other pipe trenches running parallel to the roads shall be considered areas subject to traffic loads only where instructed by the Engineer in writing. The volume will be computed from the minimum base width determined in accordance with Sub-Clause 5.2 and the depth from the top of the back fill to the top of the bedding as specified in Sub-Clause 8.3.3.1.

PSDB8 REINSTATEMENT ROADS AND PAVED AREAS (Clause 3.6 and 5.9.4)

Apart from the re-instating of tarred road surfaces, the Contractor shall also be responsible for the re-instatement of any kerbing, channelling, paving and side drains damaged by the Contractor and any subsidence and re-surfacing and re-instatement work required or deemed necessary by the Engineer.

The Contractor shall remove all paving blocks from driveways before excavating across the driveway and store and protect these blocks. After backfilling has been completed the paving shall be reinstated to match the existing paving. The Contractor shall obtain written confirmation from the relevant owner that the driveway has been re-instated satisfactorily.

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The Contractor shall remove grassing in sods before excavation takes place, stack, water and protect the sods. After backfilling has been completed the grassed areas shall be reinstated, using the sods, to the satisfaction of the Engineer. These re-instated areas must be watered for a period of 14 days after re-instatement.

Crushed stone sidewalks shall be reinstated to match the surrounding crushed stone areas, all to the satisfaction of the Engineer.

Unless otherwise specified on the drawings, trenches through roads and paved areas shall be reinstated with a 150 mm upper selected subgrade layer compacted to 93 % mod AASHTO density, followed by a 150 mm subbase layer compacted to 95 % mod AASHTO density and a 150 mm graded crushed stone base compacted to 98 % mod AASHTO density. Bitumen surfaced roads shall be provided with a 25mm thick asphalt seal.

The upper selected subgrade layer shall have a CBR of at least 15, a grading modulus of at least 0,75 and a maximum PI of 12. The subbase shall conform to SABS 1200 ME and the base to SABS 1200 MF.

PSDB9 MEASUREMENT AND PAYMENT (Clause 8.3.2)

PSDB9.1 Basic Principles (Clause 8.1)

Add the following to the sub-clause 8.1.2(a):

Payment for the excavation and backfilling of trenches shall be made at the tendered rates and at the following stages of the construction:

- i. upon completion and approval of the trench bottom, prior to bedding: 40 %
- ii. upon completion and approval of top of selected backfill: 70% (cumulative)
- iii. upon completion and approval of the main fill: remaining 30 %.

PSDK GABIONS AND PITCHING

PSDK1 MATERIALS

PSDK 1.1 Stone (Sub-Clause 3.2.1)

Replace the contents of table 2 with the following:

"TABLE 2 SIZE AND MASS OF INDIVIDUAL STONES FOR PITCHING

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

1	2	3	4
Size/mass of pitching	Thickness of pitching mm, min	Least dimension mm, min	Mass kg, min
Extra heavy	600	300	180
Heavy	400	190	50
Medium	300	150	27
Light	200	110	11

PSDK2 CONSTRUCTION

PSDK2.1 Grouted pitching

Replace the words "(table 4)" in the second line of the first paragraph with "(table 2)".

PSDK3 PITCHING (Sub-Clause 3.2.1.2)

Type of pitching shall be Grouted Ordinary Stone Pitching, unless otherwise instructed by the Engineer.

PSDK4 GEOTEXTILE (Sub-Clause 3.1.4)

Shall be Bidim U24, or similar approved unless shown otherwise on Drawings.

PSDM1 TREATMENT OF ROADBED (Clause 5.2.3.3)

Replace item b)1)ii) of this sub-clause "the depth below formation level of drilling and blasting..... and 850mm in the case of blasting" with the following :-

The maximum allowable depth below formation level of drilling and blasting in both camber and crossfall road super elevations shall be 300mm. The Contractor shall be liable for the cost of drilling and blasting beyond this maximum allowable depth of 300mm below formation level.

PSDM1 OVERHAUL

Refer to clause PSDB6 in this regard.

PSDM2 DISPOSAL OF SURPLUS MATERIAL

Refer to clause PSD6 in this regard.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSDM3 BORROW PITS

Refer to clause PSD8 in this regard.

PSDM5 ROLLING BY SPECIFIED NUMBER OF PASSES (Subclause 5.2.3.3)

PSDM5.1 General

Where shown on the drawings or ordered by the Engineer, the road-bed shall be subjected to a specified number of passes using a designated type of roller.

PSDM5.1.1 Pneumatic-tyre roller

A pneumatic-tyre roller shall consist of pneumatic-tyre wheels mounted on a rigid frame with a loading platform or body suitable for ballast loading to produce a load of at least 70kN on each wheel and arranged in a manner that allows all wheels to bear equally while operating on uneven surfaces.

The total load on any axle line shall not exceed 300kN. Tyres shall be uniformly inflated under operating conditions to a pressure within the range 500-800 kPa.

PSDM5.1.2 Vibratory roller

The vibratory roller shall be capable of exerting a combined static and dynamic force of not less than 120 kN/m width for every metre of loose-layer thickness at an operating frequency not exceeding 25 Hz and shall move at a speed not exceeding 4 km/h.

PSDM5.1.3 Grid roller

A grid roller shall have a mass of at least 13 t when ballasted, and shall be operated at this mass.

PSDM5.1.4 Impact roller

Type 1

Impact roller type 1 shall be a single multifaced roller having a maximum of five flat or nearly flat faces and a mass of over 8 t. The roller shall be of the free fall type, and the roller and towing mechanism shall be so designed that all the energy applied in lifting the roller to the position in which it is supported on an edge between consecutive faces, is dissipated on impact when the roller drops again. The roller shall be towed by a tractor of engine power not less than 160kW and towed within 20 % of its optimum towing speed.

Type 2

Impact roller type 2 shall be an impact compactor or roller delivering impact energy per blow of not less than 25 kilojoules, of the HEIC Series 600 type supplied by Compaction Technology (Pty)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Limited or equal approved. The roller shall be towed by a tractor of engine power not less than 160kW and towed within 20 % of its optimum towing speed.

PSDM5.2 Roller Compaction

Any layer which is shown on the drawings or is specified or is prescribed by the Engineer to be rolled by a specified number of passes shall be prepared by shaping if necessary and then be compacted with a specified roller which complies with the requirements specified in sub-clause PSDM5.1.

A pass for a double drum roller is hereby defined as two passes of the roller over a suitable lane width such that one drum of the roller during its second passage travels in the interdrum space created by the first passage of the roller. Adjacent lanes shall not overlap or have a gap exceeding 250mm.

Except where otherwise authorised by the Engineer, compaction shall comprise not less than the required number of complete coverages by the wheels of the roller, specified or ordered, over every portion of the area being compacted. Although it is not the intention that water be applied to the roadbed by the Contractor under this class of compaction and no rigid control of the moisture content will be exercised during compaction, the Contractor shall nevertheless satisfy the Engineer that every possible endeavour is being made to take advantage of favourable soil- moisture conditions and to carry out such compaction in so far as is possible during periods when the roadbed is neither excessively dry not excessively wet. The Engineer shall instruct the Contractor to water the roadbed at the Contractor's expense where, in the opinion of the Engineer, the Contractor has failed to comply with these requirements.

PSDM5.3 Payment

Payments for roller compaction shall be measured as follows:

- (a) Heavy pneumatic-tyred rollerm².pass
- (b) Vibratory rollerm².pass
- (c) Grid rollerm².pass
- (d) Tamping rollerm².pass
- (e) Impact roller.....m².pass

PSDM7 TEMPORARY STOCKPILING OF MATERIALS (sub-clause 5.2.2.4 and 8.3.11)

Add the following to the Sub-Clauses:

<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Contractor</div>	<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Witness 1</div>	<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Witness 2</div>	<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Employer</div>	<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Witness 1</div>	<div style="border: 1px solid black; height: 25px; width: 100%;"></div> <div style="text-align: center; font-size: small;">Witness 2</div>
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“All relevant rates shall include for temporary stockpiling where this operation is utilised by the Contractor to ease his own construction operations. It will be accepted that the Contractor has provided for the maintenance of all such temporary stockpiles in his tendered rates.

However, when measured in the Bill of Quantities, such temporary stockpiling will only be executed and paid for upon written instruction from the Engineer”.

PSDM6 GRADED ROADS

Add the following new payment clause:

“Graded roads Unit: m²

Where ordered by the Engineer, roads which are not provided with bituminous or gravel surfacing shall be graded. The roads shall be graded to follow the slope of the natural ground so that stormwater is not concentrated.

The grading of roads will be measured per square meter.

If required, additional compaction in terms of clause PSDM 5 may be specified. The compaction will be measured separately”.

PSG CONCRETE (STRUCTURAL)

PSG1 SCOPE (Sub-Clause 1)

This specification covers the requirements for water retaining structural concrete for civil engineering work.

PSG2 INTERPRETATIONS

PSG2.1 Definition (Sub-Clause 2.3)

For purpose of this Clause the following structures will be regarded as water retaining structures:

- All structures within the Bospoort WTW.
- All valve chambers associated with the project.

The Standard Specification shall be applicable to all other concrete structures not mentioned above.

PSG2.2 Explanation of Terms

PSG2.2.1 Exposure Conditions

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

For the purpose of this Specification, Water retaining structures shall be deemed to be classified under clause 2.4.1.3 (severe conditions) as specified in SABS 1200G unless specified otherwise in the project specification.

PSG3 CEMENT

PSG3.1 Applicable standards (Sub-Clause 3.2.1)

All cementitious material used in concrete shall comply with the following standards, as relevant:

Common cements

SABS ENV 197-1:1992 Cement B composition, specifications and conformity criteria B Part 1: Common cements

Cement extenders

SABS 1491: Part I-1989 Ground granulated blast furnace slag

SABS 1491: Part II-1989 Fly ash

SABS 1491: Part III-1989 Condensed silica fume

PSG3.2 Alternative types of Cement (Sub-Clause 3.2.2)

Only CEM II B-V shall be used in water retaining structures. The target Fly Ash content shall be 25-30%.

Other types of cementitious material may be used only if specifically approved by the Engineer.

PSG4 AGGREGATES (Sub-Clause 3.4)

The following additional requirements shall be applicable to water retaining structures:

PSG4.1 Fine Aggregate

Samples of the proposed fine aggregate shall be submitted to the Engineer for his approval before use.

The Contractor shall submit a sieve grading analysis to the Engineer for approval and if unacceptable, the Contractor shall offer another sample and grading for approval, or may blend aggregate from different sources and submit the blend for approval.

The water demand of the fine aggregate shall not exceed 195 ℓ/m^3 .

Fine aggregate shall be stored on a concrete surface and washed sand shall be allowed to drain for at least 24 (twenty-four) hours before use. The Engineer may require the Contractor to test the sand daily (or more frequently if necessary) for moisture content, impurities and grading before use.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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PSG4.2 Coarse Aggregate

The voids ratio of the coarse aggregate shall not exceed 47% (forty-seven per cent). Single sized aggregates shall be stored on a concrete surface in separate stock piles, according to size. The proportions of the various single sized aggregates required for the various portions of the work shall be submitted by the Contractor for the Engineer's approval.

PSG5 CONSTRUCTION

PSG5.1 Reinforcement

The following additional requirements shall be applicable to water retaining structures:

PSG5.1.1 Fixing (Sub-clause 5.1.2)

The use of plastic spacer blocks will not be allowed. Concrete spacer blocks, of same mix design as the strength concrete, shall be used.

"The Engineer will inspect the reinforcing after it has been fixed in place, the formwork has been cleaned, cover blocks have been positioned, and before concreting commences.

Welding of reinforcing steel will not be permitted."

PSG5.1.2 Cover (Sub-clause 5.1.3)

In water retaining structures the exposure condition of a reinforcing bar closest to the face in direct contact with water or soil backfilling, shall be classified as severe.

It should be noted that in some water retaining structures only one face of the structural elements will be in contact with water.

The nominal concrete cover is generally 50 mm, unless otherwise specified on the Drawings.

The soffit of a slab suspended above the water (e.g. a reservoir roof) will be treated as being in contact with the water for the purpose of determining the cover.

PSG5.2 Concrete

PSG5.2.1 Strength concrete (Sub-Clause 5.5.1.7)

It is a requirement that the Contractor employ the services of an approved specialist to recommend design mixes compatible with the Specification. The preferred specialist shall confirm in writing:

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

- (a) The proposed concrete mix is suitable for water retaining structures with aggressive (waste) water being retained.
- (b) The proposed concrete mix is of grade 35/19 (minimum).

No concrete shall be placed until the Contractor's concrete mix design has been approved by the Engineer. The Contractor shall submit to the Engineer a statement of the mix proportion proposed, together with a report from an approved testing laboratory, showing the 28-day concrete strength obtained when using the materials proposed for the work.

The strength determinations shall be based on not less than three concrete test specimens.

When the Contractor can furnish reliable test records of concrete of a quality at least equal to that specified, having been made with materials from the same sources and of the same qualities as he proposes to use, the Engineer may waive all or part of the strength tests required in the above paragraph.

The preparation of the 150 mm test cube specimens and the sampling techniques shall be in accordance with the relevant SABS specification.

Concrete for water retaining structures shall be class (min) 35 MPa/19 mm concrete and shall have a cement/water ratio not less than 2.2 and a cement content of 420 kg/m³.

Admixtures may be used to increase the workability of the concrete but only with the express approval of the Engineer and when the details of the active ingredients of the admixture and their effects are supplied to the Engineer for approval before use. No additives likely to impair low permeability of the concrete will be approved. Calcium chloride or admixtures containing chlorides may not be used in concrete for water retaining structures. Other admixtures and constituents may only be used with the approval of, or as specified by the Engineer.

PSG5.2.2 Placing (Sub-Clause 5.5.5)

Panels between construction joints shall be cast alternatively.

PSG5.2.3 Construction Joints (Sub-Clause 5.5.7)

The following additional requirements shall be applicable to water retaining structures:

The Engineer may allow the Contractor to cut an additional straight construction joint if it is possible without prejudicing the water tightness of the structure. The additional construction joint shall be sealed with the same seal that is specified for planned construction joints at the expense of the Contractor.

Construction joints in reinforced concrete walls, embankments, etc. shall consist only of horizontal joints. If under abnormal conditions a vertical construction joint is unavoidable it may only be constructed with the approval of the Engineer.

Construction joints shall only be placed at intervals shown on the drawings or as directed by the Engineer. The exact position of construction joints shall be marked on the formwork in order to obtain truly horizontal joints.

Preparation of Surface

Prior to placing any further concrete the joint must be clean, damp and free of laitance. During the period when the concrete is still green, all loose material shall be removed, without disturbing the aggregates, by light brushing. Where this is not possible, or if the concrete has already set, the surface film shall be removed by mechanical means appropriate to the degree of hardness of concrete so as to expose the aggregate over the entire surface and leave a sound, irregular surface.

Before Placing Concrete

Where the concrete of the previous lift is more than 3 days old, it shall be kept continuously wet before the mortar and fresh concrete is placed.

On all construction joints the following steps shall be taken after the surface has been prepared and at the most, 30 minutes before placing the concrete:

- (i) Remove all surface water with an air hose and dry sprinkle waterproofing additive (Vandex Premix or similar approved) at 9,8 kg per m².
- (ii) Place a layer of approximately 10 mm thickness consisting of cement, sand and water mixed in the same proportions as used in the concrete.
- (iii) Place concrete within 30 minutes.

PSG5.2.4 Curing and Protection (Sub-Clause 5.5.8)

SABS 1200G Clause 5.5.8 will be deleted for the purpose of this Specification and replaced with the following:

“All concrete other than blinding concrete shall be maintained continuously saturated for at least ten days or as directed on the drawings immediately after placement or after stripping formwork in the case of walls, by methods which shall receive the prior written approval of the Engineer if different from the following:

- a) For floors
Ponded water with a minimum depth of 30 mm.
- b) For Columns and Walls
Continuously saturated heavy jute sacking or other approved absorbent material maintained in contact with the concrete surface by fastenings spaced at not more than 2 m centres.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

c) For Floors and Columns

Covering the previously saturated surfaces with approved plastic sheets maintained in contact with the concrete surface and with all edges and joints sealed by methods approved by the Engineer.

Where the ambient temperature is below 4°C the curing period of 10 days or as directed on the drawings, will be extended by 72 hours.

Newly cast concrete sections shall not be used for supporting loaded wheel-barrows, monorails, material or scaffolding, etc., until permission is obtained from the Engineer."

PSG5.2.5 Adverse Weather Conditions (Sub-Clause 5.5.9)

(a) *Concreting in cold weather*

During cold weather no material having a temperature below 5°C shall be used for making concrete.

No concrete shall be placed when the ground or air temperature is below 2°C or if the ground or air temperature is likely to fall below 2°C within 6 (six) hours of placing the concrete.

The temperature of placed concrete shall not be allowed to fall below 5°C until the concrete has attained a strength of at least 5 MPa, and the Contractor shall be responsible for all the necessary protective measures to ensure this. All concrete that has been damaged by frost or by the formation of ice in the concrete shall be removed and replaced by the Contractor at his own expense.

(b) *Concreting in hot weather*

During hot weather, the temperature of the concrete, as placed, shall not exceed 30°C. The Contractor shall ensure that the placing of the fresh concrete does not exceed the ambient temperature by more than 5°C. Where necessary this shall be accomplished by shading aggregate stockpiles, shading or insulating water pipes and water storage tanks.

PSG5.2.6 Concrete Surfaces (Subclause 5.5.10)

(a) *Wood-Floated Finish*

Where wood floating is specified or scheduled, the surface shall first be given a finish as specified in Sub-Clause 5.5.10.1 of SABS 1200 G after the concrete has hardened sufficiently, it shall be floated to a uniform surface free of trowel marks. The screeded surface shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screed marks.

(b) *Steel-Floated Finish*

Where steel is specified or scheduled, the surface shall be treated as specified in PSG6.1 except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be steel trowelled under firm pressure to produce a dense, smooth uniform surface free from trowel marks.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

(c) *Power-Floated Finish*

Where power floating is specified or scheduled, the surface shall be treated as specified in PSG6.1 except that the screeded surface shall be power-floated to produce a high quality dense, smooth, uniform surface free from trowel marks.

PSG5.2.7 Watertight Concrete (Sub-Clause 5.5.11)

(a) *Construction Joints (Sub-Clause 5.5.7)*

Joints are the concrete at which special measures are taken to achieve subsequent continuity are termed construction joints. Construction joints will be permitted only where shown on the drawings or approved by the Engineer and shall be formed true to line on all formed or exposed surfaces. Horizontal joints shall be formed by casting against a timber or metal former. Recesses shall be formed as detailed on the drawings. Where detailed on the drawings, galvanized metal strips or waterbars shall be cast into the joints. No unplanned construction joints will be allowed. If a breakdown occurs, the contractor shall strip the shuttering as soon as possible and break out all concrete up to the previous planned construction joint.

Except in the case where movement joints are required, the entire joint contact area of the concrete already placed shall be thoroughly roughened by chipping with sharp chipping picks before placing concrete against the surface. This surface will not be accepted unless the coarse aggregate projects 5 mm beyond the surrounding matrix. In this connection approved light pneumatic or electric tools are preferred provided that no structural damage is done to the concrete being chipped: otherwise hand tools are to be used. Chipping shall not be commenced until at least 48 (forty-eight) hours after the concrete was placed.

Alternative methods of preparing the surfaces of construction joints to those given above will be considered. The Contractor shall submit proposed alternative methods of achieving the roughened surface required to the Engineer for approval.

Should the Engineer at any time withhold or withdraw permission for alternative methods to be used then the Contractor shall prepare the surfaces of construction joints in accordance with the above specification.

Immediately before the adjoining concrete is placed, the chipped surface shall be thoroughly cleaned by brushing and washing and then thoroughly wetted.

At the discretion of the Engineer the percentage of coarse aggregate of the mix may be slightly reduced in a layer not exceeding 200 mm in depth immediately above the chipped surface of a horizontal construction joint. Suitable temporary openings shall be left in the shuttering to allow for the removal of sawdust, shavings, nails, debris, etc.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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The application of compounds to the surfaces of stop ends at vertical joints to retard the setting of a film of concrete in contact with the stop end will be permitted subject to the Engineer's approval of the compound to be utilized and the Contractor's methods for the application of the same.

(b) *Movement Joints*

Movement joints shall be formed where shown on the Drawings.

Movement joints shall be formed true to line and shall be thoroughly cleaned of all accretions of concrete or other foreign matter by scraping or other approved means. The surfaces in contact with joint sealing material shall be prepared strictly in accordance with the manufacturer's Specification.

Care shall be taken to ensure that the waterbars are in perfect contact with well compacted void-free concrete throughout, particularly on horizontal joints where special procedures shall be adopted for placing and compacting concrete under the waterbars, to the approval of the Engineer.

WATERPROOFING OF CONCRETE JOINTS

Three different systems of waterproofing (or construction of systems) exist, and the appropriate system (or combination) will be applied as specified on the drawings: The three systems are:

- a) Waterproofing with hypalon bandage system
- b) Waterproofing with waterbars
- c) Waterproofing with surface sealants
- (i) Hypalon system

Hypalon bandage joint sealing system shall be the Sikadur-Combiflex Hypalon bandage system as supplied by Sika (Pty) Ltd.

The joint shall consist of 2 mm thick Combiflex Hypalon sheeting, 200 mm and 250 mm wide, as shown on the drawings. The Hypalon sheeting shall have a tensile strength of 6 N/mm² and an elongation at failure of not less than 400%.

The Hypalon sheeting shall be bonded to the concrete with Sikadur 31 two component, solvent free, moisture intensive, high viscosity, epoxy paste adhesive.

(ii) *Waterbars*

Except where otherwise specified waterbars shall be manufactured from virgin polyvinyl chloride complying with BS 2571: latest amendment (Class 3 compounds) and the Tenderer shall provide full details of the composition and properties of the material in the relevant annexure where applicable.

Samples of waterbars shall be submitted for approval and all material subsequently supplied shall be identical in size, shape, colour and quality to the approved sample. The waterbar shall be of uniform cross-section and size and shall have lugs welded at 1m centres on both edges of the waterbar to hold it securely in position during concreting operations.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

It shall be possible for all sizes of waterbar to be turned through a 75mm radius without damage or permanent set to the waterbar.

Joints in waterbars shall be kept to a minimum by the use of the longest possible lengths.
Waterbars shall be held to the required shape, lines, etc, in suitable formwork: site joints shall be bonded as directed by the manufacturer in such a way as to form a continuous watertight seal free from pin holes at any point of the length or width of the strip.

Formwork shall be designed to accommodate the waterbars without subsequent bending and the waterbars shall be adequately supported and protected from damage and sunlight until finally encased in concrete.

Waterbars shall be tested in accordance with BS 2782 and ISO R527.

(iii) Waterproofing with surface sealants

a) General

A groove of dimensions specified shall be formed, where indicated, and sealed by an approved sealant. The sealant shall be non-toxic and shall be either a hand applied bitumen putty sealant or a polysulphide sealant. The type of sealant to be specified on the drawings and the product to be used shall be approved by the Engineer.

b) Bitumen Putty Sealant

All joints shall be clean, dry and free of laitance. The concrete shall be at least four weeks old. The joint surfaces shall then be primed by an ancillary product and the sealant applied as per the supplier's specification. Special precautionary measures shall be taken to acquire a neat finish by covering the face edges of the joint with masking tape before priming. Any excess material will be cut away and finished flush.

c) Polysulphide Sealant

All joints shall be clean, dry and free of laitance. Prime joint face if required – following the suppliers specification. Apply the sealant and finish off flush with the concrete surface.

PSG6 MISCELLANEOUS

PSG6.1 Porous concrete/No-fines concrete

Porous or no-fines concrete shall be laid under foundations and floor slabs and behind walls, etc, where shown on the drawings and where directed by the Engineer. Porous concrete shall be placed behind shuttering to form a vertical layer against the external face of foundations etc where shown on drawings and where directed by the Engineer. The thickness of the horizontal, sloping and vertical layers shall not be less than that shown on the drawings.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

The exposed faces, both horizontal and vertical, of the porous concrete shall be finished with a cement mortar seal where reinforced concrete is to be cast against it. The porous concrete shall be sealed with a 10mm thick layer of mortar composed of one part normal Portland cement to two parts of fine aggregate by mass, trowelled on before the porous concrete has hardened, and finished with a screed to provide a smooth, uniform plane surface without filling any of the internal voids of the porous concrete. The surface of the seal shall have a steel or power float surface.

The schedule rates for porous concrete shall include the cost of mortar seal and steel float finish.

Porous concrete shall comprise water, cement, coarse aggregate and not more than 5% (five percent) by mass of fine sand. The voids ratio of porous concrete shall not be less than 27.5% (twenty-seven and one half) percent. Testing of porous concrete shall be carried out in accordance with test method 3 of BS 1881 Part 3 – 1970.

(a) *Classes of no-fines concrete*

No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used. Class NF 19 means a no-fines concrete with a 19 mm nominal size aggregate.

The volume of aggregate per 50 kg of cement for each class of concrete shall be as follows:

<u>Class</u>	<u>Aggregate per 50 kg cement</u>
NF 38	0,33 m ²
NF 19	0,30 m ²
NF 13	0,27 m ²

(b) *Batching and Mixing*

Cement shall be measured by mass or in full pockets of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The aggregate shall be moist or wetted before the cement is added. Where drum mixers are used, about 20% of the water shall be poured into the drum before the aggregate and cement are loaded. The mixing time in the drum shall be about 45 to 50 seconds.

The quantity of water added shall be just sufficient to form a smooth grout which will adhere to and completely coat each and every particle of aggregate, and which is just wet enough to ensure that, at points of contact of aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 liters of water for every 50 kg of cement.

Mixing shall be done in an approved batch-type mechanical mixer, but small quantities may be hand-mixed.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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(c) *Placing*

No-fines concrete shall be placed in accordance with the procedure approved by the Engineer. It shall be placed in its final position within 15 minutes of having been mixed.

The concrete shall be worked sufficiently to ensure that it will completely fill the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming shall be avoided and under no circumstances shall the concrete be vibrated.

(d) *Protection*

All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods:

- Retaining formwork in place
- Covering exposed surfaces with sacking or other approved material kept continuously wet
- Covering exposed surfaces with plastic sheeting

No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days.

(e) *Measurement and Payment*

Cast-in-situ no-fines concrete (state class) Unit: m³

The provisions of sub-clause 8.1.3 of SABS 1200 G shall apply *mutatis mutandis*.

PSG6.2 Bond breaker

Where indicated on the drawings, site or porous concrete under floor slabs and wall footings etc. shall be covered with a bond breaker consisting of 250 µm tear resistant damp proof membrane to SABS 952 (1969) C having 150mm laps and pierced at 1m intervals to allow the passage of water.

PSG6.3 Pipe work

All pipe specials shall be cast in by the Contractor. Special care shall be taken to maintain them in the exact position shown on the drawings and also to render the joints watertight.

PSG6.4 Holding Down Bolts

All holding down bolts and nuts, other than those used in structures retaining liquid shall be galvanised in accordance with SABS 763.

All holding down bolts and nuts in structures retaining liquid shall be stainless steel, Grade 316.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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All holding down bolts and anchorages, shall be set in accordance with the drawings by means of accurate constructed steel templates and securely fixed in position to prevent displacement during the concreting.

Exposed threads of holdings down bolts shall be adequately protected with grease and sacking and this protection shall be maintained in all portions of the works until they are taken over.

PSG6.5 Ferrule Cap Holes

Holes formed in reinforced concrete walls during the fixing of formwork shall be repaired on the waterside face with an approved epoxy or non-shrink grout. On the dry face the holes left in the concrete shall be repaired with a 1:3 cement-sand mortar. All grouting material shall be thoroughly panned in.

No system leaving holes passing through the walls will be permitted. Ferrules shall be of the permanent sacrificial type.

PSG6.6 Sterilization of Reservoirs

Before a reservoir is sterilised, the roof shall have been tested for water tightness as set out in Clause 9.7 below, and the pipelines serving the reservoir shall have been sterilised. The reservoir shall then be thoroughly cleaned out and washed down with clean water.

The roof, beams, columns and walls shall thereafter be thoroughly sprayed down, using pressurised equipment, and the floors shall be scrubbed with water containing 0,015 g per litre of chloride of lime.

On completion of the sterilisation, the sterilising solution shall be run to waste before the reservoir is filled for testing its water tightness.

Should additional work be required to be done inside the reservoir after the water tightness test has been completed, the reservoir shall be re-sterilised at the Contractor's expense.

PSG6.7 Testing for Water tightness

Each water-retaining structure shall be filled with water at a uniform rate not exceeding 2.0m in 24 hours until the top water level has been reached. The water level will then be carefully noted and recorded by the Engineer in relation to a fixed benchmark, and the structure shall be allowed to remain filled for a period of two weeks to permit complete absorption of water by the concrete.

Any loss of water which may have occurred shall then be made up by again filling the structure to the top water level and by allowing the water to remain undisturbed for a period of not less than four days. The structure shall be considered to be watertight if the drop in level in 96 hours (less the drop caused by evaporation) does not represent more than 0,06% of the volume of the reservoir.

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The evaporation shall be measured by the mean drop in level caused by the evaporation of the water in three flat containers floating in the water, being recorded.

The Contractor is free to attend the taking of all measurements by the Engineer.

In the event of an appreciable leakage being evident or visible at any stage of the filling or testing, or in the event of the final degree of water tightness being unsatisfactory, the Contractor shall, when so ordered by the Engineer, discontinue such filling or testing and shall, at his own expense, take approved steps to rectify the leakage, until a test proves that a sufficient degree of water tightness has been obtained.

The water tightness of the reservoir roof shall be tested before that of the reservoir itself by water being continuously sprinkled over the roof in an approved manner so that a film of water is maintained on the surface of the slab. The roof shall be considered watertight if no damp patches are visible on the underside after 48 hours of sprinkling.

Before the expiry of the defects notification period, the Engineer shall have the right to retest the structure for water tightness. Results of such further tests will be made available for the information of the Contractor. In the event of these tests indicating an unsatisfactory degree of water-tightness, the Engineer will, before issuing the final certificate, again require the Contractor to rectify the leakage, at his own expense, in such a manner as will cause the least interruption of the water supply to consumers and as will ensure the soundness of the work, to the satisfaction of the Engineer.

The costs of re-testing a water-retaining structure for water tightness shall be borne by the Contractor.

PSG7 TESTS

PSG7.1 Facilities (Sub-Clause 7.1.1)

Add the following:

"The Contractor shall provide sufficient storage capacity for the concrete cubes and shall arrange to have them tested by an approved laboratory.

The cost of all testing, including the cost of sampling, storage and transport of samples shall be included in the rates tendered for concrete work."

PSG8 ACCEPTANCE CRITERIA FOR STRENGTH CONCRETE (Sub-Clause 7.3)

Add the following:

Contractor

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Witness 2

Employer

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"Test results obtained from the supplier of ready-mixed concrete will not be accepted for evaluation in terms of sub-clause 7.3, but samples for testing shall be taken of such concrete at the point of placing."

PSG9 MEASUREMENT AND PAYMENT

PSG9.1 Measurement and Rates

PSG9.1.1 Formwork (Sub-Clause 8.1.1)

Delete "or splays over 20 mm x 20 mm" from the first line of paragraph 8.1.1.2.

Add the following to paragraph 8.1.1.2:

"Splays up to and including 25 mm x 25 mm will not be measured separately and will be deemed to be included in the formwork costs."

Add the following paragraphs:

"8.1.1.7 For construction joints at kickers, all additional costs for formwork to edges up to 300 mm high will be deemed to be included in the rates tendered for vertical formwork to sides of walls and will not be measured separately in narrow widths.

8.1.1.8 No formwork will be measured to edges of blinding layers under structures, and the cost thereof (if needed) will be deemed to be included in the rates tendered for concrete in blinding layers.

8.1.1.9 Back-shuttering or formwork to top revealed surfaces of sloping or conical formwork will only be measured to surfaces of over 40° and up to 85° to the horizontal.

8.1.1.10 Formwork to horizontal surfaces in pump stations, valve chambers, manholes or sumps can either be removed through the manhole cover opening or the Contractor may use permanent formwork at his own cost as no claims in this regard will be considered."

PSG9.2 Scheduled Concrete Items

PSG9.2.1 Strength concrete (Sub-Clause 8.4.3)

Add the following after the last sentence:

"In the case of structural floor screeds, the unit of measurement shall be the square meter and the average thickness and proportions will be stated."

Replace "Unit: m³" With "Unit: m³, m²"

Contractor

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PSG9.2.2 Unformed surface finishes (Sub-Clause 8.4.4)

(b) Steel-floated finishes

Add the following sub-item:

"(i) Extra over subitem (b) for special finishing tolerances to top of outside
ringwalls as specified..... Unit: m²

The quoted rate shall include full compensation for the additional cost of finishing the
ringwalls to closer tolerances as specified on the Drawings and in Clause PSG 6.2.3 (i)."

PSG9.3 Joints (Sub-Clause 8.5)

Replace "Unit: m" with "Unit: m or m²".

ADD THE FOLLOWING ITEMS:

"PSG9.4 PSG8.9 Miscellaneous work other than metalwork.....Unit: as scheduled

Separate items will be scheduled for each type of miscellaneous work.

The tendered rates shall include full compensation for providing all labour, materials and equipment
required to carry out the work, for all preparatory work, for constructing the work scheduled in a
workmanlike manner and for finishing off and cleaning up when the work has been completed.

PSG9.5 PSG8.10 Testing for watertightness:

- a) (Structure stated)..... Unit: sum
- b) Etc for other structures
- c) The unit of measurement shall be the number of each structure successfully passing the
specified watertightness tests to the satisfaction of the Engineer.

The sums tendered shall include full compensation for the provision of all labour, plant and materials
necessary for carrying out the test for watertightness as specified.

PSG9.6 PSG8.11 Screeds

- a) Floor screeds (1:3) with falls including V-joints to form panels and a smooth steel-trowelled
fish/power float finish to top:
 - i. Description of application and thickness Unit: m²
 - ii. Etc for other applications and thickness

The unit of measurement shall be the square meter of screed constructed.

Contractor

Witness 1

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The tendered rate shall include full compensation for constructing the screeds as specified including supplying of all materials, preparing the concrete surface to receive the screeds and for all else that may be necessary to complete the work.

PSG9.7 PSG8.12 Casting in pipes with or without puddle flanges

- a) Up to 300 mm nominal bore:
 - i. Through (description and thickness of structural elements)..... Unit: number
- b) Over 300 mm up to 600 mm nominal bore:
 - i. Through (description and thickness of structural elements)..... Unit: number
- c) Etc for other nominal bores in increments of 300 mm

The unit of measurement shall be the number of each size of pipe installed.

The tendered rates shall include full compensation for installing the pipe where new pipes are used (with or without a puddle flange) in the exact position as shown on the Drawings, for splitting or cutting the formwork where required, for ensuring watertightness where required and for all additional costs required to install the pipes specified or shown on the Drawings.

New pipes shall be measured under the items of the relevant section of the specifications.

PSG9.8 PSG8.13 Corrosion protection by

- (a) Vinyl anti-fouling paint and undercoats to form an algae- resistant coating on:
 - i. (Description of structural element stated)..... Unit: m²
 - ii. Etc for other structural elements
- (b) Solvent-free abrasion-resistant coating and primer to a minimum thickness of 3 mm on:
 - i. (Description of structural element stated)..... Unit: m²
 - ii. Etc for other structural elements

The unit of measurement shall be the square meter of surface protected against corrosion.

The tendered rates shall include full compensation for surface preparation for supplying and applying the materials as specified, for all labour, equipment and appurtenant materials necessary to carry out the work and for all waste and cleaning up after the work has been completed.”

PSG9.9 PSG 8.13 Emergency site reinforcement and equipmentUnit: ton

The Contractor must bring onto site the following site reinforcement that is to be used for emergency situations at the sole discretion of the Engineer:

10 straight lengths of 10 m of Y10 reinforcement, plus
10 straight lengths of 10 m of Y12 reinforcement, plus
10 straight lengths of 10 m of Y16 reinforcement, plus
10 straight lengths of 10 m of Y20 reinforcement

In addition to the above, the Contractor must keep on site manual tools for cutting and bending the above reinforcement in emergency situations as per Engineers' instructions.

All the above reinforcement and equipment must be kept dry, clean and available for use at very short notice. Any of the above reinforcement that is used, must be replaced as soon as practically possible.

Payment will be as follows:

1. 80% of the tendered amount will be paid when the above material and equipment is brought to site and stored in a manner that is acceptable to the Engineer.
2. Reinforcement used will be paid for under the "normal" reinforcement items.
3. The remaining 20% of the tendered amount will be paid when all material and equipment is removed from site, after being instructed to do so by the Engineer.

PSL MEDIUM-PRESSURE PIPELINES

PSL1 MATERIALS (Clause 3)

PSL 1.1 Steel pipes

Steel pipes shall comply with the following Particular Specifications:

PLN: Manufacture, supply and testing of steel pipes.
PLQ: Corrosion protection of steel pipes and fittings.
PLS: Cement mortar lining of steel pipelines

PSL 1.2 Glass Reinforced Plastic Pipe (GRP)

GRP pipes shall have a stiffness of at least SN 5000.

Manufacturing of the GRP shall be strictly in accordance with SABS 1748-1.

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Quality control by a suitable 3rd party quality inspectorate approved by the Engineer shall be implemented during manufacturing, handling, transport and installation of the GRP pipework and the cost for this external inspectorate shall in be included in the rates tendered.

PSL 1.3 uPVC pipe and HDPE pipes

uPVC and HDPE pipes shall comply with the following Particular Specification:

PLTP: Manufacture, supply and testing of plastic pipes

PSL2 HANDLING AND RIGGING (Clause 4.1)

Pipes, fittings, specials and valves shall be protected during transportation and handling against damage.

Pipes, fittings, specials and valves shall not be laid or stacked directly onto the ground but shall be supported on suitable padded cradles or other approved material near each end of the pipe, fitting, special or valve. Particular care shall be taken with pipes with fitted couplings to prevent pressure on the couplings. Cradles, spiders, jacks etc. shall be used to maintain the shape of pipes during transport, laying, welding and jointing.

The Contractor shall thoroughly inspect all pipes, fittings, specials and valves delivered to site.

All pipes with MDPE, 3LPE or Bituguard coatings shall be painted with a white PVA overcoat (to be approved by the Engineer) for protection against ultraviolet damage. The overcoat to be maintained by applying additional layers until the pipe is backfilled.

All pipes shall be stored (at the factory or on site) on sandbags at third of the pipe length from each pipe end. The width of the sandbags shall be at least 500 mm for pipes with Bituguard coating.

PSL2 WELDING (Clauses 5.2.3 and 7.2)

The welding specifications are applicable to all pipe diameters (not only 600 mm or greater).

100% of all site welds shall be examined radiographically in accordance with API 1104 and the Contractor shall price for it accordingly.

Only under special circumstances where allowed by the Engineer, 100% of the site welds of each welder shall be examined radiographically in accordance with API 1104 initially. When a 100% success rate of at least ten consecutive welds is achieved by a welder, the frequency of testing may be reduced to 50%. When a 100% success rate of at least five consecutive tests is achieved by a welder, the frequency of testing may be reduced to 10%. When a weld defect occurs again, the previous five welds of the relevant welder must also be radiographically examined, and the frequency of further tests shall immediately increase to 100%. Any defect in the previous five welds will activate

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the testing of five further previous welds until a 100% success rate of the five welds is achieved. The testing rate may always be reduced to 50% and 10% as described above.

The following site welds shall in all cases be 100% radiographically examined:

- All welds not subject to hydraulic testing.
- All welds under road and railway lines, under river/stream crossings, under any structures, in sleeve pipes, in culverts and where the pipe will be encased in concrete.
- All mitres.

PSL3 DISINFECTION OF POTABLE WATER PIPELINES (Clause 5.10)

The disinfection shall be done in accordance with SANS 1200L with the exemption that the concentration of calcium hypochlorite can be reduced to 60mg/l.

PSL4 CONSTRUCTION (Clause 5)

Add the following clauses:

PSL4.1 Connection to pipelines in operation

The Contractor shall give the Employer 14 days' notice in writing for connections to pipelines in operation. The Contractor shall ensure that all required material is available, and all preparation work is completed at least 12 hours before the "shutdown" of existing works for the connections. The Contractor shall complete and commission the connections within 12 hours after commencement of the "shutdown".

The Employer will empty the reservoir and existing pipelines as far as possible through existing scour valves. It is the responsibility of the Contractor to control and pump out water which cannot be drained at existing scour valves or water in the pipe as a result of leaking valves. No claims will be considered for standing time due to the scouring of pipes or any other work which is done by the Employer.

PSL4.2 Additional external protection for pipes cast into chamber walls

After the concrete has cured for 7 days, wire brush or scabble the exterior and interior surfaces of the wall to remove laitance. Dry brush to remove all loose powder.

Mix ABE Super Laykold (or similar material approved by the Engineer) and water (1:1 ratio) and apply as a primer to the concrete and the pipe surfaces. After 1 hour apply a thick coat of ABE Super Laykold to the concrete and the pipe and immediately embed 250 mm wide ABE non-woven polyester membrane "SBP" into the Super Laykold. After 3 hours apply another coat of Super Laykold.

This additional protection is required on the inside and outside of chamber walls.

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There must be no contact between the steel pipe and the chamber reinforcement.

PSL4.3 Deflection/ovality of pipes

The Contractor shall ensure that his handling and construction methods do not result in horizontal or vertical pipe deflection more than 2% for steel pipes with cement mortar lining and 3% for steel pipes with epoxy lining and plastic pipes.

The deflection is calculated as follows.

- Measure the actual vertical diameter of the pipe [D_v]
- Calculate the difference [Δd] between D_v and the inside diameter of a perfectly round pipe
- The deflection $\Delta =$

$$\frac{\Delta d}{ND} \times 100\%$$

x 100 %, where ND is the nominal diameter of the pipe

After completion of the main backfilling (including joint / “fox” holes) the Contractor shall determine the internal deflection of the pipe every 20m for pipes with a nominal diameter of 600 mm and larger. Should these 20m measurements indicate a position where the allowable deflection is exceeded, additional measurements shall be taken to determine the extent of the problem.

These measurements shall be done within 2 working days of the completion of the main backfill unless otherwise approved by the Engineer in writing.

The Contractor shall submit a method statement for the review of the Engineer to rectify deflection problems.

PSL4.4 Pipe coating performance requirements and integrity surveys

PSL4.4.1 Introduction

This section of the Specification provides the performance requirements for the external coatings after installation and field joint repairs.

Excessive apparent coating conductance may be caused by defective field joint coatings, mechanical damage, or spurious contacts to foreign objects or valve chamber reinforcement.

Location of such defective areas may be assisted by the DCVG surveys during construction.

The overall performance of the coated pipeline is defined in terms of specific coating conductance, in accordance with NACE TM 0102. Values normalised for soil resistivity are not utilised.

Contractor

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It should be noted that the requirements of both the construction DCVG survey and the coating conductance measurement must be fulfilled.

Also surveys shall be done by specialist Subcontractors to be nominated by the Engineer or proposed by the Contractor for the Engineer's approval, as specified in the Bill of Quantities.

PSL4.4.2 Standards

The following normative standards are referenced in this section:

NACE TM 0102	Measurement of Protective Coating Electrical Conductance on Underground Pipelines
NACE TM 0109	Aboveground Survey Techniques for the Evaluation of Underground Pipeline Coating Condition
NACE SP 0207	Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines
NACE SP 0502 – 2002	Pipeline External Corrosion Direct Assessment Methodology

PSL4.4.3 Construction DCVG Survey

The coating system is required to be free of significant (as defined by %IR below) defects at the time of installation. This will be ensured by the use of over-the-ditch holiday detection and a DCVG survey after backfilling and consolidation.

A minimum of three months shall elapse between backfilling and evaluation, unless the backfill is hydraulically compacted or significant rainfall has occurred which ensures that the pipeline is fully bedded and in intimate contact with the soil. The timing of this inspection will be determined by the Engineer and is dependent on the backfill becoming conductive. This may take considerably longer than three months, at least until the soil becomes conductive (due to infiltration of groundwater or seasonal rains).

The coating integrity survey shall be undertaken by means of DCVG survey technique in accordance with NACE TM 0109 Section 6. All DCVG indications shall be geo-referenced by means of DGPS.

On completion of the survey, sufficient calibration digs shall be conducted to characterise %IR values in the range of 1 – 5% for determination of the repair level required.

Evaluation of the construction DCVG results shall be undertaken in accordance with the following categories for %IR:

<1% IR	No repairs required.
1 – 5% IR	Repairs may be required based on results of calibration digs.
>5% IR	Repairs required.

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The %IR values quoted above are only applicable to new construction. Pipeline coatings which have been buried for longer than 2 years shall be evaluated in terms of NACE SP0502 – 2002 Appendix A6.4

All excavations and repairs shall be undertaken at the cost of the Contractor.

PSL4.4.4 Coating Performance Requirements

The CP design is based on the use of coated pipe. The coating is required to be resistant to the effects of high voltage transients due to the proximity of high voltage overhead power lines and existing and future AC traction systems (e.g. of the railways). The performance of the coating is evaluated by means of a current drainage test (CDT)

The specific coating electrical characteristics form an integral part of the CP and ACM design in determining, inter alia, spacing between anode installations.

After installation and backfilling of the pipeline, the pipeline coating shall be evaluated in sections not exceeding 5 km in terms of NACE TM 0102.

A minimum of three months shall elapse between backfilling and evaluation, unless the backfill is hydraulically compacted or significant rainfall has occurred which ensures that the pipeline is fully bedded and in intimate contact with the soil.

The specific coating conductance of the 5 km construction sections shall be less than 60 $\mu\text{S}/\text{m}^2$. In the event that the pipeline does not meet the coating conductance criterion, alternative survey techniques shall be utilised to determine the cause of the non-compliance. These techniques may include any of the surveys described in NACE TM 0109 or SP 0207 as appropriate and subject to the approval of the Engineer.

All surveys shall be conducted by Contractor.

PSL4.4.5 Tests on Completion and end of Defects Notification Period

On completion of construction and prior to the issue of the Taking Over Certificate (TOC), the pipeline shall be subjected to a CDT and a coating integrity survey.

The coating conductance shall be calculated on the current requirement for the completed pipeline.

The specific coating conductance for the completed pipeline shall be $< 60 \mu\text{S}/\text{m}^2$.

The pipeline coating integrity shall be evaluated over the entire pipeline length by means of a hybrid CIPS/DCVG survey, which shall be completed in accordance with NACE SP 0207 utilising a 10m

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longitudinal DCVG component. The results of the survey shall be correlated with those of the construction DCVG surveys.

The significance of coating defects or other anomalies identified from the DCVG survey results will be evaluated by assessing the relative loss of polarisation at the coating defect utilising CIPS results. Where DCVG defects result in a local loss in polarisation to a level below the relevant cathodic protection criterion, the Contractor will be required to rectify the defect.

The hybrid CIPS/DCVG survey shall be repeated at the end of the Defects Notification Period (DNP) prior to the issue of the Performance Certificate.

The CDT and CIPS/DCVG tests related to TOC and DNP shall be undertaken by a Specialist Service Provider/Sub-Contractor approved by the Engineer.

Any non-compliance with the requirements of the CDT or the hybrid CIPS/DCVG survey shall be investigated and rectified by the Contractor. The Contractor shall prepare method statements for the investigation and rectification and submit it to the Engineer for approval.

PSL4.5 Curing of cement mortar lining of pipes on site

The Contractor responsible for the construction of the pipeline shall be responsible for the following curing process of cement mortar lined pipes for a period of 28 days after it has been off-loaded on site:

- The pipes must be stored horizontally.
- Seal pipe ends with plastic cover.
- Add 5 litre water per day into each pipe and keep pipe ends closed.

PSL4.6 UV protection of joint coating

Joint coatings shall be protected by the Contractor against ultraviolet (UV) damage with filter cloth (Kaymat or similar) if exposed for more than 7 days.

PSL4.7 Pipeline markers

Pipeline markers shall be installed exactly above the pipe centre line at the following positions:

- Horizontal bends.
- Servitude boundaries of provincial roads and railway lines.
- Both ends of concrete encased sections.
- Property boundaries.
- Between horizontal bends and valve chambers where distances in between exceed 300 m.

Contractor

Witness 1

Witness 2

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PSL5 STANDARD HYDRAULIC PIPE TEST (Clause 7.3)

Unless otherwise specified on the Drawings, the test pressure for field testing shall:

- Not be less than 1.25 times the maximum operating pressure at design flow or static flow conditions whichever is the highest (excluding transient/surge pressure).
- Not be less than 1.10 times the design pressure including transient/surge pressure with surge protection measures as designed operating effectively.
- Not exceed 1.5 times the maximum allowable operating pressure of the pipeline.
- Not exceed the allowable test pressure for the specific pipe class.
- Not exceed 1.5 times the allowable working pressure of the specific valve and fitting class.
- Not exceed 800 microstrain (circumferential) for metallic pipes with cement mortar lining.

Immediately after the completion of the hydraulic pipe testing, the valves shall be tested as follows:

- Air valves
Isolate the air valve and remove the drain plug on the air valve to check that the float is dropping. Check that the isolating valve is sealing. Put the drain plug back and open the isolating valve to check that the float is closing and the air valve is sealing.
- Scour valves
Check the opening, closing and sealing of the scour valves and the functioning of the scour outlet structure and erosion protection measures, where applicable.

PSL6.1 Corrosion protection

- Possible damage to the internal lining to be investigated at the significant dent in the pipeline next to the pump station chamber.
- The pipeline to be pressure tested prior to being put into service.
- The installation of a cathodic protection system.
- An Insulating Flange (IF) kit needs to be installed at the pump station to electrically isolate it from the pipeline.
- The electrical continuity of the pipeline over its full length must be ensured.

PSL6.2 Pipework

- a) General
- Replace all corroded bolts, nuts and washers.

PSLB BEDDING (PIPES)

PSLB1 SELECTED GRANULAR MATERIAL (Clause 3.1)

Contractor

Witness 1

Witness 2

Employer

Witness 1

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Replace the clause with the following:

Refer to drawing LB-2. For flexible pipes, the bedding cradle shall be from the trench bottom up to 300 mm above the top of the pipe.

Requirements for the bedding cradle (from trench bottom up to 300 mm above the pipe) for flexible pipes are:

- 100% of material shall pass a 9.5 mm sieve opening except for steel pipes, joints, specials and fittings with Polymer Modified Bitumen (Bituguard) or tape wrapping coating where 100% of material shall pass a 3 mm sieve opening.
- Compatibility factor (as determined in test given in section LB of Part 3 of SABS 0120) shall not exceed 0.4.
- To be free from vegetation and other organic material to a standard acceptable to the Engineer.
- Material types SW, SP, GW and GP under the USC Classification with 12% or less passing the No. 200 sieve (0.075 mm).
- Material types GM, GC, SM and SC under the USC Classification with more than 12% passing the No. 200 sieve (0.075 mm).

The use of A-3 and A-2-4 material (based on AASHTO classification) shall be subject to the Engineer's approval, and it shall be compacted at Optimum Moisture Content (OMC) plus 2% or minus 1%. This material shall not be placed and worked in wet conditions nor be allowed to become saturated before it has been placed in position and compacted. If the material has dried out before it is covered, the top surface will break down during activities on the surface and the material shall then be reworked to achieve the specified density.

PSLB2 SELECTED FILL MATERIAL (Clause 3.2)

Replace the clause with the following:

Requirements for the selected fill blanket for flexible pipes (where applicable) are:

- Plasticity Index (PI) less than 20,
- Material does not contain vegetation or stones exceeding 50mm in diameter.

In accordance with PSLB1 above, the selected fill blanket forms part of the bedding cradle and is not applicable for flexible pipes on this contract.

Contractor

Witness 1

Witness 2

Employer

Witness 1

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PSLB3 MAIN FILL

Main fill shall be well graded material with particles less than 200 mm in diameter with no organic material. All material above the selected fill blanket (drawing SABS LB-2), or bedding cradle where the selected fill blanket is not applicable, will be regarded as main fill and shall be compacted to at least 87% modified AASHTO maximum density.

PSLB4 SELECTION OF SUITABLE MATERIAL

The Contractor shall use the following sources for material for bedding and selected backfilling if it complies with the Specifications:

- a) Separation of excavated material
The Contractor shall separate the suitable material from the unsuitable material during excavation.
- b) Sieving / screening of excavated material.
Where provision is made for this item in the Bill of Quantities, the Contractor shall allow in the rate for sieving/screening of the excavated material for bedding and selected backfilling. The Contractor shall only use source b) if the material from source a) is not sufficient.
- c) Commercial sources
The Contractor shall only use source c) if the material from sources a) and b) is not sufficient.

PSLB5 DETAILS OF BEDDING (Clause 5.1.2)

Rigid Pipes:

All clay and concrete pipes will be regarded as rigid and shall be laid on a class C bedding as shown on Drawing LB-1 of SANS 1200LB.

Flexible Pipes:

Steel, uPVC, mPVC, PVC-O, GRP, Ductile iron and polyethylene pipes (PE) will be regarded as flexible and shall be bedded as per Drawing LB-2 of SANS 1200 LB, as amended in the drawings.

PSLB6 CLASS A BEDDING (Sub-Clause 5.2.1)

Concrete to be used in class A bedding to pipes shall be of class 20/19.

PSLB7 CONCRETE CASING TO PIPES (Sub-Clause 5.4)

Concrete to be used in the casing of pipes shall be of class 20/19.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PSLB8 TOLERANCE ON COMPACTION OF BEDDING MATERIAL (Clause 6.1)

Degree of accuracy II shall prevail.

PSLB9 VOLUME OF BEDDING MATERIAL (Sub-Clause 8.1.3)

The volume computed for bedding material is net, excluding the volume of the pipe and based on trench width specified in SANS 1200 LB.

PSLB10 STONE BEDDING (Sub-Clause 8.2.6)

Add the following new sub-clause:

Stone bedding will be measured per cubic metre under the appropriate item in SABS 1200LB. Type A bedding (crushed stone wrapped in a geotextile blanket) shall be measured per linear metre along the centreline of the trench. The provision, operation and removal of a de-watering pump where authorised by the Engineer will be measured as dayworks under the appropriate item in Schedule 2.

PSPPG CONTRACTOR'S ESTABLISHMENT ON SITE AND GENERAL CHARGES

PSPPG 1 SCOPE

Apart from the normal contractual stages for the execution of the Works and subsequent defects notification period, the Contractor shall observe a 4-week Trial Operation Period after commissioning and successful completion of the Trial Operation Period shall be a pre-requisite for receiving the Taking-Over Certificate.

PSPPG 3 FACILITIES FOR THE ENGINEER

PSPPG 3.1 NAME BOARDS (Clause 3.1)

The Contractor shall supply and erect one (1) name board per section (2off total) in accordance with the details shown on the Drawings and in positions instructed by the Engineer.

PSPPG 3.2 OFFICE BUILDING (Clause 3.2)

PSPPG 3.2.1 Resident Engineer's Offices and Equipment

The Contractor shall provide three (3No) furnished offices for the Resident Engineer and two assistants at the Bospoort WTW site establishment and shall properly maintain these facilities for the duration of the Contract. The facilities shall be provided according to the Standard Specifications and as amended below. It shall be deemed that the Contractor has allowed in his rate tendered under this item for all requirements described below as well as under points (a) to (e).

The offices shall have the floor area of at least 15 m2 and a ceiling height of at least 2,5m. The offices shall be weatherproof with wooden boarded floors that are at least 150mm above the ground, and

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shall be provided with ceilings, a door with a secure lock, and with opening windows of glazed area at least 40% of the floor area. Offices shall be well ventilated and shall be insulated as to provide comfortable working conditions.

The internal finishing of each office shall include the following:

- a desk with a top of size at least 1,5m x 0.9m and at least two lockable drawers;
- a lockable upright steel cabinet with three shelves;
- a steel filing cabinet with four drawers;
- racks for hanging construction drawings;
- a wash hand basin with towel rack and soap dish;
- an acceptable model air conditioner, capable of maintaining the room temperature between 18°C and 22°C,
- suitable electrical lighting (fluorescent type);
- one high stool;
- two 15 amp plug points with earth leakage;
- one drawing table, 3m long x 1m wide x 0.9m wide, with a smooth top and draftsman stool;
- two chairs;
- an acceptable blind on each window

The Contractor shall provide all electrical equipment as required by the office staff as well as all consumables required for facilities and equipment i.e. paper, toner, stationery etc. Provisional sums have been included in schedule 2 for the electrical equipment and consumables.

The Contractor shall also be responsible to provide and maintain an adequate internet connection for the Engineer's offices.

All offices, facilities and equipment shall be new and be furnished, serviced, cleaned and maintained by the Contractor. The Contractor shall provide a full time assistant for cleaning the offices and car wash. The Contractor shall provide a full time guard service and ablution facilities for the office complex.

The Contractor shall be responsible for all running costs and costs for other services, including telecommunication, electricity, water, etc. to operate and maintain the offices efficiently. The Contractor shall be responsible for all cellular cost by the Engineer's staff. A provisional sum is included in the Contract for this item under schedule 2.

The Contractor will be responsible for the maintenance and insurance of the equipment, which shall become the property of the Contractor upon the issue of the Taking-Over Certificate.

Conference Room

The Contractor shall provide a conference room for the joint use of the Contractor's and the Employer's Personnel at the Bospoort WTW site establishment. The conference room shall be

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available to the Engineer for all meetings convened by the Engineer with the Contractor and with the Employer, and on a reasonable basis for the Engineer for meetings with his construction monitoring staff. The Contractor shall properly maintain the conference facility for the duration of the Contract.

The conference room shall be provided in accordance with the Standard Specifications and shall have a floor area of at least 30 m² and a ceiling height of 2,5m or greater. The room shall be weatherproof with wooden boarded floors that are at least 150mm above the ground, and shall be provided with ceilings, a door with a secure lock, and with opening windows of glazed area at least 40% of the floor area. Offices shall be well ventilated and shall be insulated as to provide comfortable working conditions.

The internal finishing of the conference room shall include the following:

- a 12-seat conference table;
- 12 conference table chairs;
- a serving table with top size 1,5m x 0,9m;
- facilities to hang 4 x A1 drawings against the conference room walls;
- (an) acceptable model air conditioner(s), capable of maintaining the room temperature between 18°C and 22°C;
- suitable electrical lighting (fluorescent type);
- three 15 amp plug points with earth leakage;
- suitable blinds on each window.

a) Kitchenette

The Contractor shall provide and properly maintain a kitchenette for the Engineer for the duration of the Contract at the Bospoort WTW site establishment.

The kitchenette shall have a floor area of 5 m² and generally be constructed in accordance with the standards specified for offices.

b) Office equipment

The Contractor shall provide the necessary computing, printing and copying equipment for the exclusive use of the Engineer and his staff and shall provide all maintenance and consumables for this equipment for the duration of the Contract. The cost of the equipment and consumables will be covered under provisional sums included under schedule 2.

c) Carports

The Contractor shall provide and maintain four carports with waterproof roofing for the use of the Engineer and his staff for the duration of the Contract at the Bospoort WTW site establishment. The floor shall consist of crushed aggregate to alleviate dusty and muddy conditions. Carports should be erected adjacent to the office complex of the Engineer.

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d) Ablution units

The Contractor shall provide two separate toilets for ladies and gents for the exclusive use of the Employer, Engineer and his staff. The Contractor shall provide cleaning materials and toilet paper and maintain the ablutions for the duration of the Contract.

PSPPG 6 ADDITIONAL SERVICES

PSPPG 6.1 Site visits and reporting

The Contractor shall visit the Plant at least twice (2 of) per calendar month for the duration of the defects notification period.

PSPPG 6.2 Water quality sampling

Samples shall be taken twice (2 of) per calendar month.

PSPPG 6.3 Maintenance of Mechanical and Electrical Equipment

Although the Contractor will not be expected to perform routine maintenance during the defects notification period, all flow measuring and water quality equipment shall be calibrated every 3 months and at the end of the defects notification period, including the supply of any/all reagents.

All equipment and items supplied under this Contract shall be **serviced** and **tested** at the end of the Defects Notification Period, to prove that it complies with the Specifications prior to the issuance of the Performance Certificate signifying final completion and acceptance of the Works.

PSPPG 6.4 Supply of chemicals

The Contractor shall allow in his Tender for the supply of the following chemicals and consumables for testing, commissioning and observance of the Trial Operation Period:

- Poly-electrolyte for the dewatering plant;
- Ferric-chloride
- Hydrogen Peroxide
- Filling of the diesel standby generators (800 L per generator)

Chlorine shall be supplied by the Operator for testing and commissioning purposes.

The Contractor shall supply sufficient samples of both emulsion poly-electrolyte and powder poly-electrolyte for testing and optimization of the sludge dewatering plant.

The Contractor shall supply the following chemicals at successful completion of the Trial Operation Period:

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- 1 x flow bin (1 x 1000-L) emulsion poly electrolyte (Chemal Chemfloc AOGE or similar);
- 20 000 L ferric-chloride
- Filling of both diesel generators to full capacity (allow for 1 600 L in Tender Sum)
- Hydrogen Peroxide

PSPPG 7 TRIAL OPERATION PERIOD

After successful completion of the wet commissioning phase and submission of the draft Operation & Maintenance manuals in the prescribed format, a 4-week Trial Operation Period shall commence during which the new treatment processes shall be operated under the auspices of the Contractor. The Contractor shall provide full-time attendance for the duration of the Trial Operation Period during normal working hours (07h00 to 18h00) and shall have an individual(s) on standby during non-working hours for any/all emergencies.

The purpose of the Trial Operation Period is to (a) prove the functionality of all mechanical and electrical equipment installed under the Contract, to (b) do final adjustment and optimization of relevant operational settings and to (c) prove the improvement and ultimate compliance of the final effluent.

With regards to point (c) above, the Contractor shall allow in his tender price for the taking of 3(No) daily composite samples and 10 grab samples of the final effluent on dates specified by the Engineer and the analysis for the following parameters by an accredited laboratory:

- Turbidity (NTU);
- pH;
- Residual Chlorine; and
- UV254

The Contractor shall also allow in his tender for the necessary sampling and analysis of thickened and dewatered sludge for solids concentration and 10 grab samples of each shall be included in the Tender Sum. The Contractor shall also allow for 5 samples of the filtrate to confirm solids content thereof in order to determine the overall solids capturing by the dewatering equipment.

The Trial Operation Period shall be declared successful if/when the plant operates as intended without any mechanical and/or electrical failure for a continuous period of 4(No) consecutive weeks, at which time the Taking-Over Certificate shall be issued signifying the start of the defects notification period.

PSPPG 8 MEASUREMENT AND PAYMENT

Add the following clause PSPPG 8.1.7

PSPPG 8.1.7 Provision of LEP Plan

The sum tendered shall include full compensation for the provision of a suitable Local Economic Participation (LEP) plan as required in terms of section T2.2.14 [Local Economic Participation Specification]. The tendered sum shall also include for the auditing by a recognised external

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auditing firm of the expenditure on local goods, services and labour as defined in the mentioned specification. Two audits shall be included – the first interim audit shall be undertaken once 70% of the Contract Sum has been expended while the second and final audit will be done once the Taking-Over Certificate has been issued. The issue and approval of the final audit results will be a pre-requisite for the issue of the Performance Certificate. The tendered sum shall also include for the submission of monthly progress report with respect to Local Economic Participation.

PSPPG 8.2.2 Dealing with water

The Contractor needs to allow for drainage of groundwater from existing structures during construction.

Add the following clauses to PSPPG 8.4

PSPPG 8.4.6 Salary for Labour Desk Officer and Community Liaison Officer

A Provisional Sum has been included in Schedule 2 for a salary to be paid to the Labour Desk Officer and Community Liaison Officer.

PSPPG 8.4.7 Socio Economic Development

A Provisional Sum has been included in Schedule 2 for the identification and implementation of a socio economic development initiative.

PSPPG 8.4.8 Engineers Cellular Phone Costs

A Provisional Sum has been included in Schedule 2 for telephone calls (cellular only) of the Engineer's Representative for the duration of the Contract. The Engineer's Representative will provide his own cellular telephone for the Contract. Payment for cellular calls will be based on call and rental costs.

PSPPG 8.4.9 Engineers Site Office Consumables

A provisional sum has been included in schedule 2 for the provision of all office consumables for the Engineer's office establishment to cover all expenses related to stationary, paper, printer cartridges etc.

PSPPG 8.4.10 Electronic Equipment

A provisional sum has been included in schedule 2 for the provision of all electronic equipment required by the Engineer and his representatives/assistants for the execution of their task during the construction stage, which includes computers, printers, cameras etc.

All equipment procured for the Engineer and his representatives shall be new and remain the property of the Employer i.e. ownership shall revert back to the Employer upon completion of the Works.

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PSPPG 8.4.11 Acceptance and Control Testing

A Provisional Sum has been included in Schedule 2 for acceptance control testing ordered by the Engineer to be undertaken by a commercial laboratory. Payment will be based on the actual invoicing by the laboratory to the Contractor.

PSPPG 8.4.12 Specialist Services

A Provisional Sum has been included in Schedule 2 for the appointment and payment for specialized services if and when required. These may include all work required by the following specialists, which will be appointed as nominated sub-contractors:

- Environmental compliance monitoring by the ECO;
- Acceptance control testing of pipework, coatings and linings.
- Health and Safety compliance monitoring

PSPPG 8.4.13 Social Facilitation

A Provisional Sum has been included in Schedule 2 for the appointment of a social facilitation service provider. Payment will be based on the actual invoicing of the service provider.

PSPPG 8.4.14 Specialised Security Services

A Provisional Sum has been included in Schedule 2 for the appointment of a specialised security service provider (PSiRA accredited). Payment will be based on the actual invoicing of the service provider.

PSPPG 8.4.15 Management of Local Sub-Contractors (SMME's)

A Provisional Sum has been included in Schedule 2 for the management of local sub-contractors (SMME's) including rate variations between Contractor and sub-contractor rates. Payment will be based on the actual costs of the Contractor and also on rate variations between the Contractor and sub-contractors

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