CONTRACT DOCUMENT

FOR THE

CONSTRUCTION OF A 300Mℓ RESERVOIR AND ASSOCIATED INFRASTRUCTURE NEAR MULDERSVLEI

VOLUME 1B: C3.7 SPECIFICATIONS 2

(NON-RETURNABLE DOCUMENT)

ISSUED BY:	COMPILED BY:	For official use.
CITY OF CAPE TOWN **WATER AND SANITATION** **DIRECTOR: BULK SERVICES** Water and Sanitation Head Office 8 Voortrekker Road (corner of Mike Pienaar Boulevard) BELLVILLE 7535	**ZUTARI (PTY) LTD** 1 Century City Drive Waterford Precinct CENTURY CITY 7441	**TENDER SERIAL No.:** **SIGNATURES OF CITY OFFICIALS AT TENDER OPENING** 1. 2. 3.

MAY 2025

NAME OF TENDERING ENTITY	
EMAIL ADDRESS OF TENDERING ENTITY	
FAX NUMBER OF TENDERING ENTITY	
NATURE OF TENDER OFFER (please indicate below)	
Main Offer (see clause C.2.12)	
Alternative Offer (see clause C.2.12)	

[redacted]

CITY OF CAPE TOWN

WATER AND SANITATION: BULK SERVICES

CONTRACT NO. 277Q/2024/25

CONSTRUCTION OF A 300Mℓ RESERVOIR AND ASSOCIATED INFRASTRUCTURE NEAR MULDERSVLEI, CAPE TOWN

C3.7 Specifications

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The C3.7 Specifications are included in this tender as two separate volumes: Volume 1A and Volume 1B, each containing distinct sections of the specifications in accordance with the table above.

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3.7.6 DETAILED CIVIL AND PIPELINE SPECIFICATIONS

The detailed civil and pipelines specifications consist of the following sections:

3.7.6.1 AMENDMENT TO PARTICULAR SPECIFICATIONS
3.7.6.2 BULK PIPELINE DATA SHEETS

3.7.6.1 AMENDMENT TO PARTICULAR SPECIFICATIONS

The following amendments to relevant Civil and Pipeline Particular Specifications shall apply to this contract.

Title	Description	Pages
Amendments to W&S-BW-01	Standard specification for double flanged butterfly valves for inline use on trunk mains	6
Amendments to W&S-BW-10	Standard specification for mechanical type straight couplings, stepped couplings and flange adaptors for use with steel, cast iron, fibre-cement and uPVC pipe	4
Amendments to W&S-BW-15	Standard specification for gate valves	6
Amendments to W&S-BW-16	Flow meters	4
Amendments to SPE-JJ-0003	General Corrosion Protection	6
Amendments to SPE-MP-7001	Design and Manufacture of Medium-Pressure Steel Specials	6
Amendments to SPE-MP-7002	Manufacture of Medium-Pressure Steel Pipelines	5
Amendments to SPE-CC-7003	Laying and jointing of medium-pressure steel pipes specials	7
Amendments to SPE-MM-7022	Air valve for air release and vacuum break on pipelines	4
Amendments to SPE-MP-7024	Pipe supports	3
Amendments to SPE-MM-7030	Plunger valves	5
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These specifications form an integral part of this contract and supplement the Particular Specifications.

In the event of any discrepancy between these specifications and a part of the particular specifications, the schedule of quantities, or the drawings, these specifications shall take precedence.

In certain clauses the standard and particular specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the specifications. It also contains additional specifications required for this particular Contract.

The Amendments to the Particular Specifications are included as stand-alone sections, each with their own index pages. The paragraph and sub-paragraph numbers of each amendment are unique to the Standard Specification at hand. Each paragraph and sub-paragraph are immediately followed by the heading and the number of the clause or sub-clause in the Standard Specification being referenced.

New clauses and sub-clauses, which do not form part of a clause or sub-clause in the Standard Specifications are also included. The paragraph and sub-paragraph numbers of each of the new clauses and sub-clauses are also unique to the Standard Specification at hand. New clauses and sub-clauses are identified by the text "NEW" in their headings. Each paragraph and sub-paragraph which references a new clause or sub-clause is immediately followed by its heading containing the new clause or sub-clause number.

Replace the term "Engineer" wherever it may occur in any of the specifications with "Employer's Agent".

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1. SCOPE (CLAUSE 1)

This specification shall be applicable to all butterfly valves included in the civil works, as well as to butterfly valves in the mechanical works where this specification is specifically referenced in the Detailed Mechanical Specifications.

The diameter, pressure rating and general arrangement of the valves are shown on the drawings.

2. NORMATIVE REFERENCES (CLAUSE 2)

Delete references SANS 1217, SANS 10064 and ISO 8501-1 from the list.

Add the following to the list:

"SPE-JJ-0003: General Corrosion Protection

SANS 12944 2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments

SANS 10108: The classification of hazardous locations and the selection of apparatus for use in such locations"

3. DEFINITIONS (CLAUSE 3)

No Amendments.

4. REQUIREMENTS (CLAUSE 4)

4.1 PRESSURE RATING (SUBCLAUSE 4.3)

Replace the word "1.2 MPa" *in the first paragraph to read* "1.0 MPa".

4.2 DIMENSIONS AND TOLERANCE OF BODY ENDS (SUBCLAUSE 4.5)

4.2.1 FLANGE DIMENSIONS (SUBCLAUSE 4.5.1)

Replace the subclause with the following:

"Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the Drawings.

The drilling of steel and cast iron flanges shall be off-centre and shall conform to the requirements of SANS 1123, BS EN 1092: Section 3.1, or ISO 7005: Part 1 as applicable, appropriate to the class of pipe specified, except that in the case of flanges, where M27 and M33 bolts are specified in BS EN 1092: Section 3.1, M24 and M30 bolts respectively shall be used as specified in SANS 1123. "

4.3 DESIGN (SUBCLAUSE 4.6)

4.3.1 GENERAL (SUBCLAUSE 4.6.1)

Add the following to the subclause:

"The body shall withstand the test pressure.

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Valves shall open and close smoothly at a pressure difference across the disc equal to the PN rating of the valve.

The maximum allowable handwheel operating torque shall not be exceeded.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

It shall not be possible to damage any component by over-torquing.

The valve provided shall have a successful record of use in South Africa in similar applications and shall also have had at least three years of technical support in South Africa. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable. Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Employer's Agent agrees in writing."

4.3.2 Shaft (Subclause 4.6.3)

Add the following to the subclause

"The valves shall be butterfly valves with double eccentric disc axis configuration and with disc mounted rubber seal.

The shaft shall be provided with o-ring seals."

4.3.3 Seating and seals (Subclause 4.6.4)

4.3.3.1 Seating (Subclause 4.6.4.1)

Replace the word "Annexure A" *in the last paragraph to read* "the Eccentric Axis Butterfly Valve technical datasheets, as included in the Detailed Civil and Pipeline Specifications."

4.3.3.2 Seals (Subclause 4.6.4.2)

Add the following to the subclause

"The main seal shall be uncompressed when the valve is open. It shall be replaceable by removing the retaining ring."

4.3.4 Disc (Subclause 4.6.5)

*Replace the words "*Council's Specification W&S-BW 011" *with "*SPE-MP-7001 and SPE-MP-7002".

4.4 OPERATION (SUBCLAUSE 4.7)

4.4.1 General (Subclause 4.7.1)

Replace the first paragraph with the following:

"The operating shaft shall be vertical.

Manually operated valves shall be provided with handwheels or wrench nuts for T-key actuation as indicated on the drawings. Manually operated valves shall permit easy opening of the disc when it is subjected to a differential pressure equal to the rated pressure difference across the disc. Handwheels shall not require a peripheral force greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons).

Extended spindles shall be installed as illustrated in the drawings to allow for unrestricted valve operation. The extended spindle for valves to be operated from outside the chamber using a T-key shall extend into the Bell Toby/Valve box. Adequate extended spindle supports shall be provided to prevent any horizontal movement of the spindle.

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Where automatic operation is specified or scheduled, the valve shall be supplied with an electrical actuator in accordance with Clause D16.2 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment. The minimum opening and closing period for the valve shall not be less than 15 minutes."

Add the following after the second paragraph:

"The valve shall be positively held in position over all degrees of opening whether under pressure or not."

Add the following after the third paragraph:

"Gearboxes shall comply with the requirements of Clause D22.3 of the City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment.

Gearboxes shall be selected to achieve the specified operating torque.

Gearbox external surfaces shall be provided with a coating suitable for the high corrosivity category (C4 of SANS 12944-2) and the dry film thickness shall not be less than 200 micron."

4.4.2 Position indicators (Subclause 4.7.3)

Add the following

"The valve shall incorporate provision for attaching limit switches for signalling valve fully open and valve fully closed."

4.5 MATERIALS (SUBCLAUSE 4.8)

4.5.1 Valve Materials (Subclause 4.8.1)

Replace the contents of this clause with the following:

"The valve materials shall be in accordance with the table below.

ITEM	MATERIAL
Valve body and valve disc	Ductile iron or cast steel
Seal retainer ring, Retainer fasteners and Seal seat	EN Grade 1.4401 (316) stainless steel, or better.
Seal retainer ring fasteners	EN Grade 1.4401 (316) stainless steel, or better.
Seal seat	EN Grade 1.4401 (316) stainless steel, or better.
Handwheels	Cast or forged metal.
Shafts	Stainless steel.
Shaft bearings	Self-lubricating polymer or non-ferrous metal.
Valve fasteners	EN Grade 1.4401 (316) stainless steel, or better.
Flange fasteners	As for pipework flanges.
External metal components	EN Grade 1.4401 (316) stainless steel, or better.

Carbon steel parts (wrought) are not acceptable either internally or externally. This includes high tensile items such as pins, roll pins, dowels etc."

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4.5.2 Nuts, Bolts, Washers and Jointing Material (Subclause 4.8.2)

Replace the clause contents with the following

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001.

M12 fasteners and smaller shall be of EN Grade 1.4401 (316) or better. Fasteners larger than M12 which are in non-corrosive areas shall, except when specified otherwise, be hot-dip galvanized. Plated fasteners are not acceptable."

4.6 PROTECTION AGAINST CORROSION (SUBCLAUSE 4.9)

Delete all subclauses 4.9.1, 4.9.2, 4.9.3, 4.9.4, 4.9.5 and 4.9.6 and replace with the following:

"Refer to SPE-JJ-0003 and associated amendments.

Surface abrasive blasting to Sa 2,5 is a minimum requirement prior to the application of any corrosion protection coating with the exception of hot dip galvanising.

Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning.

Metal plating of ferrous materials is not an acceptable corrosion protection system."

4.7 TECHNICAL DATA (SUBCLAUSE 4.10)

Replace the contents of this clause with the following:

The Contractor shall complete and submit the Eccentric Axis Butterfly Valve technical datasheets, as included in the Detailed Civil and Pipeline Specifications, to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter, pressure class and actuation to be used in the project. Additionally, together with the technical datasheets, the Contractor shall also submit all relevant brochures, drawings, and manufacturer datasheets.

4.8 INSTALLATION (NEW SUBCLAUSE 4.11)

The bottom of the disc shall open in the direction of flow.

Valve weight shall be fully supported. Valves of DN 300 and over shall be provided with at least one vertical support under the valve

The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.

d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.

e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.

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5. INSPECTION AND METHOD OF TESTING (CLAUSE 5)

Replace the contents of this subclause:

"All valves shall be inspected by the Employer's Agent prior to payment.

The Contractor shall further make all arrangements and carry all costs for the Employer and the Employer's Agent, or approved representatives, to inspect the workshop facilities of the manufacturer prior to dispatch whether the valve is manufactured locally or internationally."

The Contractor shall arrange for the Employer and Employer's Agent to witness the testing of valves of sizes DN 400 and larger prior to dispatch of the valve from the workshop. All travel and accommodation costs shall be the responsibility of the Contractor.

Valve bodies and discs shall be hydraulically tested in accordance with 5.2.4.1 of SANS 1849 to a test pressure of 1,5 times the valve PN rating.

Valves shall be tested for seat leakage in accordance with 5.2.4.3 of SANS 1849. The test pressure shall be the PN rating.

Test certificates shall be submitted to the Employer's Agent for all valves.

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Employer's Agent prior to the commissioning of the Works."

6. MARKING AND DELIVERY (CLAUSE 6)

Add "flow direction" to the list of marking requirements.

7. PREPARATION FOR DESPATCH (CLAUSE 7)

No amendments

8. MEASUREMENT AND PAYMENT (NEW CLAUSE 8)

8.1 PRINCIPLES (NEW SUBCLAUSE 8.1)

The installation of the valves is covered under Clause 8.2.3 of SPE-CC-7003.

8.2 SCHEDULED ITEMS (NEW SUBCLAUSE 8.2)

8.2.1 Supply and deliver valve (Subclause 8.2.1)

Separate items will be scheduled for each type, size, etc of valve and each type of end connection or coupling stated. The rate shall cover the cost of the provision of each valve, complete with couplings, gaskets and valve and pipe anchors/supports, and the cost of testing, inspections and delivering the valves to site and temporary storage thereof.

The installation of the valves is covered under Clause 8.2.3 of SPE-CC-7003.

Valve type, size, working pressure, end connections stated..... Unit: No

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1. SCOPE (CLAUSE 1)

"This Specification covers the supply and delivery of mechanical couplings and flange adaptors required in the civil works for this Contract.

Pipe couplings shall be provided for flexibility and to allow dismantling of pipework. Pipe couplings shall also be provided to accommodate possible pipe movement from settlement, etc, and to isolate machine vibration."

2. DESIGN (CLAUSE 2)

2.1 FLANGES (SUBCLAUSE 2.5)

Replace the contents of this subclause with the following:

"Flanges shall be in accordance with Clause 4.3.2 of specification SPE-MP-7001 and its associated amendments."

2.2 BOLTS (SUBCLAUSE 2.6)

Replace the contents of this subclause with the following:

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

2.3 EQUIPMENT ELIGIBILITY (NEW SUBCLAUSE 2.7)

The couplings and adaptors provided shall have a successful record of use in South Africa in similar applications and shall also have had at least three years of technical support in South Africa. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Couplings and adaptors which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Employer's Agent agrees in writing.

3. MATERIAL (CLAUSE 3)

Delete the contents of this subclause and replace with the following:

"All fasteners, including studs welded to flanges, shall be of stainless steel and provided with a solids lubricant to prevent galling.

Metal castings shall be of ductile iron or of stainless steel.

Couplings for stainless steel and 3CR12 pipework shall be fully of EN Grade 1.4401 (316) stainless steel construction (except for the seal).

Carbon steel and cast-iron components shall be protected against corrosion in accordance with SPE-JJ-0003."

4. SEALING RINGS (CLAUSE 4)

Add the following: "Sealing rings shall have a hardness of 66-75 IRHD or better".

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5. WORKING PRESSURE (CLAUSE 5)

Delete the contents of this subclause and replace with the following:

"The pressure rating of the coupling shall be not less than the rating for as its pipework. Where the pressure rating of the pipework is not specified or known, the couplings and flange adaptors shall be suitable for working pressures up to 1.0 MPa."

6. WELDING (CLAUSE 6)

Add the following: "Fabrication shall comply with Clause D4 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment."

7. PROTECTION AGAINST CORROSION (CLAUSE 7)

Replace the subclause with the following:

"Corrosion Protection shall comply with SPE-JJ-0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning."

8. MARKING (CLAUSE 8)

No amendments

9. INSTALLATION (NEW CLAUSE 9)

The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.

d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.

e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.

10. INSPECTIONS AND TESTING (NEW CLAUSE 10)

The Contractor shall make arrangements for the Employer's Agent to inspect the couplings for compliance prior to payment being made.

The correct operation of the couplings and achievement of the specified performance requirements shall be demonstrated to the Employer's Agent prior to the commissioning of the Works. All couplings shall undergo hydrostatic pressure testing, as required for the applicable pipeline, after installation.

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11. MEASUREMENT AND PAYMENT (NEW CLAUSE 11)

11.1 PRINCIPLES (NEW SUBCLAUSE 11.1)

The installation of the couplings and adaptors is covered under Clause 8.2.1 of SPE-CC-7003.

11.2 SCHEDULED ITEMS (NEW SUBCLAUSE 11.2)

11.2.1 Supply and deliver couplings and adaptors (Subclause 11.2.1)

Separate items will be scheduled for each type, size, etc of coupling and adaptor and each type of end connection or coupling stated. The rate shall cover the cost of the provision of each coupling, delivery, temporary storage (if required), and testing thereof.

Coupling and adaptor type, size, working pressure, end connections stated..... Unit : No

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1. SCOPE (CLAUSE 1)

Delete the contents of this clause and replace with the following:

"This specification shall be applicable to all gate valves included in the works.

The diameter, pressure rating and general arrangement of the valves are shown on the drawings."

2. WORKING PRESSURE (CLAUSE 2)

Replace the clause with the following:

"The pressure rating for the valve shall be as given on the relevant drawings or schedules. The valve pressure rating shall not be less than that specified for the pipeline. Where no pressure is specified or shown, the valves shall be rated to withstand pressures of up to 1.0 MPa."

3. DESIGN (CLAUSE 3)

3.1 GENERAL (SUBCLAUSE 3.1)

Replace the first paragraph with the following:

"All gate valves shall comply with the requirements of SANS 664-1: 2011.

Wedge gate valves shall comply with SANS 664-2: 2011.

Resilient seal valves shall comply with SANS 664-3: 2011.

The following additional requirements shall apply."

3.1.1 *Replace contents of Item 3.1.1 with the following:* "Valves shall be of the double flanged configuration."

3.1.2 *Replace the contents of item 3.1.3 with the following*: "The valves shall be fitted with caps or handwheels as specified on the Schedule and Drawings."

3.1.5 *Replace the contents of Item 3.1.5 with the following:* "The body ends shall be flanged. Flange drillings shall match those specified for the pipeline."

Add the following to the subclause

"3.1.8 The valve provided shall have a successful record of use in South Africa in similar applications and shall also have had at least three years of technical support in South Africa. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable. Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Employer's Agent agrees in writing.

3.1.9 Valves shall seal drip tight for all specified duties.

3.1.10 Manually operated valves shall be provided with handwheels of a size and construction which permit easy opening of the valve for a single person when subjected to a differential pressure equal to the rated pressure difference across the valve. Handwheels shall not require a peripheral force greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons).

3.1.11 The valve shall be positively held in position over all degrees of opening whether under pressure or not.

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3.1.12 Clear indication of current valve position shall be provided including valve opening and closing direction.

3.1.12 Valve opening and closing direction shall be indicated.

3.1.13 Gearboxes shall comply with the requirements of Clause D22.3 of the City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment. Gearboxes shall be selected to ensure that a peripheral force not greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons) is required to operate the valve. Gearbox external surfaces shall be provided with a coating suitable for the high corrosivity category (C4 of SANS 12944-2) and the dry film thickness shall not be less than 200 micron.

3.1.14 For valves DN250 and greater, a slipping clutch, or equivalent mechanism, shall prevent over torque which would cause damage. Shear pins and other torque limiting devices which have to be replaced after activation are not acceptable.

3.2 WEDGE GATE VALVES (SUBCLAUSE 3.2)

3.2.1 *Replace contents of Item 3.2.1 with the following:*

3.2.4 *Delete this subclause*

3.2.5 *Delete this subclause*

Add the following to the subclause:

"3.2.6 Valves shall have metal seats.

3.2.7 The bore shall be straight through.

3.2.8 Fixed lugs for end of travel limit switches shall be provided.

3.2.9 The body shall incorporate storage feet.

3.2.10 The thrust surfaces shall be outboard of the spindle seal and shall not be wetted by the fluid. The thrust housing shall be provided with a stainless steel greasing nipple or other facility for lubrication.

3.2.11 Corrosion protection shall comply with SPE-JJ-0003. Equipment shall comply with the table below.

ITEM	MATERIAL	COATING
Body	Cast iron or cast steel	Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating to a dry film thickness of at least 250 micron. Specialist applied Rilsan coatings will also be acceptable.
Guides and Wedge Shoes	Copper based alloy or of engineering plastic or of stainless steel.	
Body Seat Ring	Stainless steel	
Wedge Seat Ring	Stainless steel	
Spindle	Martensitic stainless steel	
Fasteners	EN Grade 1.4401 (316)	

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ITEM	MATERIAL	COATING
External metal components	EN Grade 1.4401 (316)	

3.3 RESILIENT SEAL VALVES (SUBCLAUSE 3.3)

3.3.1 *Replace the contents of Corrosion Protection with the following:* "Corrosion Protection shall in accordance with SPE-JJ-0003 and associated Amendments."

ITEM	MATERIAL	COATING
Body, bonnet, gate, handwheels	Ductile iron, cast iron or cast steel	Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating to a dry film thickness of at least 250 micron. Specialist applied Rilsan coatings will also be acceptable.
Gate liner	Vulcanised EPDM	
Spindle	Martensitic stainless steel	
Spindle nut	Aluminium bronze	
Fasteners	EN Grade 1.4401 (316)	
External metal components	EN Grade 1.4401 (316)	

Add the following to the subclause:

"3.3.9 The gate liner shall, in accordance with SANS 664-3, be so firmly bonded, vulcanised and accurately moulded that, when the valve is tested, the resilient material shall not become torn, loose or detached. Also, in accordance with SANS 664-3, the gate shall ensure drop tightness over the full pressure range of the valve and the lining shall have the capacity to accept foreign matter up to 1 mm in particle size.

3.3.10 The gate shall be fully lined so that the fluid does not contact any metallic part of the gate.

3.3.11 The gate shall be provided with guides. Sliding surfaces of cast iron are not acceptable.

3.3.12 Manually operated gearboxes shall be provided with a stainless steel grease nipple.

3.3.13 The thrust surfaces shall be outboard of the spindle seal and shall not be wetted by the fluid. The thrust housing shall be provided with a stainless steel greasing nipple or other facility for lubrication.

3.4 TECHNICAL DATA (NEW SUBCLAUSE 3.4)

The Contractor shall complete and submit the Wedge and Resilient Seal Gate Valve technical datasheets, as included in the Detailed Civil and Pipeline Specifications, to the Employer's Agent for approval. A separate

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datasheet must be submitted for each combination of nominal diameter, pressure class and actuation to be used in the project. Additionally, together with the technical datasheets, the Contractor shall also submit all relevant brochures, drawings, and manufacturer datasheets.

4. FASTERNERS (NEW CLAUSE 4)

Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001.

M12 fasteners and smaller shall be of EN Grade 1.4401 (316) or better. Fasteners larger than M12 which are in non-corrosive areas shall, except when specified otherwise, be hot-dip galvanized. Plated fasteners are not acceptable.

5. MARKING (NEW CLAUSE 5)

Each valve shall have a brass plate firmly fixed to the body with the following information stamped or engraved thereon:

a) Manufacture
b) Order Number
c) Date of Order
d) Size
e) Pressure Rating
f) Body and Disc Material
g) Serial Number
h) Direction of Flow

6. INSTALLATION (NEW CLAUSE 6)

The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.
d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.

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7. INSPECTION AND TESTING (NEW CLAUSE 7)

7.1 INSPECTION (NEW SUBCLAUSE 7.1)

Witnessing of factory testing would not be required. However, a test report shall be submitted to the Employer's Agent before valves are dispatched from the factory or workshop.

7.2 TESTING (NEW SUBCLAUSE 7.2)

The following testing shall be done at the factory:

The valve body shall be pressure tested to 1,5 times the pressure rating.

The valve seating shall be drip tight tested to 1,1 times the pressure rating.

The Contractor shall demonstrate the correct operation of the equipment and the achievement of the specified performance requirements to the Employer's Agent prior to the Works being commissioned.

8. MEASUREMENT AND PAYMENT (NEW CLAUSE 8)

8.1 PRINCIPLES (NEW SUBCLAUSE 8.1)

The installation of the valves is covered under Clause 8.2.3 of SPEC-CC-7003.

8.2 SCHEDULED ITEMS (NEW SUBCLAUSE 8.2)

8.2.1 Supply and deliver valve (Subclause 8.2.1)

Separate items will be scheduled for each type, size, etc of valve and each type of end connection or coupling stated. The rate shall cover the cost of the provision of each valve, complete with couplings, gaskets and valve and pipe anchors/supports, and the cost of testing and delivering the valves to site and temporary storage thereof.

Valve type, size, working pressure, end connections stated..... Unit : No

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1. SCOPE (CLAUSE 1)

This specification shall be appliable to all electromagnetic flow meters required for this Contract.

2. GENERAL (CLAUSE 2)

Replace the first sentence with the following:

"Electromagnetic flow meters shall include the sensor, the remotely mounted transmitter, the display unit, cabling, supports and grounding rings (if applicable). The meter shall be capable of detecting an empty pipe."

Add the following to the clause:

The sensor shall be a full-bore, in-line, double flanged unit. The transmitter shall provide local flow indication and 4-20 mA output.

The flowmeter shall be suitable for use in pipelines that are cathodically protected.

3. SENSING UNIT (CLAUSE 3)

3.1 GENERAL (SUBCLAUSE 3.1)

*Replace the words "*Council's Standard W&S-BW011*" in the second sentence with "*specification SPE-MP-7001".

Add the following:

"The flow sensor shall be rated to IP68 and be suitable to indefinite submergence to a depth of up to 10m. The sensor shall also be suitable for installation in underground pipes without the need for a metering chamber, vault or pit (i.e., it shall be capable of direct burial).

The external corrosion protection system for the meter sensor shall be suitable for buried applications and shall be to the approval of the Engineer.

Corrosion Protection shall comply with SPE-JJ-0003."

3.2 METERING TUBE (SUBCLAUSE 3.2)

Add the following:

"The meter shall have a polyurethane lined, stainless steel tube. Rubber linings are acceptable for treated water applications.

For applications other than for treated water, the sensor's electrodes shall be provided with electrode cleaning. Automatic, timed cleaning shall be provided.

Each flow meter of size DN 300 and larger shall be provided with a separate, dedicated support.

The pipe supports shall be designed to comply with SPEC-MP-7024 and Corrosion Protection shall comply with SPE-JJ-0003."

3.3 FASTERERS (SUBCLAUSE 3.4)

Replace the clause with the following:

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

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4. TRANSMITTING UNIT (CLAUSE 4)

Add the following:

Cabling between the flow transmitter shall be suitably designed cable providing both power and measurement signal from the flowmeter sensor to the flow meter transmitter. The instrument must be configurable via the integral display keypad and via a portable computer. The performance of the flow meter and transmitting unit must be immune to stray currents, cathodic currents and electromagnetic interference. The meter software must be capable of providing a datasheet of the meter configuration and setting. The meter system must through the software be capable of providing the historical information of the calibration setting, flow rates, peak, reverse average etc. These must be date stamped."

5. RECEIVING UNIT (CLAUSE 5)

Replace the clause with the following:

"Recording, trending and graphic display shall be provided if a SCADA system and/or an HMI are part of the Contract Works."

6. ACCURACY (CLAUSE 6)

Replace the first sentence of this clause with the following:

"The meter's system accuracy shall be better than +0.5% of reading or +0.05% of full scale, whichever is greater without the need for automatic cleaning nor remote removal of electrodes for cleaning. The signal: noise factor shall allow digital full scale mean velocity adjustment from 0-0,25 m/s to 0 - 10 m/s with media conductivities down to 1 micro siemens/cm (µS/cm) without affecting accuracy. Note: This shall include error in the converter.

Repeatability:	The repeatability shall be within +0.05% of full scale.
Minimum electrical conductivity:	1 micro-siemens/cm (µS/cm). (Most aqueous based liquids have typically 200 - 800 micro-siemens/cm (200 - 800 µS/cm).
Min. nominal full scale velocity:	0 - 0,25 m/s
Max. nominal full scale velocity:	0 - 10 m/s"

7. COMMISSIONING (CLAUSE 7)

Replace the clause contents with the following:

7.1 INSPECTION (NEW SUBCLAUSE 7.1)

The Contractor shall make arrangements for the Employer's Agent to inspect the equipment for compliance prior to payment being made.

7.2 TESTING REQUIREMENTS (NEW SUBCLAUSE 7.2)

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

7.3 INSTALLATION (NEW SUBCLAUSE 7.2)

The equipment shall be correctly installed, connected, adjusted and calibrated by competent persons.

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The meter shall be installed with a straight pipe length of at least 10 pipe diameters upstream of the sensor and a straight pipe length of at least 5 pipe diameters downstream of the meter unless the drawings indicate otherwise. If this is not possible, the design shall attempt to restore uniform turbulent flow and the complete meter installation shall comply with the manufacturer's instructions.

Grounding rings shall be supplied and installed if the application requires these."

8. VERIFICATION

No amendments

9. MEASUREMENT AND PAYMENT (NEW CLAUSE 9)

The flow meter shall be priced and supplied under the scope for the electrical works.

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipeline and valve component of the project included in the civil works, as well as to the mechanical, electrical and ancillary works where specifically referenced. The corrosion protection for the structural steel is specified elsewhere.

2 CORROSION PROTECTION SYSTEMS (CLAUSE 10)

2.1 RECOMMENDED CORROSION PROTECTION SYSTEM (SUBCLAUSE 10.1)

The corrosion protection for all mild steel pipelines shall be as follows:

Item	Environment Condition	Surface Preparation and Material	Surface Condition	System
For nominal diameters < DN100 buried in soil/ Outside Valve Chambers				
Mild steel pipes, specials and fittings	Severely Corrosive	Method 1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty) AND System 9: Tape Wrapping (Denso Ultraflex or equal approved by Employer's Agent)
Flanges	Severely Corrosive	Method 1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty) AND System 10: Petrolatum Tape Wrapping
Couplings	Severely Corrosive	Method 1: Mild Steel	Sa 3	System 6: Fusion Bonded Epoxy AND System 10: Petrolatum Tape Wrapping
For nominal diameters < DN100 in Valve Chambers/ Not buried in Soil				
Mild steel pipes, specials and fittings	Medium Corrosive	Method 1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)
Flanges	Medium Corrosive	Method 1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)

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Item	Environment Condition	Surface Preparation and Material	Surface Condition	System
Couplings.	Medium Corrosive	Method 1: Mild Steel	Sa 3	System 6: Fusion Bonded Epoxy
For nominal diameters ≥ DN100 in all conditions				
Mild steel pipes, specials, fittings and welded joints	Severely Corrosive	Method 1: Mild Steel	Sa 3	**Coating**: System PC6: Cement Mortar Sheathing AND **Lining**: System PL1: Cement Mortar Lining
Flanges	Severely Corrosive	Method 1: Mild Steel	Sa 3	System 5: Two Pack Epoxy AND System 10: Petrolatum Tape Wrapping
Couplings	Severely Corrosive	Method 2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy AND System 10: Petrolatum Tape Wrapping
For all nominal diameters				
Wedge Gate, RSV, Butterfly, Non-return and Air Valves	Severely Corrosive	Method 2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy
Water Meters	Severely Corrosive	Method 2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy
Pipe Supports, handrails, ladders, etc.	Medium Corrosive	Method 1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)

2.2 SYSTEM 5: TWO PACK EPOXY (SUBCLAUSE 10.6)

2.2.1 Application (Subclause 10.6.4)

2.2.1.1 Dry Film Thickness (Subclause 10.6.4.1)

Replace the contents of this subclause with the following: "Dry film thicknesses shall be at least 300 µm unless otherwise specified."

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2.3 SYSTEM 6 FUSION BONDED EPOXY (HEAVY DUTY) (SUBCLAUSE 10.7)

2.3.1 Application (Subclause 10.7.4)

2.3.1.1 Dry Film Thickness (Subclause 10.7.4.1)

Replace the contents of this subclause with the following: "Dry film thicknesses shall be at least 400 µm unless otherwise specified."

2.4 SYSTEM PL1: CEMENT MORTAR LINING (SUBCLAUSE 10.17)

2.4.1 Material (Subclause 10.17.2)

Replace the contents of this subclause with the following: "The cement shall be Portland cement in accordance with SANS 50197-1 CEM 1. The sand shall be suitable for plastering in accordance with SANS 1090. All other materials shall be in accordance with AS 1281-2001.

2.4.2 Application (Subclause 10.17.3)

2.4.2.1 Mixing of Mortar (Subclause 10.17.3.1)

Add the following at the end of this subclause: The aggregate cement ratio shall not exceed 1.5:1 by mass. The water content shall be the minimum required to obtain proper consistency for a dense homogeneous lining that will adhere firmly to the pipe surface.

2.4.2.2 Curing of Lining (Subclause 10.17.3.3)

Add the following at the end of this subclause:

"Where exterior sheathing is to be applied after lining, its applications shall not commence within 72 hours after completion of the lining. The lining shall be kept wet during the application of the exterior sheathing.

When the lining is sprayed after the sheathing, precautions shall be taken so as to ensure that the sheathing is not damaged by escaping water. Except for the sheathing operation, no pipe, fitting or special shall be disturbed or moved during the curing period.

When steam curing is to be used, it shall be commenced not longer than 8 hours after completion of the lining. The steam shall be introduced slowly and the total surface of the lining kept in contact with moist steam at a temperature of not less than 500 C and not more than 630 C for a period of not less than 14 hours.

When exterior sheathing is to be applied after lining, its application shall not be commenced until after completion of the steam curing."

2.4.3 Thickness of lining (New subclause 10.17.5)

All pipes, fittings and specials shall have a cement mortar lining which shall have a thickness in accordance with the following table:

NOMINAL DIAMETER OF PIPE, FITTING OR SPECIAL	THICKNESS OF LINING mm	TOLERENCE mm
100	5	+3 -0
150	5	+3 -0
200	5	+3 -0
250	6	+3 -0

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NOMINAL DIAMETER OF PIPE, FITTING OR SPECIAL	THICKNESS OF LINING mm	TOLERENCE mm
300	7	+3 -0
>300 - 600	10	+4 -0
>600 – 1 000	15	+5 -0
Greater than 1 000	20	+6 -0

2.4.4 Reinforcing (New subclause 10.17.6)

The lining of all fittings, specials, make-up pieces (where their length is less than their diameter) and at welded joints of nominal diameter 600 mm and greater shall be reinforced by means of a 50 mm x 50 mm x 2,5 mm diameter wire fabric. All reinforcing shall be tack-welded to the fitting or special in such a manner as to lie within the middle third of the lining.

2.5 SYSTEM PC6: CEMENT MORTAR SHEATHING (NEW SUBCLAUSE 10.19)

2.5.1 Materials (New subclause 10.19.1)

The cement shall be Portland cement in accordance with SANS 50197-1 CEM 1. The sand shall be suitable for concrete in accordance with SANS 1083. All other materials shall be in accordance with AS 1281-2001.

The mix shall not be subject to Alkali Aggregate Reaction where the aggregate expands deleteriously (>0,5%).

2.5.2 Thickness (New subclause 10.19.2)

All pipes, fittings and specials shall have an exterior sheath which shall have a thickness in accordance with the following table:

NOMINAL DIAMETER OF PIPE, FITTING OR SPECIAL mm	THICKNESS mm	TOLERANCE mm
Up to 600	20	+ 3 -0
Greater than 600	25	+ 6 -0

2.5.3 Method of application (New subclause 10.19.3)

The cement mortar mix shall be as specified for the lining.

The mortar shall be applied by an approved method. Fittings and specials whose shape precludes the approved method shall have the sheathing applied by hand plastering or other approved process.

The finished sheathing shall be dense, firm and adhere rigidly to the surface. Sheathing shall be tested by lightly tapping the surface with a hammer. Any pipe, fitting or special where there is no bond between the sheathing and the steel shall be rejected. Defective sheathing shall be repaired to the satisfaction of the Engineer.

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2.5.4 Reinforcing (New subclause 10.19.4)

The exterior sheathing of all pipes, fitting and specials shall be reinforced by 5 mm diameter steel wrapped around the circumference. The wire shall extend over the full length of the sheathing with a maximum spacing of 40 mm. The reinforcing shall be tack-welded to the pipe, fitting or special in such a manner as to lie within the middle third of the coating.

All fittings and specials whose shape preclude this method of reinforcement shall have their sheathing reinforces in a similar manner to that specified in Clause 10.17.6, but with 50 mm x 50 mm x 3.15 mm diameter wire fabric.

2.5.5 Curing (New subclause 10.19.5)

The Exterior sheathing shall be cured in a similar manner to the lining except that the minimum duration of the curing shall be 48 hours and 12 hours for water and steam respectively.

3 MEASUREMENT AND PAYMENT (CLAUSE 12)

Delete the contents of this clause and replace with the following: "The costs for complying with this specification shall be included in the tendered rates for the relevant items that will require corrosion protection in accordance with this specification. No separate payment shall be made for the corrosion protection, or the accompanying QCP and other documentation as required by this specification".

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipe specials and fittings required for this Contract.

The general arrangement of the specials and fittings are shown on the drawings and are described in the Bill of Quantities.

2 NORMATIVE REFERENCES (CLAUSE 2)

No amendments.

3 DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments.

4 REQUIREMENTS (CLAUSE 4)

4.1 MATERIALS (SUBCLAUSE 4.1)

4.1.1 Types of steel (Clause 4.1.2)

All mild steel specials and fitting with a nominal diameter of 150 mm and less shall be manufactured from heavy class steel in accordance with SANS 62.

All mild steel specials and fittings with a nominal diameter greater than 150 mm shall be manufactured from Grade X52 steel.

Steel pipe supports in chambers shall be manufactured from the same material as the pipework to be supported or from Grade S275JR.

4.1.2 Flanges (Clause 4.1.3)

Flanges manufactured from steel plates shall be manufactured from Grade S355JR steel and be suitable for working pressures of up to PN 16. Flanges manufactured through forging shall be manufactured from ASTM A105 grade steel and be suitable for working pressures of up to PN16.

Puddle collars and anchoring flanges used as pipe anchorages shall be of the same dimensions as corresponding flanges but those cast into concrete walls shall not be drilled. The collar/flange shall be capable of transmitting a longitudinal force 33% greater than the internal hydraulic pressure to be applied when testing, multiplied by the area of the bore and, under that condition, the stress in the material shall not exceed its yield stress.

4.2 DESIGN (SUBCLAUSE 4.2)

4.2.1 General (Subclause 4.2.1)

The Contractor shall submit a shop drawing for each steel pipe fitting or special to be manufactured. The shop drawings shall, at a minimum, include the following information:

- All face-to-face (F/F) or center-to-face (C/F) dimensions of the special

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- The nominal diameter (DN), outer diameter (OD), and wall thickness for each cylindrical component of the special
- The pressure class of the special
- The applicable testing pressure for the special
- The applicable flange tables
- The steel type and grade for each component of the special
- The applicable corrosion protection, including associated details such as dry film thickness (DFT) or overall coating thickness

4.2.2 Wall thickness (Subclause 4.2.2)

The pipe wall thickness shall not be less than the minimum shown in the table below unless stated otherwise in the schedule or on the drawings.

Nominal bore	Minimum wall thickness (mm)
Up to 150	As per SANS 62 heavy duty
>150 up to 450	4.5
>450 up to 700	6
>700 up to 900	8
>900 up to 1200	10
>1200 up to 1600	12
>1600 up to 1800	16

4.2.3 Branches and Nozzles (Subclause 4.2.4)

Delete the 3rd and 4th paragraphs of this clause and replace with the following: "Tees and crosses shall have dimensions as shown on the drawings. Where no dimensions are given on the drawings, the dimensions shall be in accordance with AWWA C208."

For pipes with a cement mortar lining, stubs/branches shall have a minimum size of DN100. The stub shall also have a cement mortar lining. After the placement of the stub, the cement mortar lining shall be repaired from the inside to form a continuous lining from the pipe into the stub.

4.2.4 Dimensions (Subclause 4.2.7)

Pipe specials and fittings with a nominal diameter up to 150 mm shall have an outer diameter in accordance with SANS 62.

Pipe specials and fittings with a nominal diameter greater than 150 mm shall have an outer diameter in accordance with SANS 719.

4.3 JOINTING (SUBCLAUSE 4.3)

4.3.1 Flexible Couplings (Subclause 4.3.1)

Couplings and flange adaptors shall be in accordance with W&S-BW-10.

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Unless otherwise specified, all flange adaptors shall be restrained through an appropriate restraining flange welded onto the adjoining special.

4.3.2 Flanges (Subclause 4.3.2)

All welding neck flanges shall be butt-welded to the pipe ends and the requirements of clauses 4.5.2 and 4.5.3.3 shall apply.

All flanges up to and including DN 2000 for pressure ratings up to and including PN25 shall be drilled in accordance with SANS 1123.

Delete the second last paragraph under Clause 4.3.2 and replace with:

"Flange sizes exceeding DN 400 up to and including DN 2000 shall have a raised face sealing arrangement for all pressure ratings up to and including 2500 kPa."

4.3.3 Insulated Flanges (Subclause 4.3.3)

Insulated flanges shall be in accordance with *Spec 2221528-AppE: AC Mitigation Infrastructure Specification*.

4.3.4 Bolts, nuts and washers (Subclause 4.3.6)

Unless otherwise shown on the drawings or scheduled in the Bill, all bolts, nuts and washers shall be heavy duty hot-dipped galvanised in accordance with SPE-JJ-0003, except where stainless steel pipes are joined to mild steel or stainless steel, in which case the bolts, nuts and washers shall be stainless steel 316.

Galvanic corrosion protection of dissimilar materials must be dealt with in accordance with Subclause 4.5.2 of Particular Specification SPE-JJ-0003.

4.3.5 Restraining Flanges (New subclause 4.3.9)

The restraining flanges shall be plate flanges (Type 01) in accordance with EN1092 Part 1. The minimum thickness for large plate flanges, not given in EN1092 Part 1, shall be as for blind flanges in subclause 4.3.10.

The drilling and bolt sizes for the restraining flange shall comply with SANS 1123.

Restraining flanges shall be fillet welded onto the pipe with a throat thickness greater than the pipe wall thickness.

4.3.6 Blind Flanges (New subclause 4.3.10)

Blind flanges up to DN1200 shall be in accordance Type 05 in EN1092 Part 1.

For PN10 blind flanges larger than DN1200, the minimum flange thickness shall be as per the table below.

Nominal Diameter	Minimum flange thickness (mm)
1400	78
1600	89
1800	100

4.4 MARKING (SUBCLAUSE 4.7)

Replace the contents of this clause with the following:

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"Each special shall have the following information stencilled, in black painted characters not less than 40 mm in height, on the inside as close to both ends as is possible and so as to be clearly visible from outside. The paint used shall be non-toxic and suitable for application in potable water.

a) Pipe reference number
b) Contract number
c) Date of manufacture
d) Nominal diameter
e) Outside diameter
f) Wall thickness/pressure rating
g) Grade of steel
h) Coating type and nominal thickness
i) Lining type and nominal thickness
j) Forming technique
k) Length
l) Mass of uncoated and unlined pipe in kg/m
m) Applicable drilling tables stamped on the periphery of all flanges
n) Bends shall have their "centre plane" marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends during laying.

4.5 STORAGE, HANDLING AND TRANSPORT (SUBCLAUSE 4.8)

4.5.1 Dunnage and storage (New subclause 4.8.4)

The Contractor shall be responsible to identify suitable stockpile areas in accordance with the areas authorised by the Environmental Management Programme and submit those to the Employer's Agent and ECO for approval. Pipes can also be off-loaded adjacent to the laying position, provided that it falls within the allowable working width and does not restrict access.

Access for delivery to site is restricted along certain section, especially during poor weather conditions. The Contractor shall make due allowance for such disruption.

5 COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

5.1 INSPECTIONS (SUBCLAUSE 5.3)

5.1.1 Hydraulic Testing (Subclause 5.3.2)

In the first paragraph, replace "Where P = the lesser of: 2 x 0.85 x Y x t/D or 7 MPa" *with* "Where P = the lesser of: 2 x 0.85 x Y x t/D or 7 MPa or 1.1 x flange rating of the special".

In the last paragraph, replace "10 seconds" *with* "3 minutes".

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

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No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BILLED ITEMS (SUBCLAUSE 8.2)

8.1.1 Pipe Factory Inspections (New Subclause 8.2.2)

a) Pipe factory inspection ..... Unit: Prov Sum

b) Overheads, charges and profit on item 8.2.2 a) above ..... Unit: %

A provisional sum is allowed to cover the total cost of inspections at the pipe manufacturer's factory. The sum shall include the cost of an independent inspectorate as well as the flights, accommodation and transport for the Employer and Employer's Agent for inspections at the factory.

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipes required for this Contract.

2 NORMATIVE REFERENCES (CLAUSE 2)

No amendments.

3 DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments.

4 REQUIREMENTS (CLAUSE 4)

4.1 MATERIALS (SUBCLAUSE 4.1)

4.1.1 Chemical composition (Clause 4.1.2)

Mild steel pipes shall be manufactured from Grade X52 steel.

Mild steel flanges manufactured from steel plates shall be manufactured from Grade S355JR steel and be suitable for working pressures of up to PN 16. Flanges manufactured through forging shall be manufactured from ASTM A105 grade steel and be suitable for working pressures of up to PN16.

Stainless steel shall be either EN Grade 1.4301 (304L stainless steel) or EN Grade 1.4401 (316L stainless steel) as shown on the drawings or scheduled in the Bill of Quantities.

4.2 DESIGN (SUBCLAUSE 4.2)

4.2.1 Dimensional Requirements (Subclause 4.2.1)

4.2.1.1 Pipe Length (Subclause 4.2.1.1)

The standard length for all pipes for this Contract shall be 18.28 m.

4.2.2 Dimensions (Subclause 4.2.2)

Delete the contents of this clause and replace with the following:

"The nominal bore of a pipe shall conform to the values given in columns 1 and 2, respectively, of table 2 in SANS 719.

The actual outside diameter of the pipe, when determined in accordance with 6.1.1(a) or 6.1.1(b) of SANS 719, as relevant, shall not differ from the nominal value by more than the following tolerances:

Up to a distance of 300 mm from the end of the pipe:

- For nominal diameters up to 250 mm +1.6 mm or – 0.4 mm
- For nominal diameters greater than 250 mm +2.4 mm or – 0.8 mm

Over the remainder of the pipe, with the diameter D in mm

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- For nominal diameters up to 250 mm ± (0.01 x D) mm
- For nominal diameters greater than 250 mm ± (0.005 x D + 1) mm or (± 6) mm whichever is less

Except where more restrictive tolerances apply, the difference between the maximum and minimum values of the outside diameter measured across the plane at right angles to the axis shall not exceed 0.5 % of the relevant outside diameter."

4.2.3 Wall Thickness (Subclause 4.2.3)

The pipe wall thickness shall not be less than the minimum shown in the table below unless stated otherwise in the schedule of quantities or on the drawings.

Nominal bore	Minimum wall thickness (mm)
Up to 150	As per SANS 62 heavy duty
>150 up to 450	4.5
>450 up to 700	6
>700 up to 900	8
>900 up to 1200	10
>1200 up to 1600	12
>1600 up to 1800	16

4.2.4 Pipe ends (Subclause 4.2.4)

All pipes with a nominal diameter of DN450 and greater shall be supplied with bevel ends to be joined by field welding. Pipes with a nominal diameter less than DN450, shall be supplied with Bell and spigot (plain) ends to be joined by fillet weld.

4.2.5 Flanges (Subclause 4.2.5)

All welding neck flanges shall be butt-welded to the pipe ends and the requirements of clauses 4.4.4 and 4.4.7.2 shall apply.

All flanges up to and including DN 2000 for pressure ratings up to and including PN25 shall be drilled in accordance with SANS 1123.

Delete b) under Clause 4.2.5 and replace with:

"b) Flange sizes exceeding DN 400 up to and including DN 2000 shall have a raised face sealing arrangement for all pressure ratings up to and including 2500 kPa."

4.3 MARKING (SUBCLAUSE 4.6)

Replace the contents of this clause with the following:

"All pipes shall have the following information stencilled, in black painted characters not less than 40 mm in height, on the inside as close to both ends as is possible and so as to be clearly visible from outside. The paint used shall be non-toxic and suitable for application in potable water:

a) Pipe reference number
b) Contract number
c) Date of manufacture

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To

d) Nominal diameter

e) Outside diameter

f) Wall thickness

g) Grade of steel

h) Coating type and nominal thickness

i) Lining type and nominal thickness

j) Forming technique

k) Length

l) Mass of uncoated and unlined pipe in kg/m

m) Applicable drilling tables stamped on the periphery of all flanges

Additionally, pipes shall be clearly marked with the unique reference number in appropriate height characters in durable paint on a black background on the outside at the end of each pipe. The supplier's and Employer's name and logo shall be stencilled on each pipe.

4.4 FABRICATION

4.4.1 Forming (Subclause 4.4.2)

Pipes shall be formed using submerged arc welding (SAW).

4.5 STORAGE, HANDLING AND TRANSPORT (SUBCLAUSE 4.7)

4.5.1 Dunnage and storage (Subclause 4.7.2)

The Contractor shall be responsible to identify suitable pipe stockpile areas in accordance with the areas authorised by the Environmental Management Programme and submit those to the Employer's Agenet and ECO for approval. Pipes can also be off-loaded adjacent to the laying position, provided that it falls within the allowable working width and does not restrict access.

Access for delivery to site is restricted along certain section, especially during poor weather conditions. The Contractor shall make due allowance for such disruption.

5 COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

5.1 HYDRAULIC TEST (SUBCLAUSE 5.5)

In the third paragraph, replace "10 seconds" *with* "3 minutes".

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BILLED ITEMS (SUBCLAUSE 8.2)

8.1.1 Pipe Factory Inspections (New Subclause 8.2.2)

a) Pipe factory inspection ..... Unit: Prov Sum

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[redacted]

b) Overheads, charges and profit on item 8.2.2 a) above.....Unit: %

A provisional sum is allowed to cover the total cost of inspections at the pipe manufacturer's factory. The sum shall include the cost of an independent inspectorate as well as the flights, accommodation and transport for the Employer and Employer's Agent for inspections at the factory.

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1. SCOPE (CLAUSE 1)

This specification shall be applicable to the laying and jointing of steel pipes and steel pipe specials required for this Contract.

2. NORMATIVE REFERENCES (CLAUSE 2)

Include the following under (d) and (e):

(d) Valve specifications

- W&S-BW-01: Standard Specification for Double Flanged Butterfly Valves: November 2013
- W&S-BW-010: Standard Specification for Mechanical Couplings and Adaptors: May 2011
- W&S-BW-015: Standard Specification for Gate Valves: May 2011
- SPE-MM-7022: Air Valves
- SPE-MP-7024 - Pipework Anchors
- SPE-MM-7030: Plunger Valves

(e) Flow meter specifications

- W&S-BW-016: Standard Specification for Electromagnetic Flow Meters: May 2011

3. DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments.

4. REQUIREMENTS (CLAUSE 4)

4.1 MATERIAL (SUBCLAUSE 4.1)

4.1.1 Bricks (Subclause 4.1.6)

Replace the contents of this subclause with the following:

"Bricks shall comply with Specification PD: Building Work."

4.2 PLANT (SUBCLAUSE 4.2)

4.2.1 Handling and rigging (Subclause 4.2.2)

After the word "over-stressed" in the first sentence, insert "or the corrosion protection is damaged"

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4.3 METHODS AND PROCEDURES (SUBCLAUSE 4.3)

4.3.1 Laying (Subclause 4.3.1)

4.3.1.1 Depths and cover (Subclause 4.3.1.4)

Replace the word "1.0 m" *in the first paragraph to read* "1.25 m".

4.3.1.2 Cold bends (Subclause 4.3.1.7)

Add the following:

"Cold bends is not permitted for cement mortar lined pipes"

4.3.2 Jointing Methods (Subclause 4.3.2)

4.3.2.1 Flexible Couplings (Subclause 4.3.2.1)

Add the following:

"Unless otherwise specified, all flange adaptors shall be restrained through an appropriate restraining flange welded onto the adjoining special."

4.3.2.2 Field Welding (Subclause 4.3.2.4)

4.3.2.2.1 General (Subclause 4.3.2.4.1)

Replace the last sentence of the first paragraph with the following: "Field welding will only be permitted on smaller diameter pipes (< DN450) where the internal corrosion protection is by means of a cement mortar lining."

4.3.2.2.2 Fillet welding (Subclause 4.3.2.4.8)

Replace the contents of this clause with the following:

"Pipes and pipe specials smaller than DN450 to be joined by field welding shall be supplied with bell and spigot ends for lap-welded slip joints. The pipes shall be welded externally by means of a concave fillet weld with a throat thickness exceeding the pipe wall thickness. All other requirements as for butt-welding shall be applicable. The internal cement mortar lining shall be made continuous at the pipe joints."

4.3.3 Installation of valves and meters (Subclause 4.3.6)

Add the following:

"Valves and meters supplied and delivered shall comply with the relevant Particular Specifications and amendments."

4.3.4 Casings, anchor blocks and chambers (Subclause 4.3.7)

4.3.4.1 Concrete casing (Subclause 4.3.7.1)

Replace the word "20 MPa/19 mm" *in the first paragraph to read* "30 MPa/19 mm".

Add the following:

"Unless otherwise specified, the contractor shall allow for a minimum reinforcement of 100 kg per cubic meter of concrete.

Where no encasing width or height is given on the drawings, the encasement shall extend 300 mm above and below the pipe and 300 mm on both sides of the pipe."

4.3.4.2 Anchor blocks (Subclause 4.3.7.2)

Replace the word "20 MPa/19 mm" *in the first paragraph to read* "30 MPa/19 mm".

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4.3.4.3 Valve Chambers (Subclause 4.3.7.3)

Delete the last sentence of this subclause.

Add the following to this subclause: "Unless otherwise indicated on the drawings, all manhole covers, and valve boxes shall be Type 2A and 3B in accordance with SANS 1882 respectively. All manhole covers shall be lockable with a stainless-steel locking mechanism. The locks shall have a universal key in accordance with the City of Cape Town requirements. At the end of the project, 5 x copies of the universal key shall be handed over to the employer."

4.3.5 Corrosion Protection (Subclause 4.3.11)

4.3.5.1 Welded field joints (Subclause 4.3.11.2)

Change the heading of this clause to "Welded field joints".

Add the following at the end of this clause:

"Where the diameter of the pipeline is too small for a person to enter the pipe (< DN450), the cement mortar lining shall be made continuous at joints as soon as the welding is completed. The contractor shall submit a method statement for the cement mortar lining repair for approval.

For small diameter pipes (< DN450), the cement mortar lining repairs/infills at site welded field joints shall be inspected in accordance with Subclause 5.1.8."

Add the following after subclause 4.3.11:

4.3.6 Pipe supports (New subclause 4.3.12)

All pipe supports shall be in accordance with SPE-MP-7024 and associated amendments.

4.3.7 Pipe marker posts (New Subclause 4.3.13)

The Contractor shall supply and accurately place marker posts on the centreline of buried pipelines, or as instructed by the Employer's Agent. Marker posts shall be placed at all points of intersection, chambers and at a maximum spacing of 200 m. Marker posts shall be placed only once the pipelines, or any sections thereof, have been successfully tested and the trenches backfilled.

The manufacture, installation and identification marks of marker posts shall comply with the drawings. Where no drawing exists, the Contractor shall propose marker posts that are suitable for the purpose, for approval of the Employer's Agent.

The co-ordinates, level and centreline distance (as determined from the as-built survey and drawings) of each marker post shall be accurately determined and recorded by the Contractor. All details shall be given to the Employer's Agent in writing.

4.3.8 Connecting to existing pipelines (New Subclause 4.3.14)

The Contractor shall complete connections between new and existing pipelines as indicated on the drawings and/or as scheduled. The Contractor shall submit a method statement for approval by the Employer's Agent for each connection to existing pipelines. The method statement shall encompass all necessary works, including, but not limited to, the excavation to expose the existing pipeline, the procurement of the required pipe specials and fittings, isolation and draining of the existing pipeline, cutting the existing pipeline, installing the new connection, applying corrosion protection where applicable, testing the connection, recommissioning the isolated pipeline, backfilling the excavation, and restoring the site to its original condition.

Where connections to existing pipelines are required, the Contractor shall excavate well in advance of work being undertaken to expose the connection point to verify that the assumed fittings are available on site and that the connection as proposed can be made. It should be noted that it may be necessary to expose a full pipe length to verity the size and class of pipe in the ground or to locate an existing fitting or joint.

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The Contractor shall liaise with the service owner of the existing pipeline and any other affected authorities to obtain the necessary approvals for the connection. The connection shall be completed within the timeframe specified by the service owner.

5. COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

5.1 TESTING (SUBCLAUSE 5.1)

5.1.1 Testing of field welds (Subclause 5.1.2)

5.1.1.1 Destruction Tests (Subclause 5.1.2.1)

Delete this subclause and replace with: "Tests as specified in API 1104 Clause 6.5 shall be carried out for each welder utilised by the contractor and approved by the Employer's Agent prior to any field welding being done."

5.1.1.2 Radiographic testing (Subclause 5.1.2.2)

Delete the third sentence of the subclause and replace with "10% of the total length of all manual field butt welds shall be examined radiographically with particular reference to weld intersections, using equipment supplied and staffed by the Inspectorate. The first 10 manual field welds for each welder shall be tested radiographically and shall not be deemed to be included in the overall 10% radiography."

Add the following to the second paragraph: "Welds shall be radiographically tested at regular intervals as determined by the Employer's Agent or Independent Inspectorate."

Delete the wording "or 2.5%" *in the last sentence of the third paragraph."*

5.1.2 Hydrostatic pressure testing (Subclause 5.1.3)

5.1.2.1 Test Pressure and Time of Test (Subclause 5.1.3.2)

The testing pressures for the DN1600 incoming pipeline and the DN1200 outgoing pipeline shall be as shown on drawings 1001757-1000-DRG-CC-1011 and 1001757-1000-DRG-CC-1110 respectively.

The DN1800 bypass pipeline for the reservoir shall be tested at a hydraulic grade line of 256 mamsl. The reservoir's overflow, scour and outlet pipelines will be tested at a hydraulic grade line of 201 mamsl.

Add new subclause after subclause 5.1.7:

5.1.3 Remote video inspection of cement mortar lining for small diameter pipelines (New Subclause 5.1.8)

On small-diameter pipelines where human entry is not possible (<DN450), remote video inspections shall be conducted to assess the integrity of the cement mortar linings after the pipeline has been laid with specific emphasis on the repair/infill at welded field joints. The Contractor shall make available a high-resolution, self-propelled or push-type camera with pan-and-tilt functionality and adequate lighting for this inspection.

The camera will record continuous footage, capturing the cement mortar lining over the entire circumference of the pipe. The video footage together with the associated pipeline chainages will be submitted to the Employer's Agent for approval.

6. TOLERANCES (CLAUSE 6)

No amendments.

7. TESTING (CLAUSE 7)

No amendments.

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8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)

Add the following after subclause 8.1.4:

8.1.1 Pipe Supports (New Subclause 8.1.5)

Except where billed separately, the rates to supply and install pipe specials, valves and meters shall include the cost of the pipe supports required complete with anchoring bolts, grouting and gaskets as indicated on the drawings.

8.2 BILLED ITEMS (SUBCLAUSE 8.2)

8.2.1 INSTALLATION OF VALVES AND METERS (SUBCLAUSE 8.2.3)

Add the following:

"Separate items will be scheduled for each type, size, etc of valve and meter to be installed."

8.2.2 CONCRETE CASING (SUBCLAUSE 8.2.7)

Add the following:

"The rate shall also cover all joints, strapping and other requirements as per Subclause 4.3.7.1.

The contractor's tendered rates shall allow for supplying, bending and fixing a minimum reinforcement of 100 kg per cubic meter of concrete where reinforcement drawings are not available at tender."

8.2.3 VALVE CHAMBERS (SUBCLAUSE 8.2.8)

Add the following:

"The rate shall also cover the casting of all pipes and specials into the concrete, as well as backfilling and finishing the area around the chamber including erosion protection measures (such as Reno Mattresses) as indicated on the drawings.

The contractor's tendered rates shall allow for supplying, bending and fixing a minimum reinforcement of 135 kg per cubic meter of concrete where reinforcement drawings are not available at tender."

8.2.4 PIPE INSTALLATION WITHIN A SLEEVE PIPE (NEW SUBCLAUSE 8.2.14)

The rate shall be extra-over to 8.2.1 for the welding, fixing and testing steel pipes in sleeve pipe complete with trolley system as detailed on the Drawings. The rate shall include for all additional plant and labour required to lift, weld and install the pipes within a sleeve pipe.

The pipe trolley system shall be designed, fabricated, delivered and installed by the Contractor and shall be strong and sturdy enough to support the full pipe weight and capable of being installed within the sleeve pipe.

Measurement will be by meter of steel pipeline installed within a sleeve pipe.

8.2.5 CONNECTING TO EXISTING PIPELINES (NEW SUBCLAUSE 8.2.15)

The rate shall cover the costs to complete connection to existing pipelines as described in 4.3.14.

The tendered rate shall include full compensation for the cost of excavation, lateral support where required, cutting into and connecting to a pipe of size and material as scheduled, isolation, drainage of water, removal of surplus material, all labour and equipment necessary to make the connection, making good and all liaison with the authorities.

The unit of measure will be sum and each connection will be scheduled separately.

The cost of new pipe specials and couplings (where required) will be measured separately.

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8.2.6 PIPE MARKER POSTS (NEW SUBCLAUSE 8.2.16)

The unit of measurement will be the number of marker posts installed.

The tendered rate shall cover all labour, material and plant required to design (where applicable), manufacture, supply and install the marker post in accordance with clause 4.3.13 and the drawings."

8.2.7 MISCELLANEOUS (NEW SUBCLAUSE 8.2.17)

An item which, in the payment clause column of the Bill of Quantities, refers to this clause, will be measured in the unit scheduled. The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

2.1 GENERAL (SUBCLAUSE 2.1)

This specification shall be applicable to all air valves included in the civil works, as well as to air valves in the mechanical works where this specification is specifically referenced in the Detailed Mechanical Specifications.

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

All air valves shall be triple orifice anti slam air valves with the three orifices functioning as follows:

- Large Orifice: Activates under subcritical airflow for rapid air release during pipeline filling or rapid air intake during negative/vacuum pressures.
- Anti-Shock Orifice: Engages during supercritical airflow to allow controlled release of air during water hammer conditions.
- Small Orifice: Permits the continuous pressurized release of air during normal operating conditions.

The air discharge and area intake capabilities of the air valves under subcritical conditions shall be comparable those of recognised air valve suppliers such as A.R.I. or Vent-O-Mat or equivalent.

Where scheduled, the air valve shall include a bias mechanism to ensure drop tight sealing for differential pressures between 0 and 0.45 bar.

All other requirements of Subclauses 5.1 and 5.2 shall apply.

6. OPERATION AND CONTROL (CLAUSE 6)

No amendments

7. EQUIPMENT CONSTRUCTION AND DESIGN (CLAUSE 7)

7.1 GENERAL (SUBCLAUSE 7.1)

The air valves shall be designed for potable water applications.

7.2 CONSTRUCTION (SUBCLAUSE 7.3)

Add the following

"The air valves or air valve stubs shall be fitted with a ½ inch BST connection and plug to allow the insertion of pressure gauges for pipeline performance testing."

8. FASTENERS (CLAUSE 8)

No amendments

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9. MATERIALS AND COATINGS (CLAUSE 9)

Add the following to this clause:

"The air valve barrel shall be Grade 316L stainless steel. Internal metal parts (e.g. float guide, nozzle, baffle plate, etc.) shall be Grade 316L stainless steel unless otherwise approved by the Employer's Agent. External metal parts (e.g. tie rods) shall be Grade 304L stainless steel."

10. INSTALLATION (CLAUSE 10)

Delete this clause and replace with the following:

"The air valve shall be installed as shown on the drawings. The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.

d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.

e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

11. CIVIL AND BUILDING MATTERS (CLAUSE 11)

No amendments

12. INSPECTIONS (CLAUSE 12)

No amendments

13. TESTING REQUIREMENTS (CLAUSE 13)

Witnessing of factory testing is not required. However, a test report/certificate shall be submitted to the Employer's Agent before valve is dispatched from the factory or workshop.

14. MISCELLANEOUS (CLAUSE 14)

No amendments

Add the following new Clause:

15. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 15)

The Contractor shall complete and submit the air valve technical datasheets, as included in the Detailed Civil and Pipeline Specifications, to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project. Additionally, together

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with the technical datasheets, the Contractor shall also submit all relevant brochures, drawings, and manufacturer datasheets.

16. MEASUREMENT AND PAYMENT (NEW CLAUSE 16)

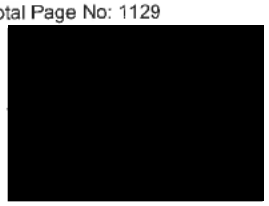
16.1 SUPPLY AND DELIVER AIR VALVES (NEW SUBCLAUSE 16.1)

Separate items will be scheduled for each type, size, etc of valve and each type of end connection or coupling stated. The rate shall cover the cost of the provision of each valve, complete with couplings, gaskets and valve and pipe anchors/supports, and the cost of delivering the valves to site, temporary storage thereof and all testing specified.

The installation of the valves is covered under Clause 8.2.3 of SPE-CC-7003.

Valve type, size, working pressure, end connections stated..... Unit: No"

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12. MEASUREMENT AND PAYMENT (NEW CLAUSE 12) 3

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

Add the following:

"This Specification covers the supply and delivery of pipe supports required in the civil works for this Contract, as well as pipe supports required in the mechanical works where this specification is specifically referenced in the Detailed Mechanical Specifications."

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. PERFORMANCE REQUIREMENTS (CLAUSE 4)

No amendments

5. EQUIPMENT CONSTRUCTION AND DESIGN (CLAUSE 5)

5.1 GENERAL (SUBCLAUSE 5.1)

In the first sentence, replace the words "each pump individually and during operation of the pump station as a whole" *with* "the individual and overall systems".

Add to the end of the clause:

"Steel pipe supports in valve chambers shall be manufactured from the same material as the pipework to be supported or from Grade S 275 JR."

6. FABRICATION (CLAUSE 6)

Replace the clause contents with the following:

6.1 GENERAL (NEW SUBCLAUSE 6.1)

Fabrication shall comply with Clause D4 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment.

Sharp edges, pits, inclusions, weld spatter, undercuts, indentations or other surface defects are not acceptable.

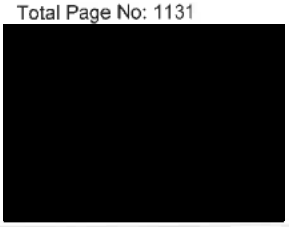
Edges shall be rounded to a radius of at least 2 mm.

Designs shall avoid inaccessible pockets and hollows.

Sharp edges on items fabricated from thin sheets will not be acceptable and sharp edges shall preferably be avoided by good design.

Inspection of fabrications shall generally be done after fabrication is complete.

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7. FASTENERS (CLAUSE 7)

Replace the last sentence of this clause with the following:

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

8. CORROSION PROTECTION (CLAUSE 8)

No amendments

9. INSTALLATION (CLAUSE 9)

Replace the clause contents with the following:

"The Works shall comply with the following:

a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.

d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.

e) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.

f) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

10. INSPECTIONS (CLAUSE 10)

No amendments

11. DOCUMENTS TO BE PROVIDED (CLAUSE 11)

No amendments

Add the following new Clause:

12. MEASUREMENT AND PAYMENT (NEW CLAUSE 12)

The rates for the design, fabrication, corrosion protection and installation of pipe and valve support / anchors shall be deemed to be included in the rates of the items being supported (refer to Clause 8.2.13 of SPE-CC-7003), unless scheduled separately.

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17 CIVIL AND BUILDING MATTERS (CLAUSE 17) 4
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20 TESTING AND REQUIREMENTS (CLAUSE 20) 4
20.1 FACTORY, ETC. (SUBCLAUSE 20.1) 4
21 DOCUMENTATION TO BE PROVIDED (CLAUSE 21) 5
22 MEASUREMENT AND PAYMENT (NEW CLAUSE 22) 5
22.1 SUPPLY AND DELIVER PLUNGER VALVES (NEW SUBCLAUSE 22.1) 5

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[redacted]

1 INTRODUCTION (CLAUSE 1)

No Amendments

2 SCOPE (CLAUSE 2)

Add the following:

"This Specification covers the supply and delivery of plunger valves required in the civil works for this Contract, as well as plunger valves required in the mechanical works where this specification is specifically referenced in the Detailed Mechanical Specifications.

The general arrangement and details of these valves are shown on the drawings."

3 NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 and SPE-MM-6004 from the list.

4 EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5 PERFORMANCE REQUIREMENTS (CLAUSE 5)

5.1 GENERAL (SUBCLAUSE 5.1)

Add the following:

Two plunger valves will be installed in the control valve chambers on the DN1200 outgoing pipeline. These plunger valves shall be electrically actuated and able to control the continuous outflow from the 300 Mℓ Muldersvlei reservoir within a range of 50 Mℓ/d to at least 220 Mℓ/d under parallel operation. The table below shows the performance requirements for each of the two plunger control valves when operating in parallel. The valve shall be capable of achieving the high and low flow scenarios within the maximum and minimum valve opening percentage limits for continuous operation as recommended by the manufacturer. The plunger control valve shall have a pressure rating of at least PN10.

Table 1: Plunger Control Valve Performance Requirements

Flow Scenarios	P1 (m)	P2 (m)	ΔP (m)	Flow (Mℓ/d)
High Flow	46.2	41	5.2	110
Low Flow	51.5	2.5	49.1	25
No Flow (Static)	53	2.4	50.6	0

6 OPERATION AND CONTROL (CLAUSE 6)

Add the following:

"The valve shall be remotely controlled as per the *Control Narrative* included in C3.7.4. The valve shall be fully integrated into the City of Cape Town SCADA as per the *Detailed Electronic Specifications* included in C3.7.9."

7 VALVE DESIGN AND CONSTRUCTION (CLAUSE 7)

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7.1 General (Subclause 7.1)

Replace the last paragraph with the following: "A control device with slotted or circular orifices shall be provided as required to meet the performance requirements specified above."

Add the following: "The flange drilling shall match the flange drillings specified for the pipeline."

7.2 Gearboxes (Subclause 7.2)

Delete the contents of this clause and replace with the following:

"Gearboxes shall comply with the requirements of Clause D22.3 of the City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment.

Gearboxes shall be selected to achieve the specified operating torque.

Gearbox external surfaces shall be provided with a coating suitable for the high corrosivity category (C4 of SANS 12944-2) and the dry film thickness shall not be less than 200 microns."

8 VALVE SUPPORTS (CLAUSE 8)

No Amendments

9 ACTUATOR (CLAUSE 9)

Delete the contents of this clause and replace with the following:

"Where automatic operation is specified or scheduled, the valve shall be supplied with an electrical actuator in accordance with Clause D16.2 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment. The minimum opening and closing period for the valve shall not be less than 15 minutes."

10 PIPE COUPLINGS (CLAUSE 10)

No Amendments

11 PRESSURE GAUGES (CLAUSE 11)

Delete the last sentence of this clause and replace with the following: "Pressure gauge shall comply with Clause D44.2.3 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment."

12 MATERIALS AND COATINGS (CLAUSE 12)

12.1 General (Subclause 12.1)

Delete the second sentence of this subclause that refers to SPE-MM-0001.

13 FABRICATION (CLAUSE 13)

Delete the contents of this clause and replace with the following: "Fabrication shall comply with Clause D4 of City of Cape Town's Standard Specification for Design-Build of Mechanical Equipment."

14 FASTENERS (CLAUSE 14)

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Delete the last sentence of the clause and replace with the following: "Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001.

M12 fasteners and smaller shall be of EN Grade 1.4401 (316) or better. Fasteners larger than M12 which are in non-corrosive areas shall, except when specified otherwise, be hot-dip galvanized. Plated fasteners are not acceptable."

15 SPARES (CLAUSE 15)

No Amendments

16 INSTALLATION (CLAUSE 16)

Delete the contents of this clause and replace with the following: "The valve shall be configured as shown on the drawings. The installation shall comply with SPE-CC-7003."

17 CIVIL AND BUILDING MATTERS (CLAUSE 17)

No Amendments

18 SAFETY (CLAUSE 18)

No Amendments

19 INSPECTIONS (CLAUSE 19)

19.1 Workshop/Factory (Subclause 19.1)

Delete the contents of this clause and replace with the following:

"The Contractor shall make all arrangements and carry all costs for the Employer and the Employer's Agent, or approved representatives, to inspect the workshop facilities of the manufacturer prior to dispatch whether the valve is manufactured locally or internationally.

Fabrications must be inspected by the Employer's Agent, or approved representatives, after fabrication is complete but prior to corrosion protection.

If the Employer's Agent, or a representative of the Employer's Agenet, cannot attend the factory inspections, the Contractor shall make all arrangements and carry all costs for an independent inspection authority, approved by the Employer's Agent, to inspect the equipment in the manufacturer's works prior to dispatch. The inspection authorities' inspection shall include a full report on compliance of the equipment with the specifications and this report shall be submitted to the Engineer prior to dispatch from the manufacturer's works."

20 TESTING AND REQUIREMENTS (CLAUSE 20)

20.1 Factory, etc. (Subclause 20.1)

Add the following to this subclause:

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[redacted]

"Factory performance testing shall be conducted for all valve DN400 and larger. The Contractor shall arrange and carry all costs for the Employer and Employer's Agent, or approved representatives, to witness the performance testing of the valve at the factory."

21 DOCUMENTATION TO BE PROVIDED (CLAUSE 21)

Add the following:

"The Contractor shall complete and submit the plunger valve technical datasheet, as included in the Detailed Civil and Pipeline Specifications, to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project. Additionally, together with the technical datasheets, the Contractor shall also submit all relevant brochures, drawings, and manufacturer datasheets."

Add the following new Clause:

22 MEASUREMENT AND PAYMENT (NEW CLAUSE 22)

22.1 Supply and deliver plunger valves (New subclause 22.1)

Separate items will be scheduled for each type, size, etc of valve and each type of end connection or coupling stated. The rate shall cover the cost of the provision of each valve, complete with couplings, gaskets and valve and pipe anchors/supports, and the cost of testing, inspections and delivering the valves to site and temporary storage thereof.

The installation of the valves is covered under Clause 8.2.3 of SPE-CC-7003.

Valve type, size, working pressure, end connections stated..... Unit: No"

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3.7.6.2 BULK PIPELINE DATA SHEETS

The following data sheets are applicable to bulk pipeline works. These data sheets shall be completed and submitted with relevant supporting documentation to the Employer's Agent for approval before the procurement of the relevant equipment.

Number	Data Sheet Description	Pages
-	Summary Page	1
1001757-1000-DST-CC-0001	Bulk Pipeline Air Valves	1
1001757-1000-DST-CC-0002	Bulk Pipeline Eccentric Axis Butterfly Valves	2
1001757-1000-DST-CC-0003	Bulk Pipeline Metal Seated Wedge Gate Valves	1
1001757-1000-DST-CC-0004	Bulk Pipeline Resilient Seal Gate Valves	1
1001757-1000-DST-CC-0005	Bulk Pipeline Plunger Valves	1
1001757-1000-DST-CC-0006	Bulk Pipeline Pipe Couplings	1
		8

In the event of any discrepancy between the project specifications and the information contained on the data sheet, the project specifications shall take precedence.

		Muldersvlei Reservoir and Assosciated Infrastructure
TITLE	CLIENT No. **194C-BW-WP037**	PAGE
BULK PIPELINE DATASHEET SUMMARY	ZUTARI No. **1001757**	REV. T0

Title:	Muldersvlei Reservoir and Assosciated Infrastructure
Client:	City of Cape Town
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757
Process Area/Unit	Bulk Pipelines

BULK PIPELINES TECHNICAL DATASHEETS

NUMBERING	DATASHEET DESCRIPTION
1001757-1000-DST-CC-0001	BULK PIPELINE AIR VALVES
1001757-1000-DST-CC-0002	BULK PIPELINE ECCENTRIC AXIS BUTTERFLY VALVES
1001757-1000-DST-CC-0003	BULK PIPELINE METAL SEATED WEDGE GATE VALVES
1001757-1000-DST-CC-0004	BULK PIPELINE RESILIENT SEAL GATE VALVES
1001757-1000-DST-CC-0005	BULK PIPELINE PLUNGER VALVES
1001757-1000-DST-CC-0006	BULK PIPELINE PIPE COUPLINGS

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DATA SHEET No. 1001757-1000-DST-CC-0001: BULK PIPELINE AIR VALVES

CLIENT No. 194C-BW-WP037 | PAGE

ZUTARI No. 1001757 | REV. T0

Rev.	Descriptrion	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0001: BULK PIPELINE AIR VALVES	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0001
BULK PIPELINE AIR VALVES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	AIR VALVE (REFER TO SPE-MM-7022 AND AMENDMENTS)			
1	**Valve Details**			
1.01	Make			
1.02	Model			
1.03	Type and design			
1.04	County of manufacture			
1.05	Project Reference/Tag Number			
1.06	Size	*DN*		
1.07	Flanged or Threaded		Flanged	
1.08	Flange Drilling Pattern		To match adjoining pipe	
1.09	Mass	*kg*		
2	**Materials**			
2.01	Material of body		Ductile iron	
2.02	Material of floats		HDPE or similar	
2.03	Material of seal		Nitrile rubber	
2.04	Material of fasteners		Stainless Steel	
2.05	Material of air port screen		Stainless Steel	
3	**Corrosion Protection**			
3.01	Surface preperation		Sa 2.5	
3.02	Corrosion Potection Type		Fusion Bonded Epoxy/Rilsan	
3.03	Dry Film Thickness (where applicable)	*µm*	200	
3	**Performance**			
3.01	Maximum working pressure	*bar*	10	
3.04	Anti-slam design	*Yes/No*	Yes	
3.05	Large Orifice Closing Differential Pressure	*kPa*	4 - 6	
3.06	Bias mechanism for sealing at low pressures	*Yes/No*		
3.07	Minimum seating/sealing pressure	*bar*	Without Bias Mechanism - 0.45 With Bias Mechanism -0.0	
4	**Equipment Eligibility**			
4.10	Technical Support and Spares in RSA (Year before tender)			
4.11	Name			
4.12	Address			
4.13	Telephone no.			
4.20	Technical Support and Spares in RSA (Two years before tender)			
4.21	Name			
4.22	Address			
4.23	Telephone no.			
4.30	Technical Support and Spares in RSA (Three years before tender)			
4.31	Name			
4.32	Address			
4.33	Telephone no.			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ ***Signature:*** _____

[redacted]

		Muldersvlei Reservoir and Assosciated Infrastructure	
DATA SHEET No. 1001757-1000-DST-CC-0002: BULK PIPELINE ECCENTRIC AXIS BUTTERFLY VALVES		CLIENT No. 194C-BW-WP037	PAGE
		ZUTARI No. 1001757	REV. T0

Rev.	Description	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0002: BULK PIPELINE ECCENTRIC AXIS BUTTERFLY VALVES	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0002
BULK PIPELINE ECCENTRIC AXIS BUTTERFLY VALVES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	ECCENTRIC AXIS BUTTERFLY VALVE (REFER TO W&S-BW01 AND AMENDMENTS)			
1	**Design and Construction**			
1.01	Make			
1.02	Model			
1.03	Size	*DN*		
1.04	Pressure Rating	*PN*	10	
1.05	Project Reference/Tag Number			
1.06	Flange Standard		EN 1092	
1.07	Flange Drilling Pattern		To match adjoining pipe	
1.08	Disc Eccentricity		Double	
1.09	Country of manufacture			
1.10	Seat retainer details and removal procedure		Removable seals shall be either stainless steel obronze mechanically held in place with either stainless steel or bronze studs respectively screwed into the body.	
1.11	Shape of cross-section of seal		O-ring/dovetail music nota/wedge/tadpioe/dumb-bell	
1.12	Gearbox ratio			
1.13	Torque-slip device details		A torque-slip device shall be fitted such that the hand wheel slips automatically in positive steps to limit the maximum possible torque to the gearbox.	
1.14	Torque limit			
1.15	Shut-off test Pressure [differential Pressure across disc]	*m*		
2	**Materials**			
2.01	Material of body		Ductile iron or cast steel	
2.02	Material of disc		Ductile iron or cast steel	
2.03	Seal retainer ring, Retainer fasteners and Seal seat		SS316	
2.04	Seal retainer ring fasteners		SS316	
2.05	Seal seat		SS316	
2.06	Handwheels		Cast or forged metal	
2.07	Shafts		Stainless steel	
2.08	Shaft bearings		Self-lubricating polymer or non-ferrous metal	
2.09	Valve Fasteners		SS316	
2.10	External metal components		SS316	
3	**Corrosion Protection**			
3.01	Surface Preperation		Sa 2.5	
3.02	Type of coating for exposed internal and external surfaces		Fusion Bonded Epoxy	
3.03	Coating dry film thickness	µm	400	
4	**Performance Requirements**			
4.01	Does valve shut off tight in both directions against the maximum working pressure?	*Yes/No*	Yes	
4.02	Will disc movement interfere with the inside of the pipe lining?	*Yes/No*	No	
4.03	Details of eccentricities and offsets to the disc closing action against the seat			
4.04	Details of thrust bearings			
4.05	Operating torque at rated pressure	*Nm*		
5	**Testing Requirements**			
5.01	Body casing test Pressure	*m*	1.5 × valve PN rating	
6	**Equipment Eligibility**			
6.01	Technical Support and Spares in RSA (Year before tender)			
6.02	Name			
6.03	Address			
6.04	Telephone no.			
6.05	Technical Support and Spares in RSA (Two Years before tender)			
6.06	Name			
6.07	Address			
6.08	Telephone no.			
6.09	Technical Support and Spares in RSA (Three years before tender)			
6.10	Name			
6.11	Address			
6.12	Telephone no.			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ *Signature:* _____

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		Muldersvlei Reservoir and Assosciated Infrastructure
DATA SHEET No. 1001757-1000-DST-CC-0003: BULK PIPELINE METAL SEATED WEDGE GATE VALVES	CLIENT No. 194C-BW-WP037	PAGE
	ZUTARI No. 1001757	REV. T0

Rev.	Descriptrion	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0003: BULK PIPELINE METAL SEATED WEDGE GATE VALVES	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0003
BULK PIPELINE METAL SEATED WEDGE GATE VALVES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	METAL SEATED WEDGE GATE VALVE (REFER TO W&S-BW15 AND AMENDMENTS)			
1	**Valve Details**			
1.01	Make			
1.02	Model			
1.03	Type and description			
1.04	Mass	*kg*		
1.05	Size	*DN*		
1.06	Pressure Rating	*PN*	10	
1.07	Project Reference/Tag Number			
1.08	Flange Standard		EN 1092	
1.09	Flange Drilling Pattern		To match adjoining pipe	
1.10	Country of manufacture			
2	**Materials**			
2.01	Body		Cast iron or cast steel	
2.02	Guides and Wedge Shoes		Copper based alloy or of engineering plastic or of stainless steel	
2.03	Body Seat Ring		Stainless Steel	
2.04	Wedge Seat Ring		Stainless Steel	
2.05	Spindle		Martensitic Stainless Steel	
2.06	Fasteners		EN Grade 1.4401 (316)	
2.07	External metal components		EN Grade 1.4401 (316)	
3	**Corrosion protection**			
3.01	Surface preperation		Sa 2.5	
3.02	Valve body coating		Fusion Bonded Epoxy	
3.03	Coating dry film thickness	*µm*	250	
4	**Performance Requirements**			
4.01	Maximum permissible velocity through valve (m/s)	*m/s*		
5	**Operation and Control**			
5.01	Handwheel diameter (mm)	*mm*		
5.02	Method of indicating gate position			
5.03	Gearbox ratio (if applicable)		02:01	
5.04	Gearbox over-torque limiting device		Spur reduction	
5.05	Maximum peripheral force for opening valve	*N*	250	
6	**Equipment Eligibility**			
6.01	Technical Support and Spares in RSA (Three years before tender)			
6.02	Name			
6.03	Address			
6.04	Telephone no.			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ *Signature:* _____

[redacted]

DATA SHEET No. 1001757-1000-DST-CC-0004: BULK PIPELINE RESILIENT SEAL GATE VALVES

CLIENT No. 194C-BW-WP037 | PAGE

ZUTARI No. 1001757 | REV. T0

Rev.	Description	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0004: BULK PIPELINE RESILIENT SEAL GATE VALVES	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0004
BULK PIPELINE RESILIENT SEAL GATE VALVES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	RESILIENT SEAL GATE VALVE (REFER TO W&S-BW15 AND AMENDMENTS)			
1	**Design and Construction**			
1.01	Make			
1.02	Model			
1.03	Type and description			
1.04	Complies with SANS 665	Yes/No	Yes	
1.05	Pressure rating	PN	10	
1.06	Maximum differential pressure	m		
1.07	Size	DN		
1.08	Handwheel diameter	mm		
1.09	Face to face dimension	mm		
1.10	Mass	kg		
1.11	Country of manufacture			
1.12	Project Reference/Tag Number			
1.13	Flange Standard		EN 1092	
1.14	Flange Drilling Pattern		To match adjoining pipe	
2	**Materials**			
2.01	Body, bonnet, gate, handwheels		Ductile iron, cast iron or cast steel	
2.02	Gate Liner		Vulcanised EPDM	
2.03	Spindle		Martensitic Stainless Steel	
2.04	Spindle nut		Aluminium bronze	
2.05	Fasteners		EN Grade 1.4401 (316)	
2.06	External metal and components		EN Grade 1.4401 (316)	
3	**Corrosion protection**			
3.01	Surface preperation		Sa 2.5	
3.02	Valve body coating		Fusion Bonded Epoxy	
3.03	Coating dry film thickness	µm	250	
4	**Performance Requirements**			
4.01	Gate liner's capacity to accommodate foreign matter (particle size in mm)	mm		
4.02	Maximum permissible velocity through valve	m/s		
4.03	Max. required operating torque for valve's rated pressure	Nm	700	
4.04	Max. required operating torque for this application	Nm		
5	**Operation and Control**			
5.01	Description of spindle sealing arrangement			
5.02	Method of indicating gate position			
5.03	Gearbox ratio (if applicable)			
5.04	Description of gearbox over-torque limiting device			
6	**Equipment Eligibility**			
6.01	Spares supplier and address			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ *Signature:* _____

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		Muldersvlei Reservoir and Assosciated Infrastructure				
DATA SHEET No. 1001757-1000-DST-CC-0005: BULK PIPELINE PLUNGER VALVES		CLIENT No. 194C-BW-WP037				PAGE
		ZUTARI No. 1001757				REV. T0

Rev.	Description	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0005: BULK PIPELINE PLUNGER VALVES	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0005
BULK PIPELINE PLUNGER VALVES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	ECCENTRIC AXIS BUTTERFLY VALVE (REFER TO SPE-MM-7030 AND AMENDMENTS)			
1	**Design and Construction**			
1.01	Make			
1.02	Model			
1.03	Size	*DN*		
1.04	Mass (kg)	*kg*		
1.05	County of manufacture			
1.06	Spares supplier and address			
1.07	Pressure Rating	*PN*	10	
1.08	Project Reference/Tag Number			
1.09	Flange Standard		EN 1092	
1.10	Flange Drilling Pattern		To match adjoining pipe	
2	**Performance Requirements**			
2.01	Maximum design body pressure (m)	*m*		
2.02	Maximum allowable pressure across valve (m)	*m*		
2.03	Body casing test pressure (m)	*m*		
2.04	Shut-off test pressure [differential pressure across valve] (m)	*m*		
2.05	Overall length (mm)	*mm*		
2.06	Design conditions (m3/s @ m)	*m3/s @m*		
2.07	Maximum permissible flow through valve (m3/s)	*m3/s*		
2.08	Operating torque [or force] for this application (Nm [or N])	*Nm*		
2.09	Closing torque [or force] (Nm [or N])	*Nm*		
3	**Materials**			
3.01	Valve Body		Ductile iron	
3.02	Plunger		Stainless steel	
3.03	Plunger Guides		Non-ferrous metal or stainless steel (of a different hardness to the plunger)	
3.04	Seal retaining ring		Stainless steel	
3.05	Linkages		Stainless steel or coated cast iron	
3.06	Pins		Stainless steel	
3.07	Drive shaft		Stainless steel	
3.08	Bushes		Bronze (not brass) or a load bearing engineering plastic	
3.09	Valve trim (seat ring and control sleeve)		Martensitic stainless steel	
3.10	Handwheel		cast iron or cast aluminium	
3.11	Fasteners		EN Grade 1.4401 (316)	
3.12	External metal components		EN Grade 1.4401 (316)	
4	**Corrosion Protection**			
4.01	Surface preperation		Sa 2.5	
4.02	Valve body coating		Fusion Bonded Epoxy	
4.03	Linkages coating		Fusion Bonded Epoxy	
4.04	Coating dry film thickness	*µm*	200	
5	**Operation and Control**			
5.01	Seal removal procedure			
5.02	Does valve shut off drop tight against the maximum working pressure?	Yes/No	Yes	
5.03	Describe detail of sleeve design and flow pattern			

[redacted]

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
6	Equipment Eligibility			
6.01	Technical Support and Spares in RSA (Year before tender):			
6.02	Name			
6.03	Address			
6.04	Telephone no.			
6.05	Technical Support and Spares in RSA (Two years before tender):			
6.06	Name			
6.07	Address			
6.08	Telephone no.			
6.09	Technical Support and Spares in RSA (Three years before tender):			
6.10	Name			
6.11	Address			
6.12	Telephone no.			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ ***Signature:*** _____

[redacted]

		Muldersvlei Reservoir and Assosciated Infrastructure	
DATA SHEET No. 1001757-1000-DST-CC-0006: BULK PIPELINE PIPE COUPLINGS		CLIENT No. 194C-BW-WP037	PAGE
		ZUTARI No. 1001757	REV. T0

Rev.	Description	By	Ckd	APP.	Aut.	Date
T0	DATA SHEET No. 1001757-1000-DST-CC-0006: BULK PIPELINE PIPE COUPLINGS	EG	IM	SK		26/09/2024

DATA SHEET No. 1001757-1000-DST-CC-0006
BULK PIPELINE PIPE COUPLINGS

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	PIPE COUPLINGS/FLANGE ADAPTERS (REFER TO W&S-BW10 AND AMENDMENTS)			
1	**Design and Construction**			
1.01	Fabricator			
1.02	Make			
1.03	Model			
1.04	Type and design		Sleeve type	
1.05	Size	*DN*		
1.06	Pressure rating	*PN*		
1.07	Country of manufacture			
1.08	Project Reference/Tag Number			
1.09	Flange Standard		EN 1092	
1.10	Flange Drilling Pattern		To match adjoining pipe	
2	**Materials**			
2.01	Metal Castings		Ductile iron or stainless steel	
2.02	Fasteners, including studs welded to flanges		Stainless steel	
3	**Corrosion Protection**			
3.01	Surface preparation		Sa 2.5	
3.02	Corrosion Protection Type		Fusion Bonded Epoxy and Petrolatum Tape Wrapping	
3.03	Coating dry film thickness	µm	250	
4	**Equipment Eligibility**			
4.01	Technical Support and Spares in RSA (Year before tender):			
4.02	Name:			
4.03	Address:			
4.04	Telephone no.			
4.05	Technical Support and Spares in RSA (Two years before tender):			
4.06	Name:			
4.07	Address:			
4.08	Telephone no.			
4.09	Technical Support and Spares in RSA (Three years before tender):			
4.10	Name:			
4.11	Address:			
4.12	Telephone no.			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ *Signature:* _____

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3.7.7 MECHANICAL SPECIFICATION

The mechanical specifications consist of the following sections:

3.7.7.1 DETAILED MECHANICAL SPECIFICATION
3.7.7.2 MECHANICAL DATA SHEETS

3.7.7.1 DETAILED MECHANICAL SPECIFICATIONS

The Detailed Mechanical Specification is included immediately hereafter, comprising 160 pages.

These specifications shall be read in conjunction with the relevant Particular Specifications and form an integral part of this contract.

In the event of any discrepancy between these specifications and a part of the Particular Specifications, the schedule of quantities, or the drawings, these specifications shall take precedence.

In certain clauses the Particular Specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the specifications. It also contains additional specifications required for this particular Contract.

Replace the term "Engineer" wherever it may occur in any of the specifications with "Employer's Agent".

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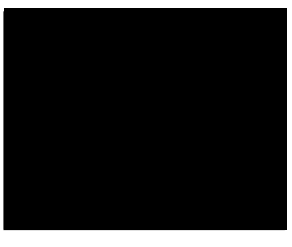
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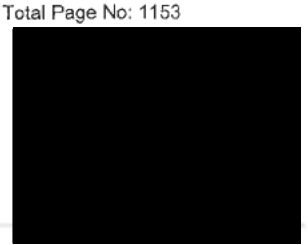
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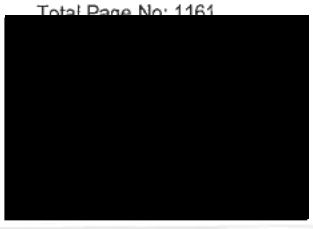
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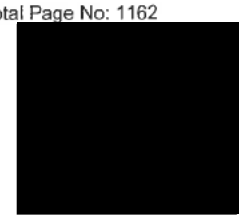
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1. EQUIPMENT FOR SALT DISSOLUTION TANKS

1.1 SCOPE

1.1.1 INTRODUCTION

This specifies the requirements for the equipment and pipework around the salt dissolution tanks to be provided by the Contractor.

1.1.2 CONFIGURATION

Saturated brine solution shall be produced by the dissolution of granular sodium chloride in softened water. The softened water will be prepared in the on-board softeners in the sodium hypochlorite generation skids. The dissolution shall take place in two (2) concrete tanks in a duty/standby configuration.

The salt dissolution tanks are represented in the following drawings:

- 1001757-2000-PID-PP-2050 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric views
- 1001757-2000-DRG-MM-2761 General arrangement
- 1001757-2000-DRG-MM-2767 Plan view
- 1001757-2000-DRG-MM-2768 Isometric and sectional Views

1.1.3 KEY ELEMENTS

- Softened water supply pipework and valves
- Pipework for level monitoring instrumentation
- Tank connections and lid cover
- Internal tank filters and pipework
- Non-electronic instrumentation
- Safety Equipment
- Spares
- First fill of chemical

1.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

1.1.5 OTHER ELEMENTS

Other work, materials, and equipment ancillary to the key elements above, which are required to enable works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

1.2 NORMATIVE REFERENCES

- SANS 1200 G
- SANS 1200 H

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- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

1.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

IP Ingress Protection

SCADA Supervisory Control and Data Acquisition

1.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

1.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect, and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

1.6 PERFORMANCE REQUIREMENTS

This section provides the overall performance requirements of the salt dissolution tanks. The Contractor shall refer to the descriptions of each key element (as listed above) for detailed descriptions of each element's performance requirements. The detailed descriptions include images from the relevant P&IDs for further clarity.

Each salt dissolution tank shall receive 192 L/hr of softened water from the on-board water softeners on the four (4) sodium hypochlorite generation skids. Granular sodium chloride salt shall be added to the salt dissolution tanks to produce fully saturated (approximately 26.4 wt%) brine solution. Under normal operation, a total of 192 L/hr of brine solution shall be produced. However, the Contractor shall size the pipework to allow for a total of 384 L/hr of brine.

Level monitoring in the tanks shall be accomplished by means of four (4) level switches. In addition, the salt level in the tanks shall be monitored using a radar salt level monitor in each tank.

1.7 OPERATION AND CONTROL

The level switches on each salt dissolution tank shall be used by the PLC to control the opening and closing of the actuated valves on the softened water feed lines to the salt dissolution tanks.

Operation and control are specified in further detail in Section C3.7.4.

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1.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

a) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

b) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

1.9 SOFTENED WATER SUPPLY PIPEWORK AND VALVES

The Contractor shall provide all the required pipework to convey softened water from the water softener installed on each sodium hypochlorite generation skid to the salt dissolution tanks. The battery limit for this pipework shall begin at the actuated valve on the softened water exiting the on-board softener in the sodium hypochlorite generation skid (see Figure 1).



Figure 1: Pipework and actuated valve on softened water discharge line from duplex softener

Figure 2 below shows the softened water supply pipework to the salt dissolution tanks as presented on the P&ID. The softened water pipes from the water softeners on each of the four (4) sodium hypochlorite generation skids shall feed into a common header before

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branching out into two (2) pipelines that feed the respective salt dissolution tanks.

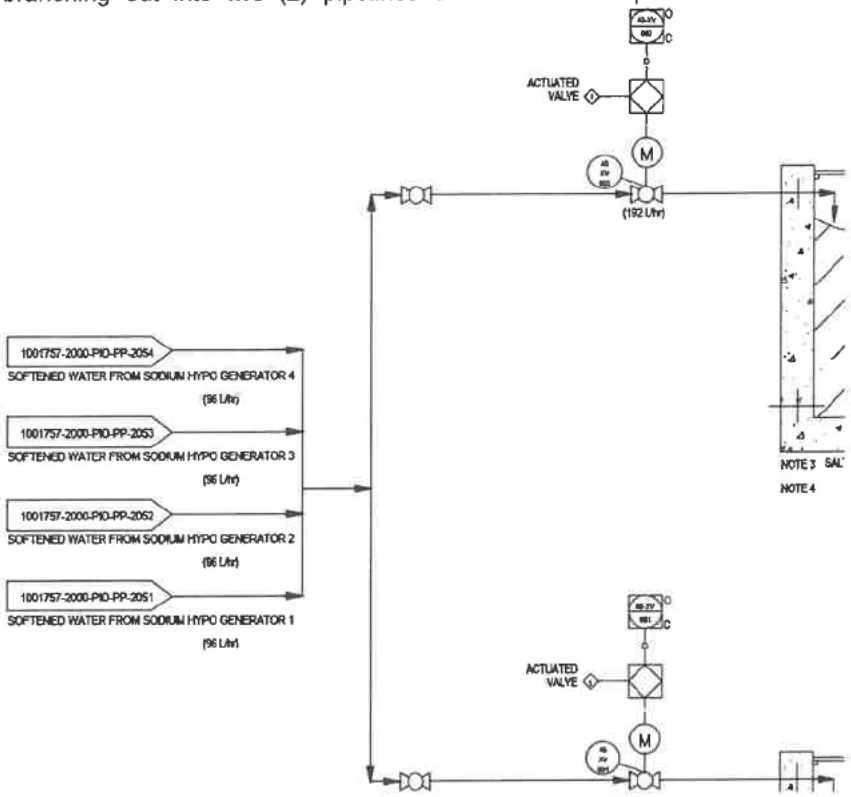


Figure 2: Salt dissolution tanks softened water inlet pipework and instrumentation

The softened water pipes from the sodium hypochlorite generation skids shall each be sized to convey 96 L/hr of water and the salt dissolution tank inlet pipes shall be sized to allow for a flow rate of up to 194 L/hr. All pipework shall be stainless steel 316 complying with Clause D11.1.2 in Section D. The pipework shall be sized according to Clause D11.2.2 in Section D.

The softened water supply pipe to each salt dissolution tank shall be fitted with a manual ball valve for isolation purposes, followed by an actuated ball valve to control the tank water level. The OPEN/CLOSE status of each actuated valve shall be displayed on the SCADA system. Valves and fittings shall have the same nominal size and pressure rating as the corresponding pipework. The ball isolation valve shall be a full bore 3-piece stainless steel 316 ball valve. The valve shall be of a similar construction to the pipework, complying with Clause D15 in Section D. The valve actuator shall comply with Clause D16 in Section D.

The inlet pipe shall feed the top of each tank, above the water surface. Puddle pipes for the connection to the concrete salt dissolution tank shall be provided by Others.

1.10 PIPEWORK FOR LEVEL MONITORING INSTRUMENTATION

The Contractor shall supply the pipework for the installation of level monitoring instrumentation in the salt dissolution tanks. Figure 3 below shows the installation of level monitoring instrumentation on the tanks, as presented on the relevant P&ID.

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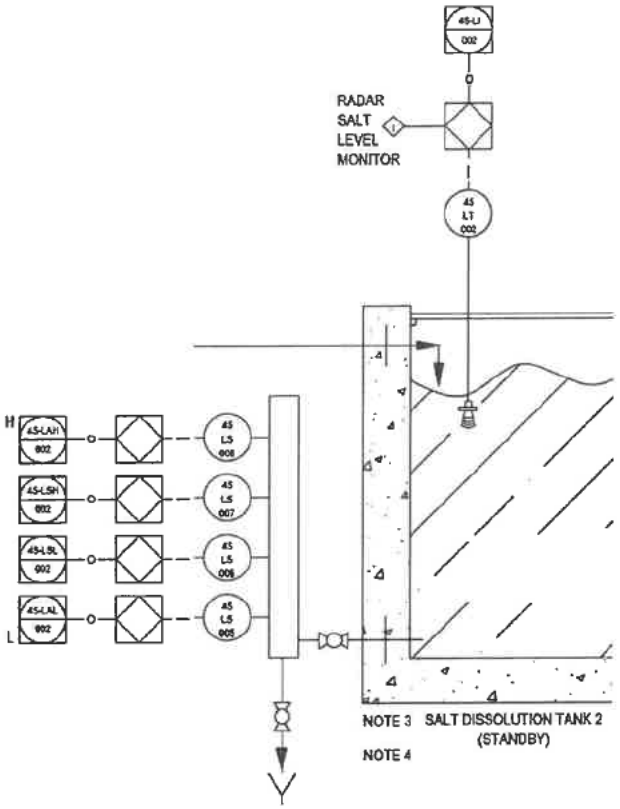


Figure 3: Pipework for Level Monitoring Instrumentation on Salt Dissolution Tank

Each salt dissolution tank shall be equipped with an external standpipe which shall be used to install level instrumentation. The standpipe shall be fitted with four (4) connections to allow for the installation of these level switches; two (2) level switches shall be equipped with level alarms and the other two (2) switches shall act as level control points. The Contractor shall provide the standpipe and a manual ball isolation valve to feed the standpipe from the bottom of the salt dissolution tank. The standpipe shall be supported by suitably sized pipe brackets on the side of the salt dissolution tank. The standpipe shall comply with Clause D11.1.9 in Section D. The ball isolation valve shall be suitable for high salt concentrations and of a similar material of construction than the standpipe. The puddle flange for the standpipe will be provided by others. The Contractor shall also provide a drainpipe and drain valve for the standpipe. The drainpipe shall comply with Clause D11.1.9 in Section D.

Each salt dissolution tank shall be fitted with a radar salt level monitor probe for the continuous monitoring of granular sodium chloride inside the tank. The probe of the salt monitor shall be fully submerged to ensure that the air-water interface does not interfere with the measurements. This salt level monitor is specified elsewhere in the project specifications.

Furthermore, the Contractor shall provide lighting for the interior of each salt dissolution tank. A swimming pool-like light with a degree of protection of IP68 or better shall be used inside the tank.

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1.11 TANK CONNECTIONS AND LID COVER

Figure 4 below shows the tank connections and tank cover on the salt dissolution tanks as presented on the P&ID.

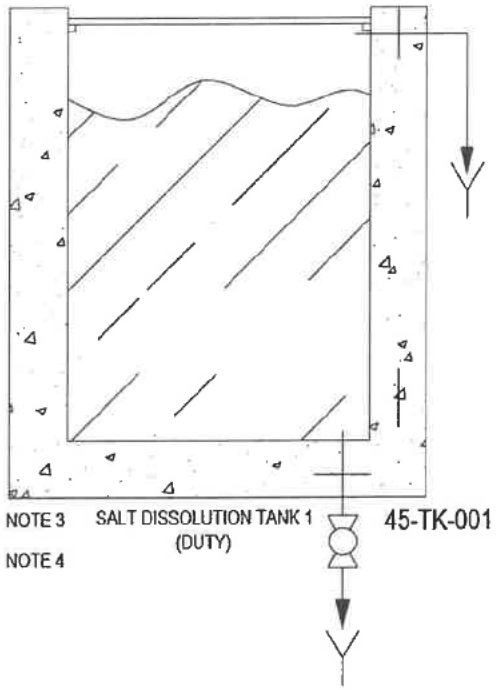


Figure 4: Tank connections and tank lid cover on salt dissolution tank

The Contractor shall equip each salt dissolution tank with an overflow pipe that shall be routed to a safe location for drainage. The overflow pipe shall be at least 50 mm above the softened water inlet pipe. The pipe shall be sized to convey a minimum flow rate of 384 L/hr plus a reasonable safety factor as specified by the Contractor. The puddle pipe for the overflow pipe shall be provided by others. The overflow pipe shall comply with Clause D11.1.9 in Section D.

The Contractor shall also equip each salt dissolution tank with a drainpipe and drain valve for the emptying of the tank. The puddle pipe for the drainpipe shall be provided by others. The drainpipe shall comply with Clause D11.1.9 in Section D.

The salt dissolution tanks shall be kept closed to ensure that the salt solution does not cause a significant rise in humidity in the room. This shall also prevent foreign objects and debris from entering the tanks. As such, the Contractor shall provide a removable HDPE tank cover of the correct dimensions to fit in the salt dissolution tanks. The tank covers shall be positioned 50 mm below the top of the tank wall and shall rest on an adequately sized lip-support that shall run along the interior edge of the salt tank wall.

Furthermore, the Contractor shall provide a removable ladder for access inside the tank.

1.12 INTERNAL TANK FILTERS & PIPEWORK

Figure 5 below shows the filters, pipework, and instrumentation on the inside of the salt dissolution tanks.

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The filters shall be constructed from highly corrosion resistant material such as polypropylene or similar. The mesh size of each filter shall be no more than 150 µm.

1.13 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

1.14 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

1.15 SPARES

The Contractor shall provide the following spares:

- Internal salt tank filters (6 off)

1.16 FIRST FILL OF CHEMICALS

The Contractor shall provide one month's supply of 1 tonne salt bags for start-up. The salt shall be non-iodised and comply with the following specification:

Water soluble	0.1% maximum
Calcium	400 mg/kg maximum
Magnesium	300 mg/kg maximum
Sodium chloride	99.8% minimum
Bromide	300 mg/kg maximum

1.17 FABRICATION

Fabrication shall comply with Section D.

1.18 FASTENERS

Fasteners shall comply with Clause D7 in Section D.

1.19 MATERIALS AND CORROSION PROTECTION

Equipment shall comply with the table below. Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D. Corrosion protection shall comply with Clause D5 in Specification D.

ITEM	MATERIAL	COATING
Softened water inlet pipework and valves	Stainless steel 316	N/A
Salt dissolution tank removable cover	HDPE or similar	N/A

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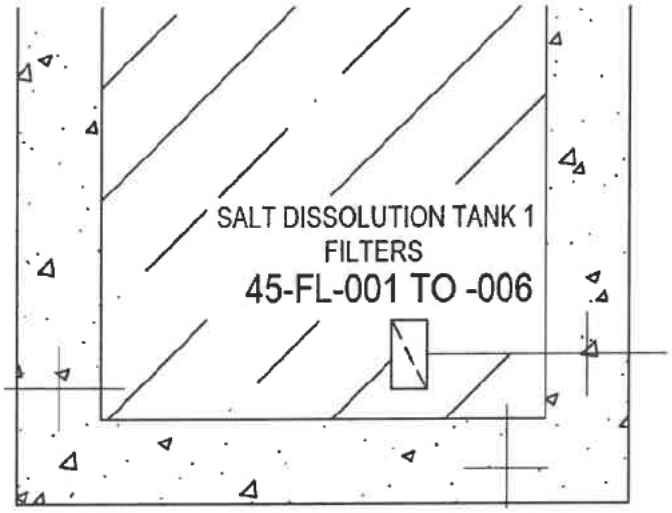


Figure 5: Internal filters of the salt dissolution tank

The Contractor shall provide the pipework and filters inside the salt dissolution tanks. The pipework shall comply with Clause D11.1.9 in Section D. The saturated brine outlet pipe shall be fitted with six (6) filter nozzles installed on a rectangular manifold inside the salt dissolution tanks. This manifold shall rest on a rectangular PMMA plate and be placed at the bottom of each salt dissolution tank. A suitable cover plate shall be provided for each filter for protection against the weight of the salt.

A schematic of the salt tank internal filters is given below in Figure 6.

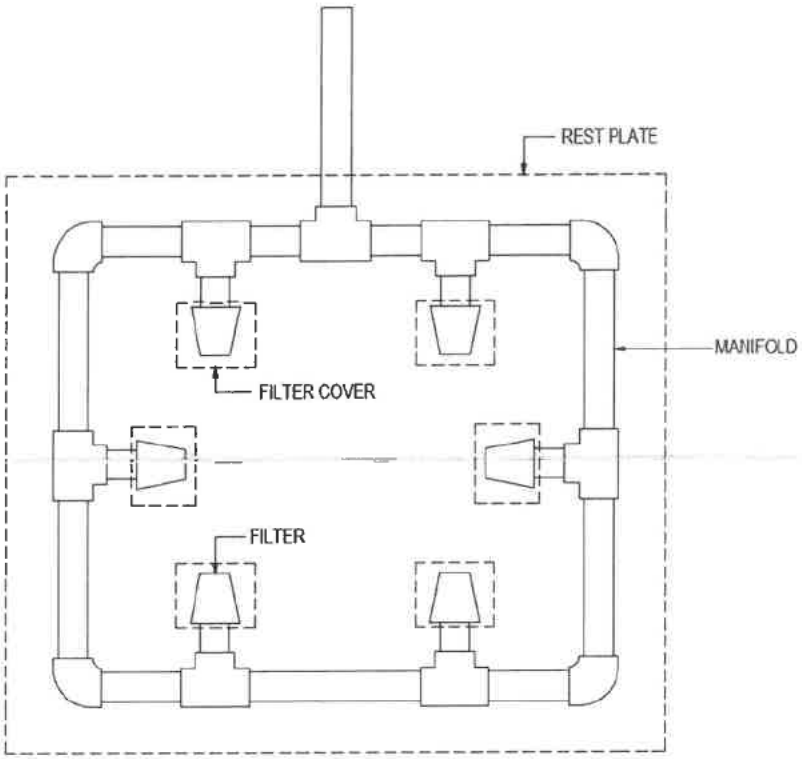


Figure 6: Schematic of salt tank internal filters

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[redacted]

ITEM	MATERIAL	COATING
Coarse filters inside salt dissolution tank	PP or similar	N/A
Salt dissolution tank drainpipe and valve	PP, uPVC or similar	N/A
Salt dissolution tank overflow pipe	PP, uPVC or similar	N/A
Salt dissolution tank standpipe and surrounding pipework	PP, uPVC or similar	N/A
Coarse filters on salt dissolution tank outlet	PP, uPVC or similar	N/A

1.20 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

1.21 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

1.22 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

1.23 INSTALLATION

Installation work shall comply with Clause D6 in Section D.

1.24 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of the water retaining structures.

1.25 INSPECTIONS

1.25.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

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1.25.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

1.26 TESTING REQUIREMENTS

1.26.1 FACTORY

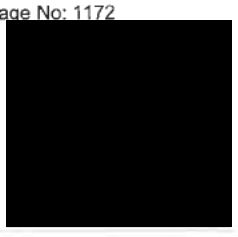
The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

1.26.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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2. ONSITE SODIUM HYPOCHLORITE GENERATION EQUIPMENT

2.1 SCOPE

2.1.1 INTRODUCTION

This specifies the requirements for onsite sodium hypochlorite generation equipment to be provided by the Contractor.

2.1.2 CONFIGURATION

Sodium hypochlorite shall be produced onsite by the electrolysis of saturated brine (NaCl) solution in sodium hypochlorite electrolytic reactors. The brine shall be pumped from the salt dissolution tanks via the brine pumps installed on the sodium hypochlorite electrolytic reactors skid, where it shall be diluted with softened water to the desired concentration before being fed to the reactors. The softened water shall be produced by passing process water through an on-board water softener. A portion of the softened water shall bypass the reactors and be fed to the salt dissolution tanks to prepare the saturated brine solution.

The sodium hypochlorite design is represented in the following drawings:

- 1001757-2000-PID-PP-2051 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2052 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2053 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2054 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2767 Plan View
- 1001757-2000-DRG-MM-2768 Isometric and sectional Views

2.1.3 KEY ELEMENTS

- Saturated brine solution pipework
- Water softener
- Brine pump
- Flow regulation pipework
- Electrolytic reactor
- Transformer/rectifier
- Mobile HCl cleaning system
- Non-electronic instrumentation
- Safety Equipment
- Spares

2.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

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2.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

2.2 NORMATIVE REFERENCES

- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

2.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

IP Ingress Protection

SCADA Supervisory Control and Data Acquisition

2.4 EQUIPMENT ELIGIBILITY

The equipment to be provided shall have a successful track record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

2.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

2.6 PERFORMANCE REQUIREMENTS

This section provides the overall performance requirements of the sodium hypochlorite generation system. The Contractor shall refer to the descriptions of each key element (as listed above) for detailed descriptions of each element's performance requirements. The detailed descriptions include images from the relevant P&IDs for further clarity.

The Contractor shall provide four (4) sodium hypochlorite generation skids in a two (2) duty, two (2) standby configuration. Each sodium hypochlorite generator shall be able to deliver up to 10 kg/hr of equivalent free chlorine in the form of a 0.8% sodium hypochlorite solution. Process water shall be supplied to each generation system at temperatures ranging between 12.7 and 26°C, as regulated by the temperature control system discussed in Clause 9 of this specification.

For each generator, the anticipated saturated brine solution supply shall be 96 L/hr and shall be supplied from the salt dissolution tanks. The resultant sodium hypochlorite shall be delivered at a rate of 1230 L/hr and a concentration of 0.8%. Each system shall also

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soften 100 L/hr of process water which shall bypass the electrolytic reactor and be sent to the salt dissolution tanks.

The on-board water softener on each electrolytic reactor shall have the capacity to reduce the total water hardness from 30 mg/L to <10 mg/L $CaCO_3$ at an operating temperature suitable for the specified feed conditions.

A rectifier shall be used to convert the mains AC current into DC current required for the electrolytic cells of the electrolytic reactor. The rectifier shall be positioned directly beside the electrolytic reactor in a separate free-standing frame.

Each sodium hypochlorite generation skid shall come complete with a local control panel complying with Clause 5.5 of C3.7.8 Detailed Electrical Specification.

2.7 OPERATION AND CONTROL

Operation and control are specified in further detail in Section C3.7.4.

2.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

a) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

b) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

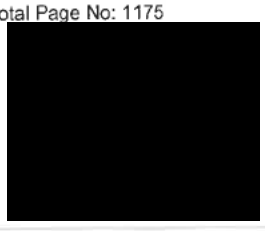
2.9 SATURATED BRINE SOLUTION PIPELINE

The Contractor shall provide the pipework to convey saturated brine solution from the puddle pipe flanged connection on the salt dissolution tank to the sodium hypochlorite generator. The outlet pipe from each salt dissolution tank shall be sized to convey 384 L/hr of saturated brine to allow for each tank to supply 96 L/hr to all four (4) sodium hypochlorite generation skids if necessary. All pipework shall comply with Clause D11.1.9 in Section D.

For each salt dissolution tank, the discharge pipework shall include the following valves and fittings (see Figure 7 below):

- One (1) actuated diaphragm valve with OPEN/CLOSED status displayed on the SCADA.
- Two (2) in-line manual 100 µm disk filters in a duty/standby configuration. The filters shall be constructed from plastic material such as PVDF or similar suitable material. Each filter shall have one (1) upstream and one (1) downstream manual ball valve for isolation.
- One (1) manual ball valve for isolation prior to entering the common header.

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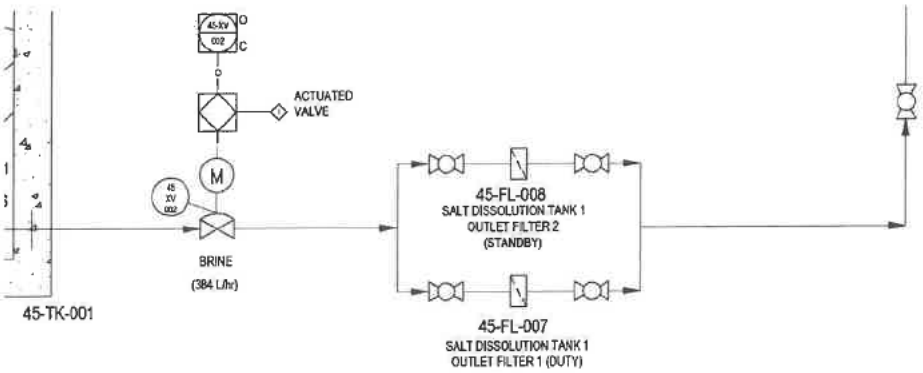


Figure 7: Saturated brine solution pipeline from salt dissolution tanks

Valves and fittings shall have the same nominal size and pressure rating as the corresponding pipework.

After the isolation valve on each pipeline, the two (2) pipelines from the salt dissolution tanks shall feed a discharge manifold with four (4) take-offs which lead to the sodium hypochlorite generation skids. This is shown in Figure 8. The anticipated flowrate of the brine supply pipes to each generator shall be 96 L/hr. The Contractor shall propose a nominal pipe diameter and pressure rating for the pipework.

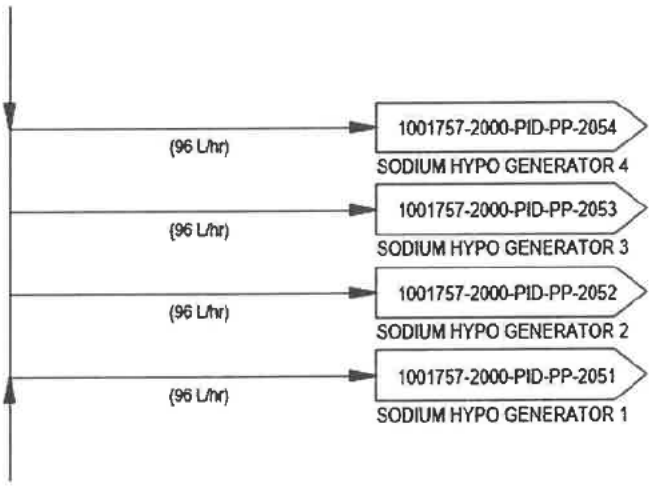


Figure 8: Discharge manifold from salt dissolution tanks

The pipework shall comply with Clause D11.1.9 of Section D.

Additionally, the Contractor shall supply an isolation ball valve that will have the same nominal size and pressure rating as the corresponding pipework. This isolation valve is shown in Figure 9 below.

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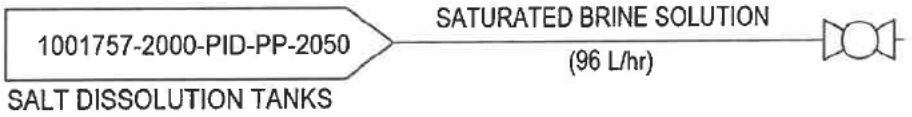


Figure 9: Isolation ball valve on saturated brine stream feeding to sodium hypochlorite generation skid

2.10 WATER SOFTENER

2.10.1 INTRODUCTION

Figure 10 below shows the on-board duplex water softener and interconnecting pipework as presented on the P&ID.

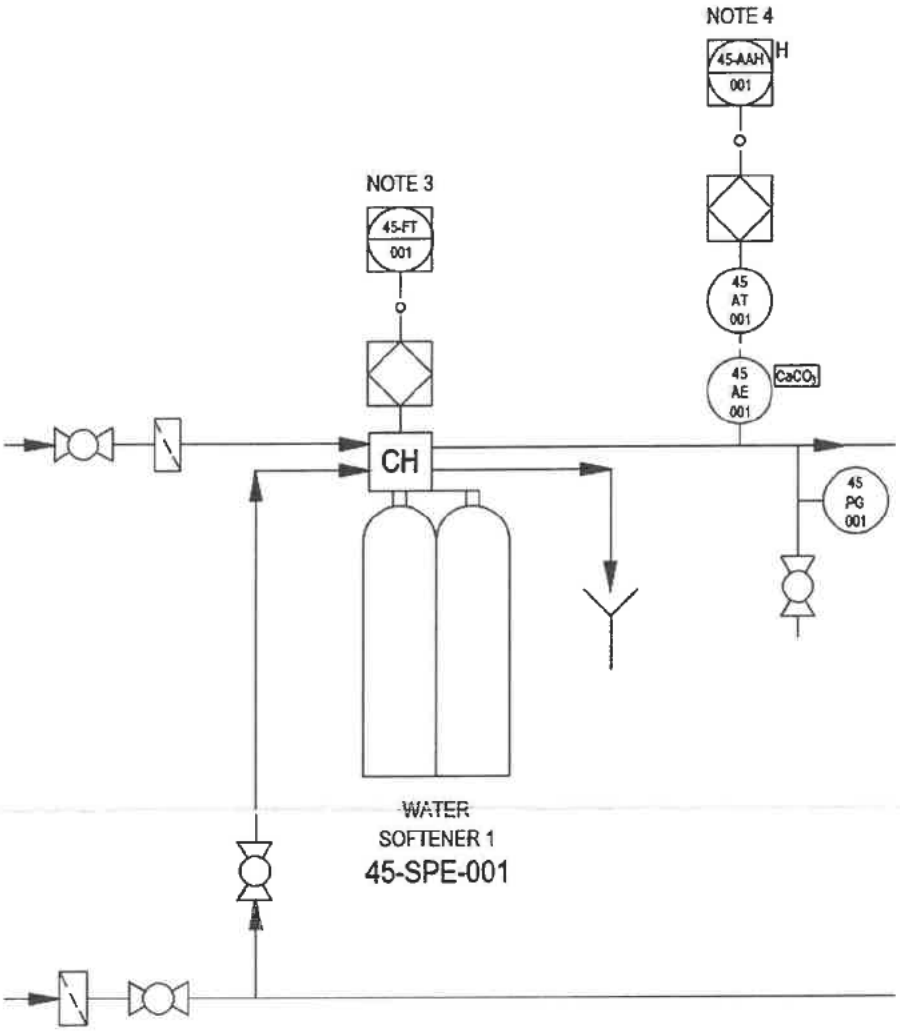


Figure 10: Duplex water softener in sodium hypochlorite generation system

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2.10.2 PROCESS WATER SUPPLY

The Contractor shall provide all the necessary pipework and fittings for the process water supply to the water softener as described in Clause 9.11 of this specification. Prior to entering the water softener, the process water shall pass through an 80 µm fine filter (0.2 bar pressure drop). This filter shall be provided with a manual isolation valve.

All process water piping on the water softener shall be suitably selected for the application and shall comply with Clause D11.1.9.

2.10.3 SATURATED BRINE SOLUTION SUPPLY

Saturated brine solution from the salt dissolution tanks shall be used for the regeneration of the ion-exchange resin in the softeners once the resin nears saturation with calcium and magnesium. The Contractor shall provide the pipework and associated fittings for the brine solution as described elsewhere. Additionally, the Contractor shall supply a manual isolation valve and a 150 µm fine filter (0.2 bar pressure drop). The housing and filter insert shall be resistant to concentrated NaCl solution. Union fittings shall be placed upstream and downstream of the fine filter for ease of removal. The filter shall be followed by a pipe tee such that the saturated brine solution shall feed both the softener and the brine pump leading to electrolytic reactor.

All saturated brine solution piping on the water softener shall be from a suitable material and shall comply with Clause D11 in Section D.

2.10.4 SOFTENER UNITS

The water softeners shall reduce the total hardness in the process water supply from 30 mg/L to <10 mg/L $CaCO_3$. The softeners shall have a suitable operating temperature to accommodate the feed temperature of 12.7 - 26°C. Each sodium hypo generation skid shall include duplex water softeners in a duty/standby configuration such that the softening process can continue while one of the units is being regenerated. The freeboard area in each softener shall allow for 50% expansion of the cation resin during backwash. The softeners shall be constructed of fibreglass reinforced polyester (FRP) and the exterior shall be reinforced by a continuous roving glass filament overwrap of the same colour as the vessels. The Contractor shall provide pipework for draining the spent brine after a regeneration event, including union fittings and a drain valve.

The softener shall be equipped with a top-mounted automatic valve head with digital display of the cumulative volume of water that has been softened and the time that has elapsed since the last regeneration. The valve head shall be fitted on both the duty and standby softener such that the standby unit shall automatically begin operation once the regeneration of the duty softener is initiated. The data from the valve head shall also be accessible to the operator on the SCADA system.

The valve head shall be sized to accommodate the 1232 L/hr of process water being softened. The operating temperature and pressure of the valve head shall ensure that the process water remains within 12.7 - 26°C and 2.5 - 6 bar. The thread connections on the valve head shall accommodate the heads of the softening vessels.

2.11 BRINE PUMP

The on-board brine pump shall convey the saturated brine solution from the salt dissolution tanks to the electrolytic reactor. A diaphragm pump shall be used for the precise and continuous delivery of 96 L/hr of brine at a suitable pressure as specified by the Contractor.

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[redacted]

The pump shall be fitted with a speed indicator controller which shall automatically switch to STOP mode in the case of high temperatures in the electrolytic reactor. The STOP/START status of the brine pump shall be displayed on the SCADA system.

The brine pump shall be manufactured of a suitable corrosion resistant material to withstand the corrosive nature of the saturated brine solution.

Figure 11 below shows the on-board brine pump as presented on the P&ID.

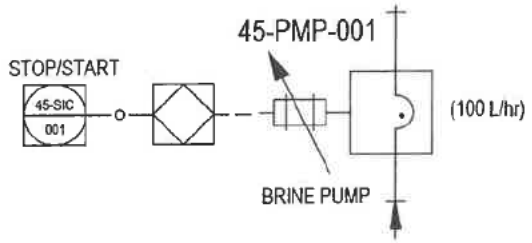


Figure 11: On-board brine pump in sodium hypochlorite generation skid

2.12 FLOW REGULATION PIPEWORK

Figure 12 below shows the flow regulation pipework that leads to the electrolytic reactors as presented on the P&ID.

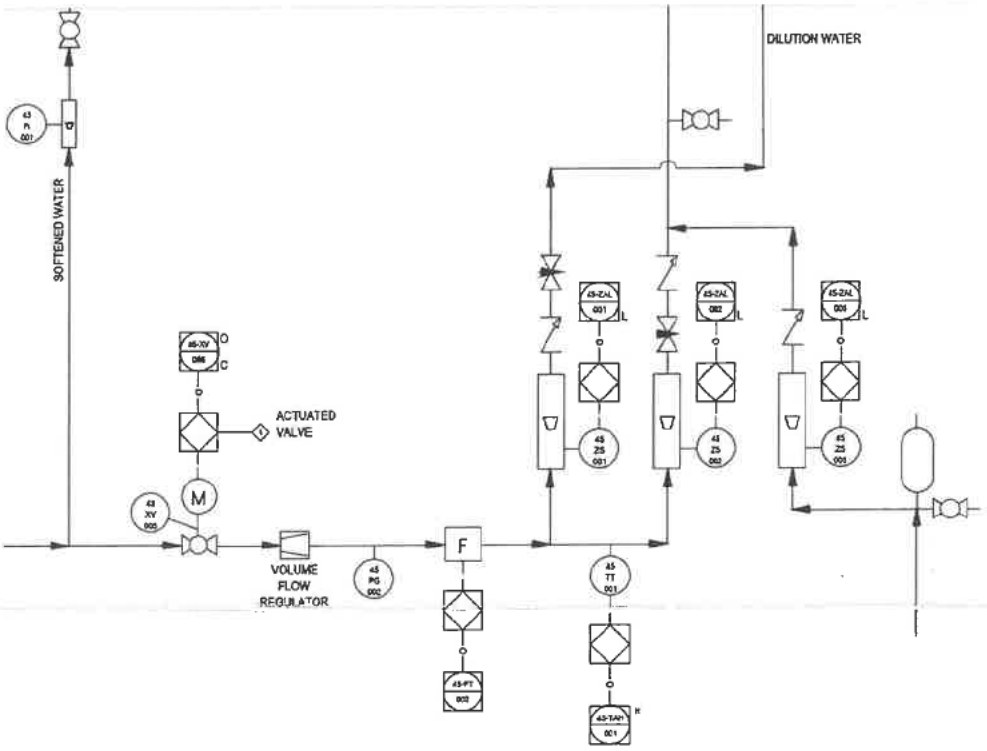


Figure 12: Flow regulation pipework leading to electrolytic reactors in sodium hypochlorite generation skid

The softened water product line from the softener units shall be diverted into two lines: the softened water used in the salt dissolution tanks and the soft water required in the electrolytic reactors. The softened water line for salt dissolution (96 ± 5 L/hr) shall be fitted

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with a rotameter and an associated ball isolation valve. The discharge from the isolation valve to the salt dissolution tanks is specified elsewhere.

The softened water for electrolysis shall be fitted with an electrically actuated valve which shall automatically switch to stop mode in the case of high temperatures in the electrolytic reactor. The OPEN/CLOSE status of the valve shall be displayed on the SCADA system.

Following the actuated valve, a volume flow regulator shall be fitted on the line to ensure that 1136 L/hr of softened water is fed to the electrolytic reactor. A suitably sized flow regulator constructed of Super Duplex stainless steel (or better corrosion resistance) shall be used. The volume flow regulator shall be followed by a mechanical pressure gauge and a magnetic flow meter.

The softened water shall be diverted further into two dilution water lines for the electrolytic reactor. The primary softened water dilution line shall be fitted with a temperature transmitter (specified elsewhere) which shall initiate an alarm condition when the softened water temperature is not within the allowable limits. The HIGH/LOW status of the transmitter shall be indicated on the SCADA system. Following the temperature transmitter, the line shall be fitted with a rotameter including a position switch connected to the SCADA system, as well as a needle flow control valve and a non-return valve. The rotameter shall be sized to easily read over the range of flows.

The primary softened water dilution line (1000 ± 5 L/hr) shall be combined with the saturated brine discharge from the brine pump. This saturated brine line shall be fitted with a rotameter including a position switch connected to the SCADA system followed by a non-return valve. The rotameter shall be sized to easily read over the range of flows. The diluted brine line shall be fitted with a ball valve and connection point for the mobile HCl cleaning system prior to entering the electrolytic reactor.

The secondary softened water dilution line (136 ± 5 L/hr) shall be fitted with a rotameter including a position switch connected to the SCADA followed by a non-return valve and a needle flow control valve. The rotameter shall be sized to easily read over the range of flows. This line shall feed directly to the electrolytic reactor.

All pipework and valves shall be suitably selected for the corrosive environment and comply with Clause D11.1.9 in Section D. The pipework shall be sized according to Clause D11.2.2 in Section D.

2.13 ELECTROLYTIC REACTOR

Figure 13 below shows the electrolytic reactor as presented on the P&ID.

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[redacted]

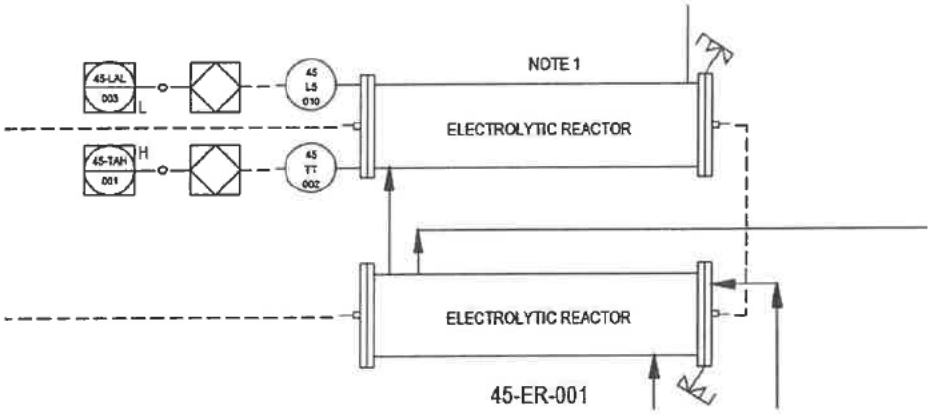


Figure 13: Electrolytic reactor in sodium hypochlorite generation system

2.13.1 CONFIGURATION

The electrolytic reactor shall comprise two reactor cells connected in series, with a product line from each reactor cell. The cells shall be cylindrical in shape, undivided and shall be oriented horizontally, one above the other. The first reactor cell shall include two input streams: diluted brine and secondary dilution water, as discussed in Clause 2.12. The reactor shall produce a stream of 0.8% ±0.05% sodium hypochlorite at a rate of 1230 L/hr with 5.2 m³/hr entrained hydrogen gas.

The electrolytic generator shall be fed with process water that is between 12.7°C – 26.7°C and will produce a product stream with a temperature that exceeds the feed stream temperature by no more than 20°C.

The topmost electrolytic reactor cell shall be equipped with a temperature transmitter that shall measure the internal temperature of the cell. This temperature transmitter shall be hardwired to the rectifier to ensure that power to the skid is cut off if the temperature in the reactor cell exceeds 50°C. The topmost electrolytic reactor cell shall also be equipped with a level switch. The level switch shall also be hard wired to cut power from the rectifier if the cell water level is low.

The bottommost reactor cell shall include the following connections:

- Connection point for the HCl mobile cleaning unit
- Product outlet connecting to upper reactor cell
- Dilution water inlet (partial current)
- Sodium chloride solution inlet
- Electrical connection to the rectifier
- Electrical connection to the upper reactor cell

The topmost reactor cell has the following connections:

- Connection point for the HCl mobile cleaning unit
- Product outlet: 0.8% NaOCl + H_2
- Interconnecting pipework to the lower reactor cell
- Electrical connection to the rectifier
- Electrical connection to the lower reactor cell

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[redacted]

Pipework shall be appropriately sized as per the contractor's recommendations.

The body of the electrolytic reactor shall be constructed of plexiglass or a similar suitable material. Each reactor cell shall consist of bipolar electrodes that shall be assembled onto an electrode stack consisting of fully coated titanium plates. The electrodes shall have a minimum lifespan of five years.

2.13.2 POWER SUPPLY

The reactor cells shall be connected in series to the rectifier (power supply unit). The connected load of each reactor system shall not be greater than 37 kVA.

2.13.3 MECHANICAL INSTALLATION

Only authorized and qualified technicians may install the electrolytic reactors. All electrical work on the system must be performed by qualified electricians.

2.13.4 INSTALLATION OF THE CONNECTIONS

Prior to setting up connections, transport plugs shall be removed from the system. Furthermore, pipelines shall be permanently installed in a technically fixed position and structurally protected from damage. Pipework installed near floor level shall be protected with bridges.

2.14 TRANSFORMER/RECTIFIER

Figure 14 below shows the transformer/rectifier as presented on the P&ID.

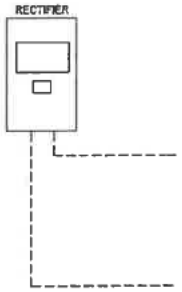


Figure 14: Transformer/rectifier connected to electrolytic reactor in sodium hypochlorite generation system

The contractor shall supply a silicon-controlled rectifier with a switch mode power supply that is to be mounted on a separate free-standing frame directly beside the electrolytic reactor. The rectifier shall be housed in a NEMA 3R enclosure. When constructing the frame of the rectifier, the following must be observed:

- Distance to the chlorine electrolysis system shall be a minimum 210 mm
- Distance to the storage tank shall be a minimum of 830 mm

The rectifier shall deliver an electrolysis direct current of 730 A and a maximum voltage of 72 V.

- Electricity supply: 3/N/PE AC 400/230 V, 50 Hz
- The maximum permissible voltage tolerance shall be ±10 %

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The rectifier shall be equipped with an onboard cooling fan that shall be interlocked with its operation, such that the rectifier shall not turn on unless the cooling fan is running.

2.15 MOBILE HCL CLEANING SYSTEM

Figure 15 below shows the mobile HCl cleaning system as presented on the P&ID.

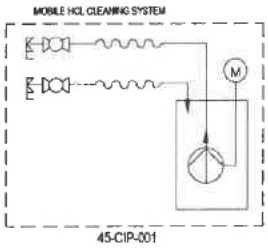


Figure 15: Mobile HCl cleaning system for electrolytic reactors

The Contractor shall supply a mobile cleaning system for the periodic cleaning of the electrolytic reactor with 5% HCl solution. The cleaning system shall consist of, as a minimum, a 60 L HDPE canister, positive displacement circulation pump, HCl venting ball valve, and flexible hoses with suitable thread connections for the electrolytic reactors. The cleaning system shall be mounted on a hand truck. All pipework and valves shall be suitably selected for the corrosive environment.

The Contractor shall also supply 30 L of the 5% HCl solution to be used in start-up.

2.16 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

2.17 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

2.18 SPARES

The Contractor shall provide the following spares:

Two (2) electrode stacks

One (1) temperature sensor

One (1) level switch

One (1) full set of O-rings and gaskets for one electrolyser

2.19 MISCELLANEOUS

Not applicable

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[redacted]

2.20 FABRICATION

Fabrication shall comply with Specification D.

2.21 FASTENERS

Fasteners shall comply with Clause D7 in Specification D.

2.22 MATERIALS AND CORROSION PROTECTION

2.22.1 GENERAL

Where applicable, all materials shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D.

2.22.2 EQUIPMENT

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D. Corrosion protection shall comply with Clause D5 in Specification D.

ITEM	MATERIAL	COATING
Process water supply pipework and valves	Stainless steel 316	Pickled and passivated
Brine supply pipework and valves	PP/uPVC/PE	N/A
Softened water pipework	Stainless steel 316	Pickled and passivated
Sodium hypochlorite pipework and valves	PP/uPVC/PE	N/A
Process water fine filters	Stainless steel 316	Pickled and passivated
Brine fine filters	PP/uPVC/PVDF	N/A
Water softeners	FRP	N/A
Brine pump	PP/uPVC/PVDF	N/A
Electrolytic reactor body	Plexiglass	Manufacturer's standard
Electrolytic reactor electrodes	Titanium	Manufacturer's standard

2.23 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

2.24 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

2.25 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

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2.26 INSTALLATION

Installation work shall comply with Specification D.

2.27 INSPECTIONS

2.27.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

2.27.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

2.28 TESTING REQUIREMENTS

2.28.1 FACTORY

Prior to dispatch to site, each electrolyser shall be tested at the factory to ensure that it delivers the required concentration and flow of sodium hypochlorite. The Contractor shall submit such a test report as well as any other relevant tests to the Engineer and shall provide copies in the Manual.

2.28.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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3. SODIUM HYPOCHLORITE STORAGE SYSTEM

3.1 SCOPE

3.1.1 INTRODUCTION

This specification covers the requirements for the storage of the 0.8% sodium hypochlorite produced onsite. This includes the pipework, storage tanks and non-electronic instrumentation to be provided by the Contractor.

3.1.2 CONFIGURATION

The 0.8% sodium hypochlorite produced by the sodium hypochlorite generation skids shall be conveyed to the sodium hypochlorite storage tanks. Four (4) sodium hypochlorite storage tanks shall be provided: two (2) tanks connected in series shall act as duty tanks, and another two (2) tanks connected in series shall be standby units. The first tank in each series shall be equipped with blowers for the dilution of hydrogen gas that is entrained in the sodium hypochlorite feed stream.

The sodium hypochlorite storage tank system is represented in the following drawings:

- 1001757-2000-PID-PP-2055 Process & Instrumentation Diagram
- 1001757-2000-DRG-CC-2706 General Arrangement
- 1001757-2000-DRG-CC-2711 General Arrangement
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2765 Plan View
- 1001757-2000-DRG-MM-2766 Isometric and Sectional Views

3.1.3 KEY ELEMENTS

- Sodium hypochlorite supply pipework
- Sodium hypochlorite storage tanks
- Pipework for level monitoring instrumentation
- Transfer pipework between first and second tank
- Hydrogen dilution and venting system
- Non-electronic instrumentation
- Safety Equipment
- Spares

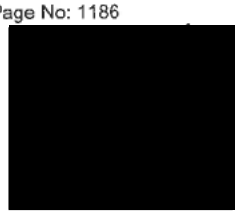
3.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

3.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable the works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

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3.2 NORMATIVE REFERENCES

The following forms part of the Contract Document:

Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

3.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

ATEX rating	A classification system used to identify the level of protection provided by equipment used in potentially explosive environments
EPDM	Ethylene Propylene Diene Monomer
FPM	Fluorinated Propylene Monomer
SCADA	Supervisory Control and Data Acquisition

3.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

3.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

3.6 PERFORMANCE REQUIREMENTS

This section provides the overall performance requirements for the sodium hypochlorite storage system. The Contractor shall refer to the descriptions of each key element (as listed above) for detailed descriptions of each element's performance requirements. The detailed descriptions include images from the relevant P&IDs for further clarity.

The system shall allow for the safe storage of 0.8% sodium hypochlorite solution. The storage system shall receive a total of 2460 L/hr of sodium hypochlorite from the sodium hypochlorite generation skids which contains more than 10 m^3/hr of entrained hydrogen gas. As such, the storage system shall dilute hydrogen gas to a safe concentration of <1% which shall be vented to the atmosphere.

The pipes and hoses conveying the sodium hypochlorite shall be of non-flame propagating materials. They shall be arranged for easy dismantling for cleaning, and, if screwed joints or joints formed by solvent welding are proposed, enough flanged or flexible joints shall be provided to enable the pipework to be removed in sections without working from one end to the other of a particular run. Tees and cocks shall also be provided at convenient points for the connection of a pressure water supply to flush pipework through as required.

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All necessary chemical delivery piping, fittings, support racks or trays and brackets to serve the plant supplied shall be provided.

3.7 OPERATION AND CONTROL

The level instrumentation on the sodium hypochlorite storage tanks shall control the operation of the sodium hypochlorite generation skids such that the generation systems will start and stop based on the tank levels.

Operation and control are specified further detail in Section C3.7.4.

3.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

a) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

b) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

3.9 SODIUM HYPOCHLORITE SUPPLY PIPEWORK

Figure 16 below shows the start of the battery limit for the supply pipework to the sodium hypochlorite storage tanks.

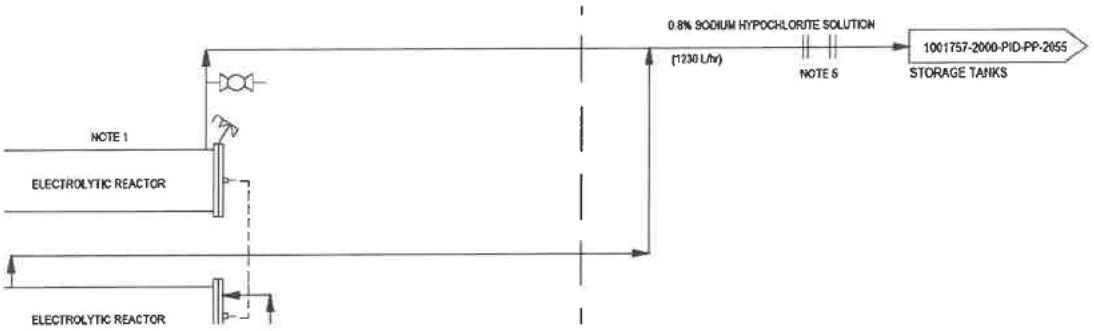


Figure 16: Combined outlet pipework from two reactor cells in each generator

This pipework shall start at the outlets of the four (4) sodium hypochlorite reactors and terminate at the inlet of the first sodium hypochlorite storage tank that are installed in series with a second tank. Each sodium hypochlorite reactor shall consist of two reactor cells; as such, a connection point shall be provided for these two lines. In addition, the outlet from the uppermost reactor cell shall be fitted with a sampling ball valve. The combined product line from each reactor shall be fitted with a spool piece.

The combined product pipelines of the four (4) reactors shall be routed to a common header (see Figure 17 below).

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Total [redacted]

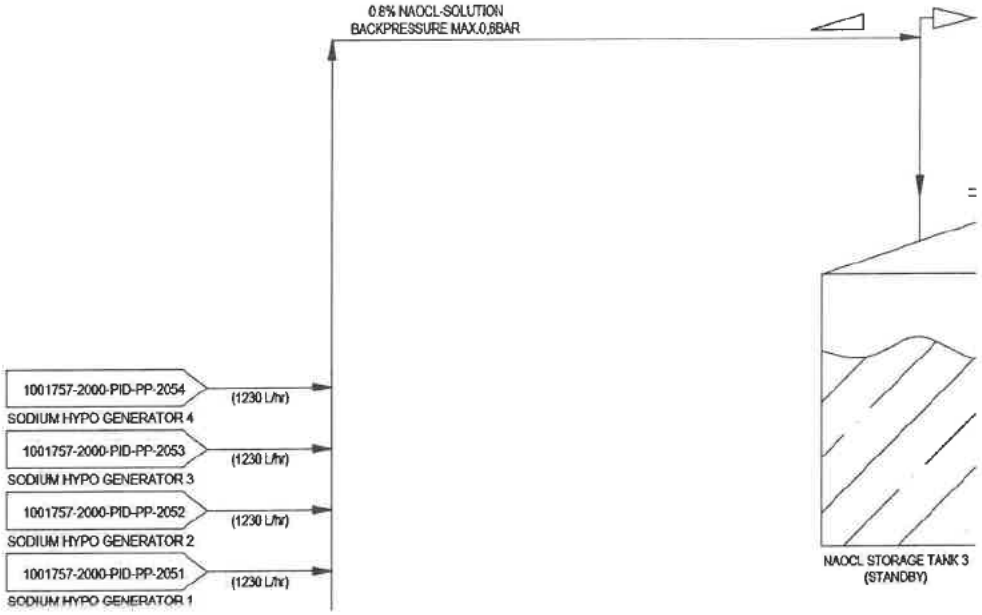


Figure 17: Inlet pipework to sodium hypochlorite storage tanks

From the common header, the pipeline shall branch off into two (2) lines which shall feed each of the first tanks. Sodium hypochlorite solution shall be fed at the top of the first tank in each series. The vertical distance from the sodium hypochlorite reactor outlet to the storage tank shall be no more than 6 m. The filling pipe for each storage tank shall be horizontal or rising steadily to the tank and permanently installed. The filling pipe shall include an angled connection piece to allow hydrogen gas to feed directly into the diluted hydrogen vent pipe.

The pipes shall be sized to allow for 2460 L/hr of 0.8% sodium hypochlorite solution. The fittings shall have the same nominal size and pressure rating as the corresponding pipework. All pipework shall comply with Clause D11.1.9 in Section D. The colour of all sodium hypochlorite pipework shall be Light Stone with Canary Yellow banding according to Clause D5.7 in Specification D.

3.10 SODIUM HYPOCHLORITE STORAGE TANKS

3.10.1 TANK CAPACITY AND OPERATING CONDITIONS

The Contractor shall provide four (4) 15 m^3 storage tanks of a material suitable for storage of 12% to 0.8% sodium hypochlorite solution, such as uPVC, HDPE, GFPR or similar. The tanks shall be opaque and gas-tight and shall have a flat or conical tank cover. The tanks shall allow for an overpressure of 4.5 mbar and an operating temperature of 0 to 50°C.

The storage tank shall be positioned at least 800 mm away from the electrolysis system and shall allow enough space for maintenance.

The base of the tanks shall be flat, suitable for bedding on to a flat concrete plinth using an approved bedding material of sand and bitumen mixture, which will distribute the load on the tank base and minimize any stress concentrations. The roof of the tank shall be domed such that it does not visibly deflect when a load of 150 kg is imposed vertically upon it. At least three lugs positioned slightly below the domed roof and equally spaced around the

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tank shall be bonded as part of the tank construction and shall incorporate a hole in each for securing the tank, if necessary.

The storage tanks shall be bolted down.

Unless otherwise stated, the colour of the tank shall be Light Stone with Canary Yellow banding according to Clause D5.7 in Specification D.

3.10.2 FITTINGS ON STORAGE TANK BUND

The storage tanks shall be housed in a concrete bund (by Others) with a leak detector. The bund shall be equipped with a drain pipe and normally closed manual ball valve with connection for honeysucker. The puddle pipe for this drain pipe shall be provided by Others.

The Contractor shall equip the bund with a vertical access ladder with top handrails to allow for access into the bund. The ladder shall be fixed to the inside of the bund wall and shall have a length of approximately 450 mm, to be confirmed by the Contractor. The ladder shall be constructed of suitable corrosion resistant material such as FPR or high-grade stainless steel.

The Contractor shall supply a suitably sized staircase on the outside of the bund wall. FRP handrails shall be provided on both sides of the staircase unless the staircase consists of less than three (3) treads. The treads and landing shall be constructed of non-slip mesh FRP grating. The handrail shall be constructed of FRP. The side supports of the staircase shall be of stainless steel 316. The staircase shall comply with Clause D10.3 in Section D.

The top of the bund wall shall also be fitted with suitable guard railing.

3.10.3 TANK CONNECTIONS AND PIPEWORK

A set of sodium hypochlorite storages is shown in Figure 18 below.

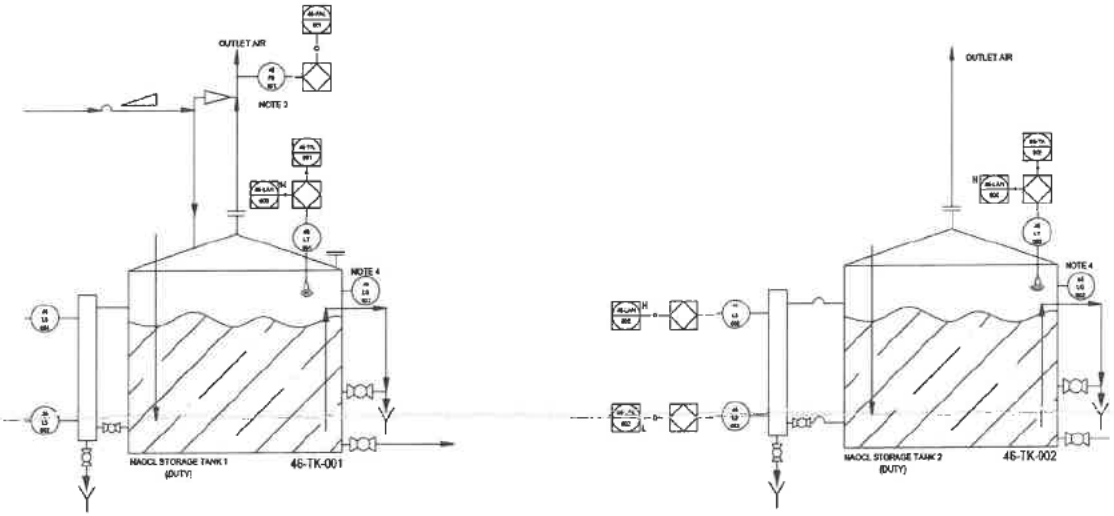


Figure 18: One set of sodium hypochlorite storage tanks

The first tank in each series shall have the following connections and associated pipework:

- A flanged access manhole with at least 450 mm clear circular opening on a vertical axis in the domed roof. The manhole shall be fitted with a suitable weatherproof cover. On tanks with a total capacity of more than 5.0 m³ a flanged manhole at least 450 mm clear circular opening shall also be incorporated in the side of the cylindrical section

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approximately 1.0 m above the floor level. The flanged manhole shall be fitted with a blank flange.

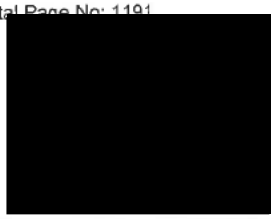
- If Ultrasonic Level Sensing in the storage tanks is specified, a 100 mm nominal bore nozzle shall be incorporated on a vertical axis close to the centre of the domed roof.
- Suitable connections for the installation of an external sight glass. The sight glass to be provided shall be the magnetic level type such as Kuebler or similar and shall be connected between an upper and lower 50 mm nominal bore nozzle on the tank. A ball type isolating valve shall be positioned at each nozzle to isolate the sight glass if required. The sight glass shall be supported to the cylindrical wall of the tank at no more than 1.0 m centres.
- An inlet screw connection at the top of the tank for the filling of 0.8% sodium hypochlorite from the sodium hypochlorite generation skids. This inlet pipe is specified elsewhere.
- An inlet screw connection at the top of the tank for the filling of commercial sodium hypochlorite (12%) for the back-up system. This pipe is specified elsewhere.
- An overflow screw connection on the side of the tank. The overflow pipe shall extend to the bottom on the inside of the tank to ensure that hydrogen gas is not drawn into this line.
- A drain screw connection on the side of the tank. The drainpipe shall be fitted with a suitably sized drain valve and shall be joined with the overflow pipe prior to draining off.
- An outlet screw connection below the drainpipe for the discharging of sodium hypochlorite from the storage tank. The outlet pipe is specified elsewhere.
- Screw connections for the pipework associated with the standpipe on the side of the tank: one (1) connection for the pipe feeding the bottom of the standpipe and one (1) connection higher than the overflow pipe connection to return any hydrogen gas trapped in the standpipe to the top of the storage tank. These pipes are specified elsewhere.
- A flanged flushing air connection at the top of the tank for hydrogen dilution. This pipe is specified elsewhere.
- A flanged vent connection in a central position on the tank top for the venting of diluted hydrogen. This pipe is specified elsewhere.
- Tanks with a capacity of over 5 m^3 shall incorporate a bolt-on vertical ladder. The ladder shall extend from 200 mm above the tank base, to the domed roof where there shall be a small grating type platform to access instrumentation and the manhole. The ladder shall be in accordance with the relevant safety requirements and shall incorporate a cage and handrails at the platform. The ladder, cage, platform and hand railing shall be constructed from FRP.

All flanges moulded in plastic shall be drilled or equivalent to SABS 1123 Table 1000/3. Mild Steel backing flanges will not be acceptable on the tank nozzles. The final orientation of all the manholes and nozzles shall be to the approval of the Engineer.

The colour of all sodium hypochlorite pipework shall be Light Stone with Canary Yellow banding according to Clause D5.7 in Specification D.

The second tank in each series shall have the following connections and associated pipework:

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- A flanged access manhole with at least 450 mm clear circular opening on a vertical axis in the domed roof. The manhole shall be fitted with a suitable weatherproof cover. On tanks with a total capacity of more than 5.0 m³ a flanged manhole at least 450 mm clear circular opening shall also be incorporated in the side of the cylindrical section approximately 1.0 m above the floor level. The flanged manhole shall be fitted with a blank flange.
- If Ultrasonic Level Sensing in the storage tanks is specified, a 100 mm nominal bore nozzle shall be incorporated on a vertical axis close to the centre of the domed roof.
- Suitable connections for the installation of an external sight glass. The sight glass to be provided shall be the magnetic level type such as Kuebler or similar and shall be connected between an upper and lower 50 mm nominal bore nozzle on the tank. A ball type isolating valve shall be positioned at each nozzle to isolate the sight glass if required. The sight glass shall be supported to the cylindrical wall of the tank at no more than 1.0 m centres.
- An inlet screw connection at the bottom of the tank for filling from the first tank. This connection shall also act as the outlet on the second thank. This pipework is specified elsewhere.
- An inlet screw connection at the top of the tank for the filling of diluted commercial sodium hypochlorite for the back-up system. The pipe is specified elsewhere.
- An overflow screw connection on the side of the tank. The overflow pipe shall extend to the bottom on the inside of the tank to ensure that hydrogen gas is not drawn into this line.
- A drain screw connection on the side of the tank. The drainpipe shall be fitted with a suitably sized drain valve and shall be joined with the overflow pipe prior to draining off.
- Screw connections for the pipework associated with the standpipe on the side of the tank: one (1) connection for the pipe feeding the bottom of the standpipe and one (1) connection higher than the overflow pipe connection to return any hydrogen gas trapped in the standpipe to the top of the storage tank. These pipes are specified elsewhere.
- A flanged vent connection in central position on the tank top for the venting of diluted hydrogen. This pipe is specified elsewhere.
- Tanks with a capacity of over 5 m³ shall incorporate a bolt-on vertical ladder. The ladder shall extend from 200 mm above the tank base, to the domed roof where there shall be a small grating type platform to access instrumentation and the manhole. The ladder shall be in accordance with the relevant safety requirements and shall incorporate a cage and handrails at the platform. The ladder, cage, platform and hand railing shall be constructed from FRP.

All flanges moulded in plastic shall be drilled or equivalent to SABS 1123 Table 1000/3. Mild Steel backing flanges will not be acceptable on the tank nozzles. The final orientation of all the manholes and nozzles shall be to the approval of the Engineer.

The colour of all sodium hypochlorite pipework shall be Light Stone with Canary Yellow banding according to Clause D5.7 in Specification D.

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3.11 PIPEWORK FOR LEVEL MONITORING INSTRUMENTATION

The Contractor shall provide a suitable standpipe and manual isolation ball valve on the side of the tank to allow for the installation of the instrumentation. Figure 19 below shows the pipework on the storage tanks for the level monitoring as presented on the P&ID.

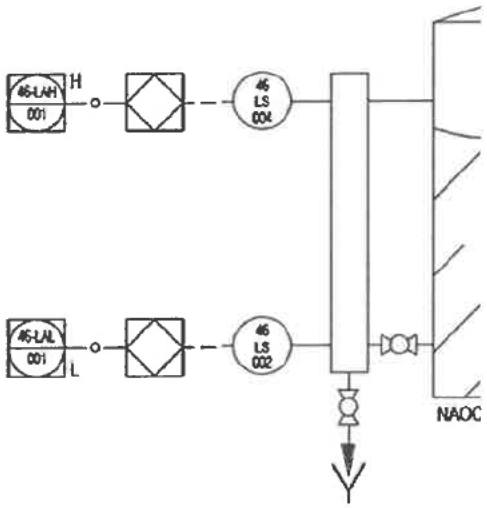


Figure 19: Sodium hypochlorite storage tanks level monitoring pipework

Each standpipe shall be fitted with two (2) connections for the installation of level switches. Each storage tank shall be fitted with two (2) tuning-fork type level switches, one (1) ultrasonic level indicator, and one (1) magnetic visual level indicator.

The Contractor shall also supply a manual ball isolation valve to feed the bottom of the standpipe. The standpipe shall be supported by suitably sized pipe brackets on the side of the tank. In addition to the standpipe, the Contractor shall also provide a drainpipe and drain valve for the standpipe. All pipework and valves shall be selected for the corrosive environment and comply with Clause D11.1.9 in Specification D.

3.12 TRANSFER PIPEWORK BETWEEN FIRST AND SECOND TANK

The Contractor shall provide a transfer pipeline between the first and second storage tank in each series, shown in Figure 20 below.



Figure 20: Transfer pipework between first and second sodium hypochlorite storage tank

Transfer shall be under gravity. The outlet pipe on the first tank in each series shall be fitted with a manual ball valve for isolation purposes. This shall be followed by a pipe tee (specified elsewhere) to allow for connection to the hydraulic-powered chemical injectors for the dilution of commercial sodium hypochlorite (specified elsewhere). This tee shall be

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followed by a manual isolation ball valve with OPEN/CLOSE limits for SCADA representation and piping leading to the inlet of the second storage tank in series.

The second tank shall be equipped with a bidirectional isolation valve at its inlet. This valve shall also act as the tank outlet once the filling is completed, and the sodium hypochlorite must be withdrawn.

The outlet pipe from each storage tank shall feed a manifold with two (2) take-offs leading to the two (2) sodium hypochlorite dosing skids (specified elsewhere). The two (2) pipelines leading to the dosing skids shall each be equipped with a manual ball valve for isolation. This is shown in Figure 21 below.



Figure 21: Pipework leading to sodium hypochlorite dosing skids

All pipework, valves and fittings shall be suitably selected for the application and comply with Clause D11.1.9 in Specification D. If PVC is selected, the PVC shall be resistant to direct sunlight. The colour of all sodium hypochlorite pipework shall be Light Stone with Canary Yellow banding according to Clause D5.7 in Specification D.

3.13 HYDROGEN DILUTION AND VENTING SYSTEM

Hydrogen gas is a by-product of the electrolytic reaction and remains entrained in the sodium hypochlorite stream that exits the reactors. When this stream is fed to the storage tanks, the hydrogen gas is released as the sodium hypochlorite solution fills the tank.

The hydrogen gas shall be diluted with air to ensure that the hydrogen-air ratio remains within safe limits. The dilution system for each of the first tanks in series shall consist of the following (see Figure 22 below):

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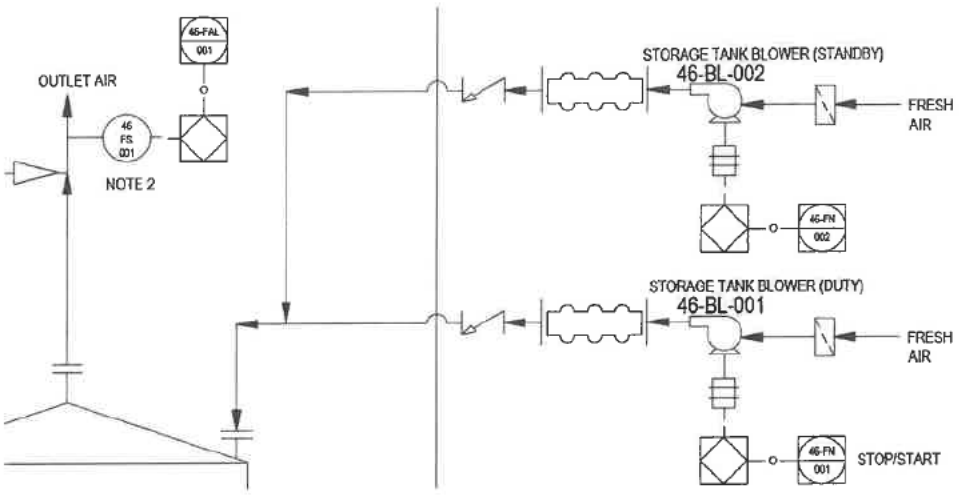


Figure 22: Hydrogen dilution and venting on first sodium hypochlorite storage tanks

3.13.1 HYDROGEN DILUTION

The Contractor shall provide two (2) ATEX rated certified radial blowers in a duty/standby configuration for each of the first tanks. The blowers shall comply with Clause D35 in Specification D. Each blower shall supply 1040 Nm^3/h of fresh air and the STOP/START status of each blower shall be displayed on the SCADA system. The blowers shall be positioned on the bund wall. If this is not possible, the blowers shall be 0.5 - 1.5 m above ground.

The pipework around each blower shall consist of the following:

- One (1) air filter on the suction side of the blower
- One (1) flexible joint on the discharge side of the blower
- One (1) non-return valve on the discharge side of the blower

The pipework from the blower to the storage tank shall be installed horizontal or steadily rising to the tank connection. The pipework shall not include reducers, isolation valves, or pipe junctions. Pipe elbows may be fitted as necessary.

The pipework shall be constructed of PVC or HDPE and comply with Clause D11.1.9 in Specification D.

3.13.2 DILUTED HYDROGEN VENTING

The Contractor shall provide a vent pipe on each tank to release the diluted hydrogen gas to atmosphere. The pipe shall not be fitted with reducers, shut-off valves, or pipe junctions. Pipe elbows may be used but shall be limited to seven (7) elbows fitted on the pipe. The pipe length shall be no more than 50 m and the air velocity through this pipe shall be at least 5.3 m/s. The pipe shall be gas-tight and constructed of PVC or HDPE, complying with Clause D11.1.9 in Specification D. The colour of the hydrogen vent pipework shall be Poppy Red according to Clause D5.7 in Specification D.

The vent opening shall be at least 3 m away from doors and windows, and at least 10 m away from other air vents. This opening shall be kept clear and protected from debris.

The vent pipe shall be fitted with an ATEX-rated flow switch installed in a vertical orientation. The flow monitor shall be installed immediately before the position where the hydrogen vent pipe leaves the building.

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3.14 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

3.15 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

Signage:

- Sodium hypochlorite storage tanks shall be marked with a sign that says "Contains sodium hypochlorite >1%".
- Outlet pipework shall be labelled in accordance with DIN 2403: flammable gases (in this case, hydrogen) shall be marked yellow; air shall be marked grey. The flow direction of both air and hydrogen shall be indicated.
- The dilution hydrogen vent pipe shall be fitted with warning sign D-W001 for dangerous substances in accordance with DIN 4844.
- Sign D-P002 shall be provided to prohibit fire, naked light or smoking at the opening of the hydrogen vent pipe.

3.16 SPARES

Not applicable

3.17 FABRICATION

Fabrication shall comply with Specification D.

3.18 FASTENERS

Fasteners shall comply with Clause D7 in Specification D.

3.19 MATERIALS AND CORROSION PROTECTION

3.19.1 GENERAL

Where relevant, materials shall comply with Specification D as well as indicated below.

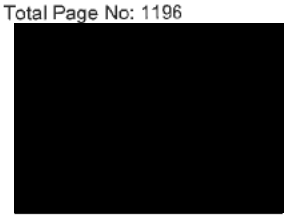
Corrosion protection shall comply with Clause D5 in Specification D.

3.19.2 EQUIPMENT

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the harsh nature of the chemical environment and according to Specification D.

ITEM	MATERIAL	COATING
Sodium hypochlorite inlet pipework and valves	PP	N/A
Sodium hypochlorite storage tanks	uPVC/HDPE/GFRP	N/A

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ITEM	MATERIAL	COATING
Standpipe and associated pipework	PP/PVC	N/A
Dilution air pipework and valves	PVC/HDPE	N/A
Hydrogen vent pipe	PVC/HDPE	N/A
Air blowers	PVC/HDPE	N/A

3.20 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

3.21 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

3.22 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

3.23 INSTALLATION

Installation work shall comply with Specification D.

3.24 INSPECTIONS

3.24.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

3.24.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

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3.25 TESTING REQUIREMENTS

3.25.1 FACTORY

A pressure test with air shall be undertaken at the factory to ensure that the tanks are watertight. The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

3.25.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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4. SODIUM HYPOCHLORITE DOSING SYSTEM

4.1 SCOPE

4.1.1 INTRODUCTION

This specification covers the requirements for the dosing of 0.8% sodium hypochlorite solution at the inlet and outlet of the Muldersvlei Reservoir. The dosing system shall be supplied with diaphragm dosing pumps, pipework, pulsation dampener, suction and discharge isolation valves, pressure reducing valves, pressure gauges with chemical diaphragm seals and all ancillary items required for a complete working system.

4.1.2 CONFIGURATION

The dosing pumps shall draw sodium hypochlorite from the storage tank and dose the sodium hypochlorite at the inlet and outlet of the Muldersvlei Reservoir.

The sodium hypochlorite dosing system is represented in the following drawings:

- 1001757-2000-PID-PP-2056 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2765 Plan View
- 1001757-2000-DRG-MM-2767 Plan View
- 1001757-2000-DRG-CC-2260 Site Layout

4.1.3 KEY ELEMENTS

- Suction pipework
- Dosing cabinet
- Sodium hypochlorite dosing pumps
- Interconnecting pipework & fittings
- Delivery pipework
- Injection lances
- Chemical dosing pipe supports
- Non-electronic instrumentation
- Safety equipment

4.1.4 ELECTRICAL & ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

4.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

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4.2 NORMATIVE REFERENCES

The following mechanical specifications are relevant to this section:

Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

4.3 DEFINITIONS AND ABBREVIATIONS

HDPE	High-density polyethylene
P&ID	Process & Instrumentation Diagram
PVC	Polyvinylchloride
PP	Polypropylene

4.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

4.5 GENERAL REQUIREMENTS

The chemical solution shall be pumped to the point of application via a 2 duty, 1 standby dosing pump arrangement. The Contractor shall supply the complete dosing pump arrangement for each point of application.

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

4.6 PERFORMANCE REQUIREMENTS

The dosing rates shall be accurate to ±5% of the required rate over the full specified range. Chemical dosing shall be proportional to the measured water flowrate.

Sodium hypochlorite shall be produced in the sodium hypochlorite generation skids as an 0.8% solution. The expected sodium hypochlorite dosing rate is 1.5 mg/ℓ at a feed flowrate of 240 MLD. The pumps be able to shall deliver sodium hypochlorite at a dosing rate of up to 950 L/hr.

4.7 OPERATION AND CONTROL

This description only serves to give a brief overview on the operation & control of the dosing pump arrangement. Notwithstanding this, the Contractor shall also refer to the Control Narrative which gives a more detailed description of the control requirements of the plant.

Chemical dosing control shall be proportional to the flow rate unless otherwise specified in the Project Specification. The operator will have to select the preferred dosing control option by logging in as a supervisor via the SCADA.

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To

For proportional flow rate dosing control, a flow meter or Coriolis mass flow meter shall be used to monitor the respective chemical feed rate to the process and a flow control loop shall control the dosing pump speed via an inverter drive to feed the chemical at the desired rate to the process.

The operator shall set the desired chemical dosing rate proportional to the main flow rate via the SCADA. The PLC shall calculate the desired mass dosing rate and the dosing pump shall maintain the desired mass rate via a PID control loop.

Operation and control are specified further detail in Section C3.7.4.

4.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

- For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.
- For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

4.9 SUCTION PIPEWORK

As shown in Figure 23, for each dosing skid, the battery limit for the suction pipework shall begin at the flushing point on the suction line and terminate at the suction manifold to the pumps.

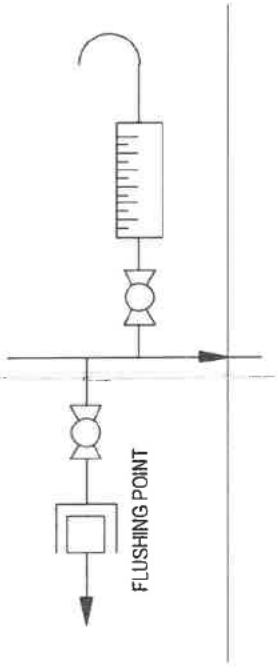


Figure 23: Suction pipework for sodium hypochlorite dosing skid

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A water flushing system shall be provided to flush the pumps and pipework. The water supply system is specified elsewhere. Pipework shall be provided from the supply point to a position within 1 m from the dosing pump suction line flushing point. The water supply line shall be fitted with a three-piece ball isolation valve. The final connection between the water line and the flushing point shall be via a flexible braided hose fitted with a quick coupling connection such as Kamlock or equivalent.

The flushing point shall be followed by a calibration tube in the pumps suction line. The calibration tube shall be in the form of a vertical cylinder of clear polycarbonate, 80 mm diameter and of 5.0 L capacity. The tube shall incorporate graduated markings on the side in 0.2 L increments and have a vent pipe at the top.

The suction line of each dosing skid shall feed into the suction manifold which shall have three (3) take-offs to service the respective pumps. The suction pipework shall be polypropylene or any other equivalent plastic suitable for the application. The suction pipework and valves shall comply with Clause D11.1.9 in Section D.

4.10 DOSING CABINET

The Contractor shall supply a dosing cabinet for the installation of each sodium hypochlorite dosing skid. All dosing equipment shall be mounted on a single skid within an enclosed cabinet.

The thickness of the mounting plate may vary depending on the size and weight of the pumps required and shall be designed specifically to the requirements of each unit.

The enclosure shall be constructed from polyvinylidene fluoride (PVDF) and shall be protected against external and internal (if any) corrosion. The doors to the cabinet shall be transparent plastic polyvinyl chloride (PVC) ensuring that the cabinet is splash resistant and to provide safe viewing of the dosing system.

The dosing cabinet shall be designed for ease of access and maintenance of all equipment contained therein.

The dosing cabinet shall be fully enclosed and constructed with a solid base with a bund wall of at least 100 mm in height in order to ensure that all spillages can be contained within the system.

The dosing cabinet shall be adequately ventilated at the top.

4.11 SODIUM HYPOCHLORITE DOSING PUMPS

4.11.1 GENERAL

For each dosing skid, the sodium hypochlorite dosing pumps shall be provided in a two (2) duty, one (1) standby configuration. The dosing pumps shall be positive displacement diaphragm type pumps (see Figure 24 below) suitable for pumping 0.8% sodium hypochlorite. In addition, the pumps shall be digital dosing with a LC display of the flow rate on the pump such as offered by the Alldoss SMART series or any other equivalent.

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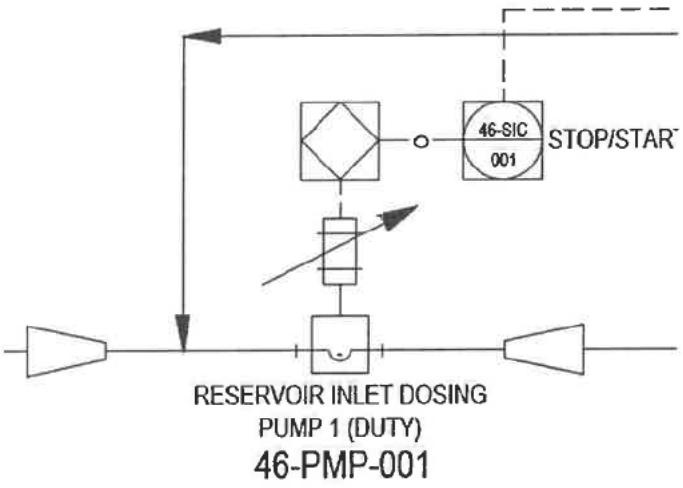


Figure 24: Diaphragm dosing pump used for sodium hypochlorite dosing

The pumps shall be complete with all suction piping and valves for connecting to the delivery pipework.

4.11.2 DIAPHRAGM TYPE PUMPS

Diaphragm type dosing pumps shall be electric motor and gear driven. The pump shall be driven through an oil-filled gearbox and a spring-loaded plunger with a support plate at the rear of the diaphragm. An eccentric cam system which actuates the plunger shall be manually adjustable to deliver from 0 to 100% of the design quantity of discharge.

The diaphragm chamber shall be designed such that in the event of a diaphragm rupture the pumped liquid cannot escape or enter the cam and gear mechanism of the pump and is drained away to a special chamber. The pump shall be designed in such a way that a leakage detector probe can be installed if specified in the Specification Data or if required at a later date. The diaphragm and coating shall be completely resistant to sodium hypochlorite.

Pumps shall be driven direct through an oil lubricated helical or planetary type reduction gearbox and motor, which shall be speed controlled by frequency variation from a 4 to 20 mA signal. The maximum pump design speed shall equate to a frequency of 50 Hz. The STOP/START status of each pump shall be displayed on the SCADA system.

Each pump shall be provided with a low flow switch to switch off the relevant pump and prevent any damage in the event of an isolating valve being closed.

The diaphragm housing shall be manufactured from PVC or other suitable material. The diaphragm plunger shall be manufactured from stainless steel with the diaphragm support plate specially coated to resist any liquid which could leak through the diaphragm in the event of a rupture.

4.12 INTERCONNECTING PIPEWORK & FITTINGS

The pipework upstream and downstream of each dosing pump shall be constructed of polypropylene or similar suitable corrosion-resistant material, complying with Clause D11.1.9 in Section D. The material shall be resistant to direct sunlight. The pipe shall be PN10 rated and adequately sized for 950 L/hr.

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[redacted]

The Contractor shall provide all the necessary isolation valves and fittings required for a successful operating plant. All valves and fittings shall be of a high quality designed and proven for the application in which they are to be used. Manufacturers such as F.I.P., Stubbe, Jesco, Alldos or equivalent approved shall be used.

The Contractor shall supply the following fittings for each pump (see Figure 25 below):

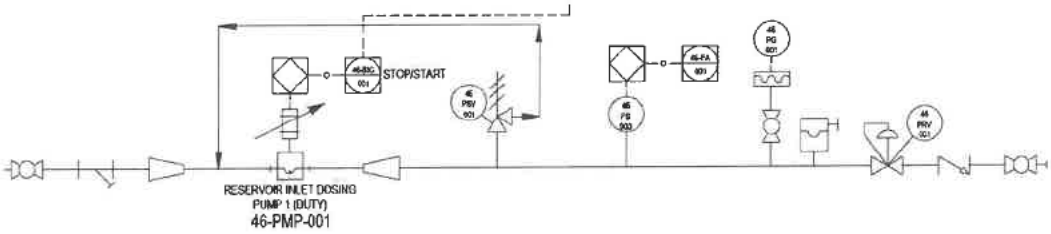


Figure 25: Interconnecting pipework and fittings for sodium hypochlorite dosing pumps

- An isolation valve shall be provided upstream and downstream of each pump. Isolating valves shall be manual and of the 90° operation ball type. All isolating valves shall be positioned such that they can be operated easily and safely from walkways etc.
- A strainer shall be provided upstream of each dosing pump. The strainers shall be complete with an easily removable element and incorporate a transparent casing so that the degree of blockage can be observed with the casing in place.
- A pressure relief valve shall be provided on the discharge line to each dosing pump. The relief valve shall relieve pressure at the pipe design pressure. The discharge line of the pressure relief valve shall be circulated back to the suction side of the dosing pump.
- A flow switch shall be fitted on the discharge line of each dosing pump.
- A pressure gauge shall be fitted on the discharge line of each dosing pump.
- Pulsation dampers shall be fitted on the discharge line of each dosing pump. The pulsation dampers shall have an FRP or other suitable plastic casing and incorporate a diaphragm and connection fitting which shall allow pressurisation of the damper with compressed air from a handheld type pump. The pulsation dampers shall be sized so as not to be classified as pressure vessels; i.e. multiple shall be provided if necessary.
- A pressure regulating valve shall be provided on the discharge line to ensure a constant supply pressure to the dosing point.
- Non-return valves shall be incorporated on the delivery side of each pump. The valves shall be an integral part of the pump and of the double-ball type. The balls shall be manufactured from glass or ceramic material, and the valve seats from PVC or other suitable and resistant material.
- Suitably sized reducers shall be fitted upstream and downstream of each dosing pump.

4.13 DELIVERY PIPEWORK

The Contractor shall provide all delivery pipework from the dosing pumps to the relevant dosing points. For each dosing skid, the discharge lines from each pump shall feed into a discharge manifold. The common discharge line shall be fitted with a Coriolis mass flow meter which shall be used to measure the flow rate from each dosing pump accurately. This flow meter is specified elsewhere in the Project Specification.

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[redacted]

The delivery pipework inside the building shall be polypropylene or any other equivalent plastic suitable for the application. The battery limit shall be inside the trench at the sleeve where the pipeline will exit the building. Pipework inside the sleeve shall be flexible and is specified elsewhere. The delivery pipework and valves shall comply with Clause D11.1.9 in Section D and shall conform to the following:

- As far as possible all piping shall be surface run along the sides or on the top of structure walls, or along walkways to allow for easy removal and replacement. The pipework shall be adequately supported to the satisfaction of the Engineer, inside suitably sized steel trays or with clamps that will be mounted on the side of the structure to which the pipework will be secured.
- All valves and fittings shall be constructed from Class 16 PVC, HDPE, PVDF or Polypropylene that shall be resistant to 0.8% sodium hypochlorite. No metallic parts shall be in normal contact with the chemical solution. The PVC or Polypropylene shall incorporate UV inhibitors and shall be resistant to direct sunlight.

All delivery pipework exiting the building shall be installed in sleeves with manholes connecting the sleeves at evenly spaced points along the pipe route. The sleeves and manholes shall be provided by others. The flexible pipework between the building and the dosing point shall be food grade ultra-high molecular weight polyethylene (UHMWPE). The UHMWPE pipework shall comply with the following:

- The tube shall be transparent UHMWPE and shall be suitably reinforced using high tensile textile cords with embedded steel helix wire.
- The tube cover shall be opaque and shall be abrasion resistant.
- The pipe shall be crack resistant and shall not permit any material leaching out into the sodium hypochlorite.
- The pipe shall be PN10 rated and adequately sized for 1900 L/hr.

4.14 INJECTION LANCES

The Contractor shall design, supply, and install a high-pressure chemical injection lance assembly for the controlled and effective injection of sodium hypochlorite into the main water pipeline.

4.14.1 FUNCTION AND COMPATIBILITY

The lance shall enable direct injection of disinfectant into the main process stream.

It shall be connected to a flexible UHMWPE chemical feed line from each sodium hypochlorite dosing pump skid.

The entire assembly shall be rated for continuous operation under the design pressure and temperature of the main pipeline.

4.14.2 LANCE CONSTRUCTION AND MATERIALS

The lance shall be constructed from corrosion-resistant materials compatible with sodium hypochlorite (e.g., Hastelloy C-276, titanium, or PVC-U/HDPE, depending on system pressure and chemical concentration).

The lance shall incorporate a retractable quill to allow for safe insertion and removal while the main pipeline remains in service and pressurized.

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4.14.3 RETRACTABLE MECHANISM AND SEALING

The retractable lance shall include a double-start jacking screw mechanism, capable of withstanding the hydraulic expulsion forces during both insertion and withdrawal from the pipeline.

The quill shall be fitted with a shock absorber packing system to minimize the mechanical impact of water pressure on the quill during operation. The shock absorber shall be constructed from EPDM or equivalent elastomer resistant to both chlorinated environments and mechanical fatigue.

The sealing assembly shall include a double O-ring gland to ensure leak-free operation under full system pressure.

4.14.4 QUILL AND DIFFUSER DESIGN

The tip of the injection quill shall incorporate a convex full-cone spray nozzle (refer to the figure below) designed to achieve even and effective dispersion of sodium hypochlorite within the flow stream.

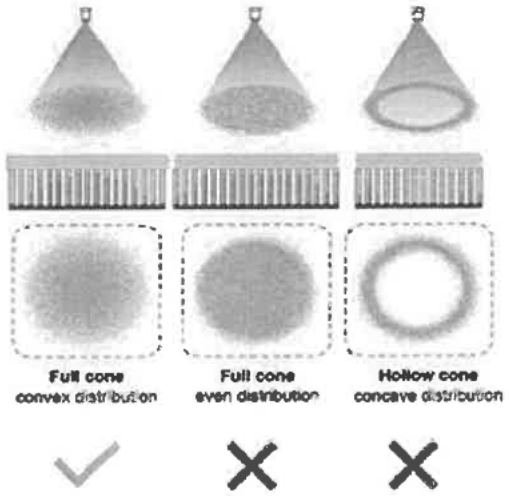


Figure 26: Full cone convex distribution nozzle

The diffuser shall be installed at a depth corresponding to 50% of the radius of the main pipeline to promote optimal mixing. The diffuser shall be of a removable type for maintenance or replacement, if required

4.14.5 FLOW ISOLATION AND MAINTENANCE

The lance shall feature isolation valves at both the inlet and outlet, enabling safe maintenance of the lance without the need to dismantle surrounding pipework or interrupt the operation of the main water pipeline.

4.14.6 CHEMICAL BACKFLOW PROTECTION

The lance shall be equipped with a non-return valve (check valve) of either the sprung ball or plunger type, installed on the chemical feed line or at the lance inlet, to prevent any backflow of water or contaminants into the dosing system.

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4.18 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

4.19 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

4.20 MATERIALS AND CORROSION PROTECTION

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D. Corrosion protection shall comply with Clause D5 in Specification D.

ITEM	MATERIAL	CORROSION PROTECTION
Calibration tube	Polycarbonate	N/A
Dosing cabinet enclosure	PVDF	N/A
Dosing cabinet doors	PVC	N/A
Interconnecting pipework	PP/uPVC/HDPE	N/A
Sodium hypochlorite discharge piping in buildings	PP/uPVC/HDPE	N/A
Sodium hypochlorite delivery piping in sleeves	UHMWPE	N/A
Sodium hypochlorite chemical dosing pumps (diaphragm housing)	PVC/PVDF	N/A
Sodium hypochlorite chemical dosing pumps (diaphragm plunger)	Stainless steel	Pickled and passivated
Injection lances	Hastelloy C276	Pickled and passivated
Pulsation damper casing	FRP	N/A
Pipe supports	Mild steel	Galvanized

4.21 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

4.22 CONTRACTORS DOCUMENTS

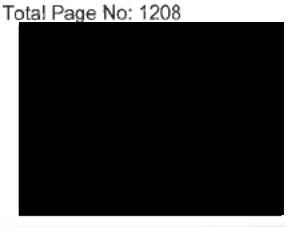
General documents and requirements for Contractors Documents are specified elsewhere.

4.23 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

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4.14.7 SIDE ENTRY CONNECTION

The lance shall include a side-entry port for connection to the sodium hypochlorite feed line (as indicated in the reference figure), ensuring smooth and secure chemical delivery into the quill.

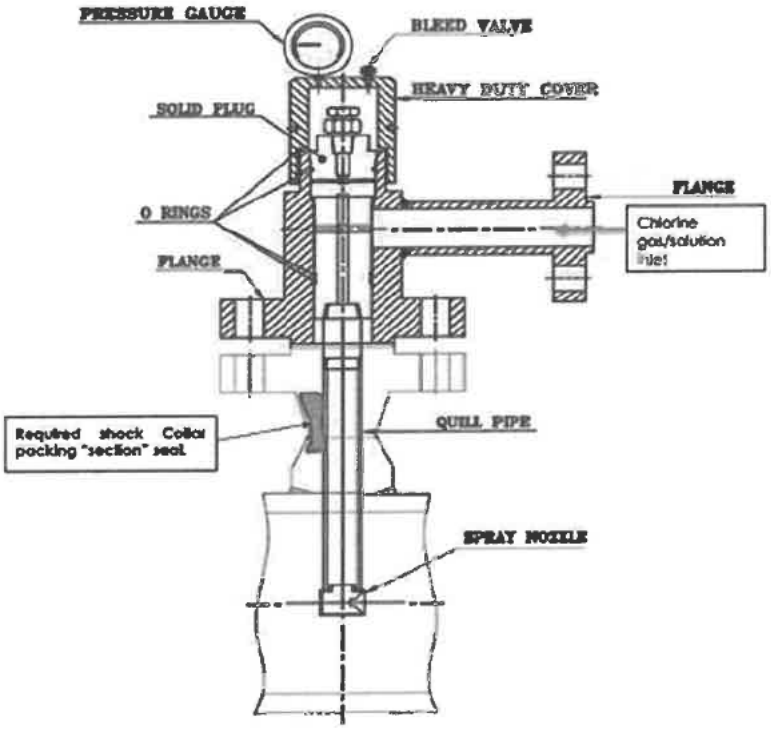


Figure 27: Injector quill design showing side entry for chlorine solution

Injection lances offered by Prochem, Calibre Life Sciences, Metagroup, NND Oil and gas, Evoqua and Mazzei & Cumberland, or similar reputable manufacturers, shall be provided.

4.15 CHEMICAL DOSING PIPE SUPPORTS

Where fixed along the sides or on the top of structure walls, all chemical dosing piping shall be mounted in open galvanized steel racks/trays at least 100mm deep, similar to those used for installing electric cables. The racks/trays shall be provided complete with all fixings, mountings and where necessary, support posts to adequately support the cable trays.

4.16 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

4.17 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

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[redacted]

4.24 INSTALLATION

Installation work shall comply with Section D.

4.25 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures and plinths on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of such civil works.

4.26 INSPECTIONS

4.26.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

4.26.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

4.27 TESTING REQUIREMENTS

4.27.1 FACTORY

Not applicable

4.27.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

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5. EQUIPMENT FOR COMMERCIAL SODIUM HYPOCHLORITE OFFLOADING & DILUTION

5.1 SCOPE

5.1.1 INTRODUCTION

This specifies the requirements for commercial sodium hypochlorite offloading and dilution equipment to be provided by the Contractor.

5.1.2 CONFIGURATION

Commercial sodium hypochlorite (approximately 12% solution) shall be used as a back-up system in the event that the sodium hypochlorite generation units are not operational. The first sodium hypochlorite storage tank (storage tanks are specified elsewhere) shall receive the bulk chemical from a road tanker. The sodium hypochlorite shall be drawn from these tanks and diluted using two (2) hydraulic-powered chemical injectors in a duty/standby configuration. The diluted commercial sodium hypochlorite shall be fed to the second storage tank in each series. The sodium hypochlorite dosing skids will receive suction from these tanks and operate as specified in Section 4.

The commercial sodium hypochlorite offloading and dilution system is represented in the following drawings:

- 1001757-2000-PID-PP-2055 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2056 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2765 Plan View
- 1001757-2000-DRG-MM-2766 Isometric and Sectional Views

5.1.3 KEY ELEMENTS

- Commercial sodium hypochlorite offloading and storage
- Commercial sodium hypochlorite dilution
- Diluted commercial sodium hypochlorite discharge pipework
- Non-electronic instrumentation
- Safety Equipment
- Spares
- First fill of chemical
- Miscellaneous

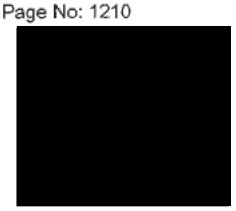
5.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

5.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element,

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this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

5.2 NORMATIVE REFERENCES

The following forms part of the Contract Document:

Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.

5.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

EPDM Ethylene Propylene Diene Monomer

FPM Fluorinated Propylene Monomer

SCADA Supervisory Control and Data Acquisition

5.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

5.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

5.6 PERFORMANCE REQUIREMENTS

This section provides the overall performance requirements for the commercial sodium hypochlorite offloading and dilution system. The Contractor shall refer to the descriptions of each key element (as listed above) for detailed descriptions of each element's performance requirements. The detailed descriptions include images from the relevant P&IDs for further clarity.

The system shall dilute 127 L/hr commercial sodium hypochlorite (12%) to 1900 L/hr of 0.8% sodium hypochlorite using suitably sized hydraulic-powered chemical injectors. Using 1773 L/hr of dilution water, the injectors shall each achieve an injection rate of 7.1%.

5.7 OPERATION AND CONTROL

When the sodium hypochlorite generation skids are not operational, the switch-over to the commercial sodium hypochlorite storage and dilution system shall be done manually by the operators. Once in the necessary pipe connections have been made, the level switches on the sodium hypochlorite storage tanks shall control the actuated valve on the dilution water feed line.

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Operation and control are specified in further detail in section C3.7.4.

5.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

a) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

b) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

5.9 COMMERCIAL SODIUM HYPOCHLORITE OFFLOADING AND STORAGE

Figure 28 below shows the tanker offloading pipework as presented on the P&ID.

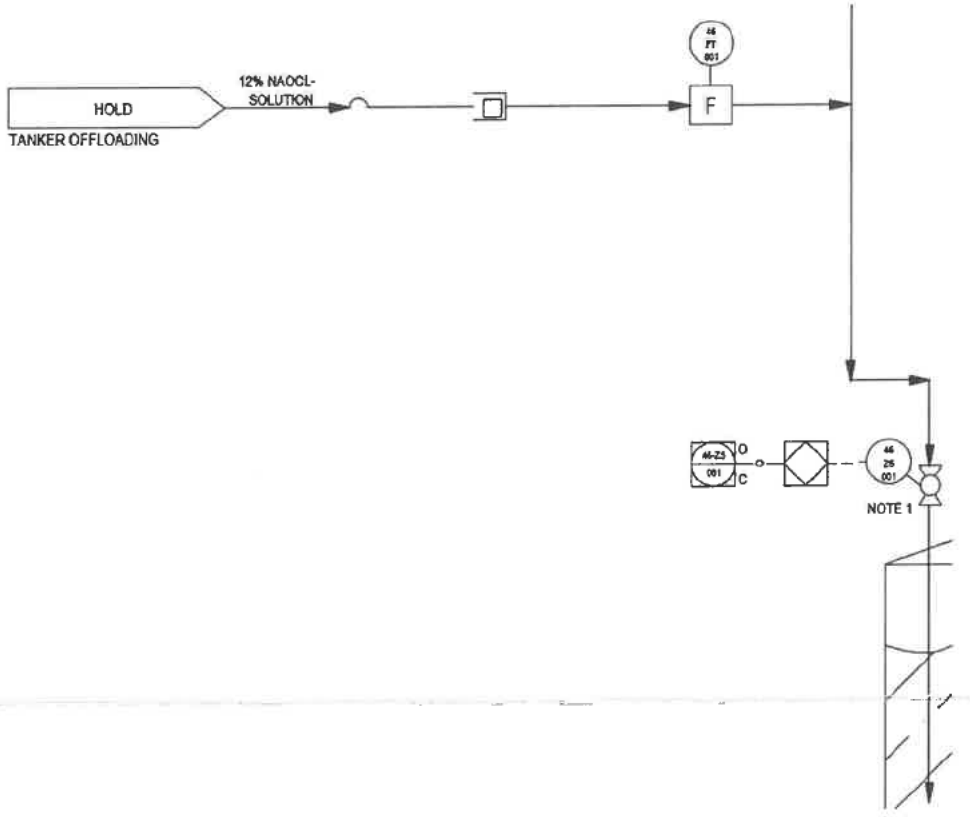


Figure 28: Commercial sodium hypochlorite tanker offloading and storage

The Contractor shall supply the pipework and fittings for the offloading of commercial sodium hypochlorite at 12% from a road tanker to the sodium hypochlorite storage tanks inside the building. The Contractor shall provide one (1) suitable connector for connecting the tanker filling pipe as required by the sodium hypochlorite supplier. The connector shall provide a drip-free solution. Notwithstanding the drip-free connector, a suitable drip tray

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shall also be provided under the connection point to collect any potential spillages. All fittings shall have the same nominal size and pressure rating as the corresponding pipework.

This sodium hypochlorite feed pipe shall also be fitted with a mechanical flow meter. The main header between the connection point on the outside of the building and the tanks inside the building shall feed a manifold with two (2) take-offs to feed the respective sodium hypochlorite storage tanks positioned inside the building. From the manifold, dedicated filling lines shall be provided to route the commercial sodium hypochlorite to the top of the first storage tank in each series. The selection of which tank is to be filled shall be made on the manifold station by opening of the appropriate isolation valve to a tank. The isolation valve shall be a manually operated ball valve that shall be fitted with a proximity switch. The OPEN/CLOSE status of each valve shall be displayed on the SCADA system. For each filling line, the ball valves shall be placed as close as possible to the tank inlet such that the possible build-up of hydrogen gas in the line is minimised during the filling of the tank with sodium hypochlorite product from the sodium hypochlorite generation skids. The filling pipe shall further extend to the bottom of the tank on the inside of the tank to provide a liquid trap to prevent hydrogen from entering the pipeline.

The filling line between the manifold and each tank shall be properly supported and connected to the flanged filling nozzle on the tank where it shall be rigidly fixed to the tank roof. The filling pipeline material of construction, including valves & fittings shall comply with Clause 11.1.9 in Specification D.

5.10 COMMERCIAL SODIUM HYPOCHLORITE DILUTION

5.10.1 COMMERCIAL SODIUM HYPOCHLORITE SUPPLY

From each of the first sodium hypochlorite storage tank in series, the Contractor shall provide a tee off from the outlet line to feed the hydraulic-powered chemical injectors. The tee shall connect to a polypropylene pipe which shall be fitted with a manual full bore ball valve for isolation (see Figure 29 below). The valve shall be fitted with a position switch such that the OPEN/CLOSED status of the valve shall be visible on the SCADA system. The valve body shall be made of PVC and the seals shall be FPM.

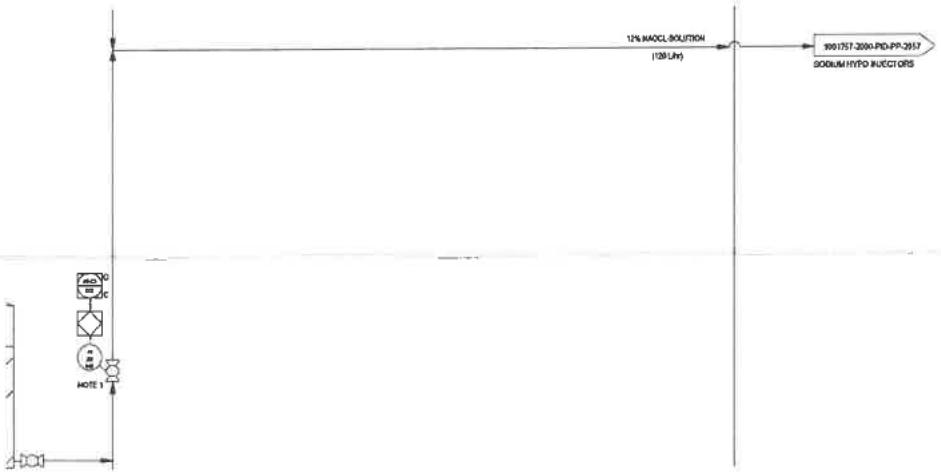


Figure 29: Suction line from sodium hypochlorite storage tank

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The pipes from the two tanks shall be joined with a pipe tee and feed a single pipeline. As shown in Figure 30 below, this pipe shall be fitted with an actuated full bore ball valve. The isolation valve shall be followed by a plastic Y-strainer with cleanable EPDM O-rings. The pipe shall then be fitted with a 3-way valve including a position switch. Following the 3-way valve, the pipework shall branch out to feed each chemical injector. The feed line to each injector shall be fitted with a PTFE quick connection to connect the pipe to a flexible PVC hose. The flexible hose shall be connected to the chemical suction end of the injector. Clamps shall be provided to ensure that the flexible tube remains in place. All fittings from the tank to the chemical injector shall be corrosion resistant to a 12% sodium hypochlorite solution.

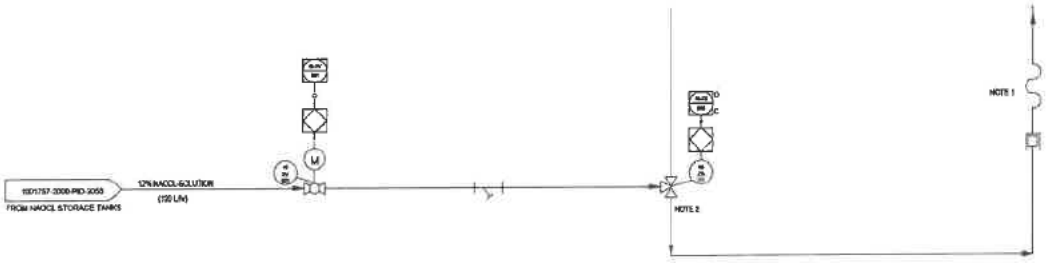


Figure 30: Chemical suction lines to injectors

The maximum suction height from the storage tank to the chemical injector shall not exceed 4 m.

5.10.2 DILUTION WATER SUPPLY

Figure 31 below shows the dilution water pipework supply to the chemical injectors as presented on the P&ID.

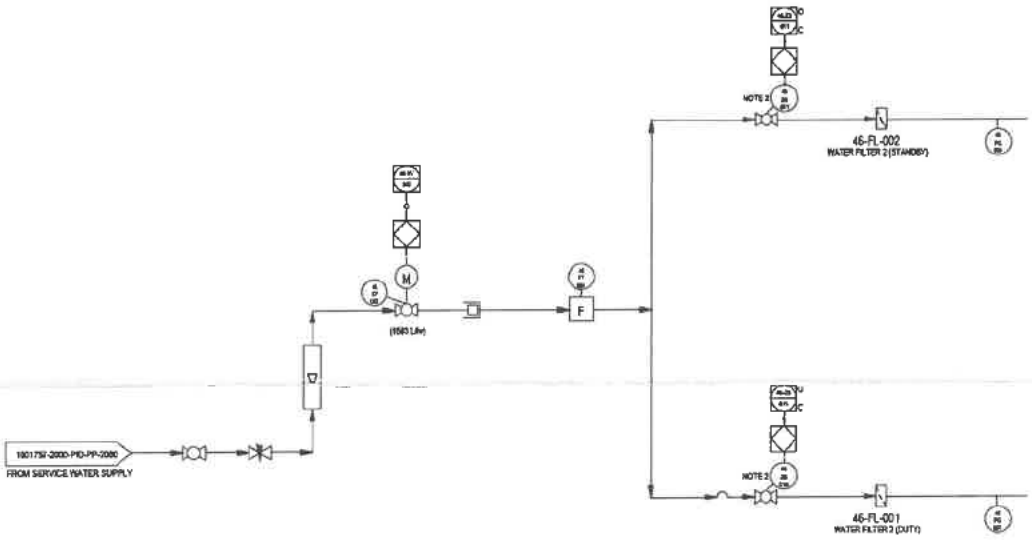


Figure 31: Dilution water supply to chemical injectors

A stainless steel 316 pipeline shall convey the dilution water from the service water supply line to the venturi injector. This pipe shall be fitted with a manual ball valve for isolation purposes, followed by a needle valve for controlling the water supply rate. The pipeline

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shall also be fitted with a mechanical type flowmeter with a read out for checking the flow being sent to the injector. A motorised actuated ball valve will also be installed on the downstream side of the mechanical flowmeter. The OPEN/CLOSE status of the valve shall be displayed on the SCADA system. The actuator shall comply with Clause D16 in Specification D. After the valve, the pipeline shall be fitted with a removable coupling and a magnetic flow meter.

The pipeline shall feed a manifold with two (2) take-offs to the hydraulic-powered chemical injectors. For each injector, the supply line shall be fitted with a manual full bore ball valve including a proximity switch. The ball valve shall be a 3-piece ball valve fitted with OPEN/CLOSE limits to be displayed on the SCADA system. The valve shall be followed by a 50 to 60 µm filter and mechanical pressure gauge. This water supply line shall then feed the injector.

The dilution water supply line, valves & fittings shall comply with Clause D4 in Specification D.

5.10.3 SODIUM HYPOCHLORITE HYDRAULIC INJECTORS

Two (2) hydraulic-powered chemical injectors shall be provided in a duty/standby configuration for the mixing & dilution of sodium hypochlorite. A chemical injector is shown in Figure 32 below.

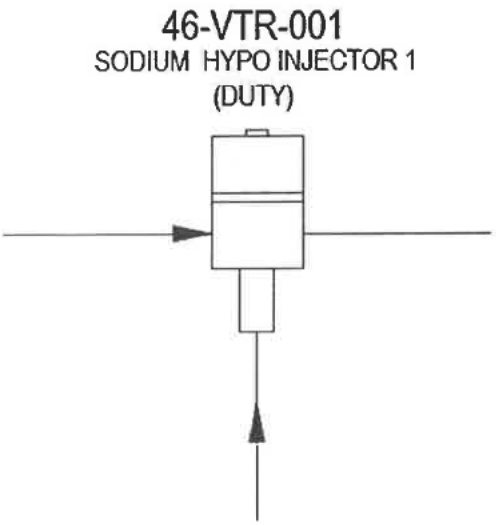


Figure 32: Hydraulic-powered chemical injector

Each injector shall be wall-mounted and the water inlet of each injector shall be above the maximum liquid level in the storage tank. The chemical suction end of the injector shall be self-priming. A drip tray shall be installed under the injectors.

The injector shall have sufficient capacity to produce 1900 L/hr of 0.8% sodium hypochlorite using 127 L/hr of 12% sodium hypochlorite and 1773 L/hr of dilution water. The injection shall perform the dilution at an accuracy of ±10% or better and a repeatability of ±3% or better. The injector shall be completely non-electronic and the injection of sodium hypochlorite shall be proportional to the volume of motive water entering the device irrespective of fluctuations in pressure or flowrate in the main water line.

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The injector housing, motor piston, and injection area shall be constructed of polypropylene or similar suitable material for 12% sodium hypochlorite. Venturi injectors such as supplied by Dosatron, or any other similar equivalent injector shall be used.

5.11 DILUTED COMMERICAL SODIUM HYPOCHLORITE DISCHARGE PIPEWORK

Figure 33 below shows the discharge pipework from the sodium hypochlorite dilution system as presented on the P&ID.

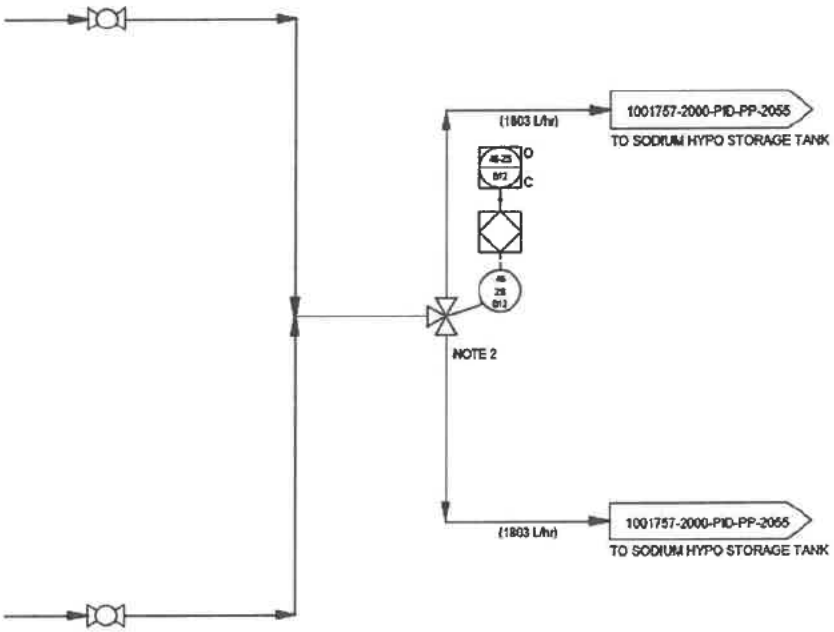


Figure 33: Discharge pipework from the sodium hypochlorite dilution system

The discharge pipeline of each chemical injector shall be fitted with a manual ball valve for isolation. The pipelines from the two (2) injectors shall then feed a common header leading to a 3-way valve fitted with OPEN/CLOSE limits to be displayed on the SCADA system. From this 3-way valve, two (2) feed pipelines shall supply the diluted sodium hypochlorite to the duty and standby storage tank set, respectively.

This filling pipe shall feed the top of the second sodium hypochlorite storage tanks in series, extending to the bottom of each tank internally. The pipe shall be fitted with a ball valve fitted with a proximity switch. The OPEN/CLOSE status of each valve shall be displayed on the SCADA system.

The pipework and fittings shall be constructed of polypropylene and shall be sized to allow for a flow rate of 1900 L/hr of 0.8% sodium hypochlorite, complying with Clause D11.1.9 of Specification D.

5.12 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

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5.13 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

5.14 SPARES

Not applicable.

5.15 FIRST FILL OF CHEMICALS

The Contractor shall provide the first fill of 12% commercial sodium hypochlorite to be used for commissioning tests. One month's supply of chemical shall be provided.

5.16 MISCELLANEOUS

The Contractor shall supply one (1) centrifugal pump to empty the 12% sodium hypochlorite into the storage tank. This shall primarily be used for testing during commissioning. The pump shall be sized to deliver 3 m^3/h at a head of 20 - 30 m.

All pipework and valves shall be suitably selected for the application. The materials of construction shall be chemically resistant to 12% sodium hypochlorite.

The pump shall comply with Clauses D26.2.1 to D26.2.11 of Section D.

5.17 FABRICATION

Fasteners shall comply with Clause D4 of Section D.

5.18 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

5.19 MATERIALS AND CORROSION PROTECTION

5.19.1 GENERAL

Materials shall comply with Clause D11.1.9 in Specification D.

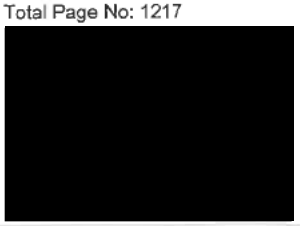
Corrosion protection shall comply with Clause D5 in Specification D.

5.19.2 EQUIPMENT

Equipment shall comply with the below table. Components not specified in the table shall be suitably selected for the corrosive environment.

ITEM	MATERIAL	COATING
Commercial sodium hypochlorite offloading pipework and fittings	PP/PVC	N/A
Service water supply pipework and fittings	Stainless steel 316	N/A
Hydraulic-power chemical injector housing	PP	N/A
Hydraulic-power chemical injector motor piston	PP	N/A
Hydraulic-power chemical injector injection area	PP	N/A

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ITEM	MATERIAL	COATING
Hydraulic-power chemical injector discharge pipework and fittings	PP/uPVC	N/A

5.20 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

5.21 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

5.22 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

5.23 INSTALLATION

Installation work shall comply with Specification D.

5.24 TOLERANCES

Not applicable

5.25 INSPECTIONS

5.25.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

5.25.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

5.26 TESTING REQUIREMENTS

5.26.1 FACTORY

Not applicable

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[redacted]

5.26.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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6. EQUIPMENT FOR CALCIUM HYPOCHLORITE PREPARATION

6.1 SCOPE

6.1.1 INTRODUCTION

The Contractor shall provide a back-up calcium hypochlorite make-up and storage system. This specification covers the requirements for the equipment and pipework around the calcium hypochlorite make-up system and storage tanks to be provided by the Contractor.

The design is covered by the following piping & instrumentation diagrams:

- 1001757-2000-PID-PP-2058 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2764 Isometric and Sectional Views

6.1.2 CONFIGURATION

Service water shall be fed to four (4) calcium hypochlorite hoppers. The hoppers shall be filled manually with calcium hypochlorite chips. The calcium hypochlorite chips shall be dissolved by the service water to create a calcium hypochlorite solution that shall be conveyed by gravity to downstream storage tanks from where the solution shall be dosed to the process.

6.1.3 KEY ELEMENTS

- Inlet pipework
- Calcium hypochlorite hoppers
- Calcium hypochlorite hoppers mezzanine support
- Calcium hypochlorite storage tanks
- Pipework for level monitoring system
- Transfer pipework
- Outlet pipework
- Non-electronic instrumentation
- First fill of chemicals
- Safety equipment
- Spares

6.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

6.1.5 OTHER ELEMENTS

Other work, materials, and equipment ancillary to the key elements above, which are required to enable the works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

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6.2 NORMATIVE REFERENCES

The following forms part of the Contract Document:

- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.

6.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

GRP	Glass reinforced plastic
P&ID	Process & Instrumentation Diagram
PVC	Polyvinylchloride
LLDPE	Linear low-density polyethylene

6.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

6.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

6.6 PERFORMANCE REQUIREMENTS

The Contractor shall provide a fully functional and operating plant to store & feed calcium hypochlorite solution to the process. The plant shall be able to achieve a free chlorine residual of up to 1.5 mg/l in a water flow of 240 ML/day via the dosing of calcium hypochlorite.

All chemical feeding and storage equipment shall be provided complete with all piping, valves, brackets, fixings and all equipment necessary for the chemicals specified.

All materials used in the construction of the equipment shall in themselves be resistant to the chemicals to be used or shall be suitably protected from the action of these chemicals. Details of materials proposed shall be stated in the relevant Detail Data Sheet.

All necessary chemical delivery piping, fittings, support racks or trays and brackets to serve the plant supplied shall be provided.

6.7 OPERATION AND CONTROL

The preparation of calcium hypochlorite shall be controlled via the level in the downstream storage tanks. When the maximum storage capacity of the tanks has been reached, the

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calcium hypochlorite solution preparation will cease by closing of the service water supply valve. Upon reaching the minimum storage tank level, the preparation of calcium hypochlorite shall again start automatically.

The storage tank level across the storage tanks which are connected in parallel shall be monitored by level instrumentation. An ultrasonic level transmitter as well as two level switches shall be provided.

The actuated service water supply valve shall automatically open to allow service water to be fed to the calcium hypochlorite hopper for preparation of calcium hypochlorite solution when the storage tank level is below the required level.

The ultrasonic level transmitter will continuously measure the level of calcium hypochlorite solution and this level will be presented on the DCS HMI.

The Contractor shall also refer to the Control Narrative which gives a more detailed description of the control requirements of the system.

6.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

- For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.
- For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

6.9 INLET PIPEWORK

The Contractor shall provide all the pipework to convey service water from the service water header to the four (4) calcium hypochlorite hoppers. This pipework is illustrated in Figure 34 below, as represented in the relevant P&ID.

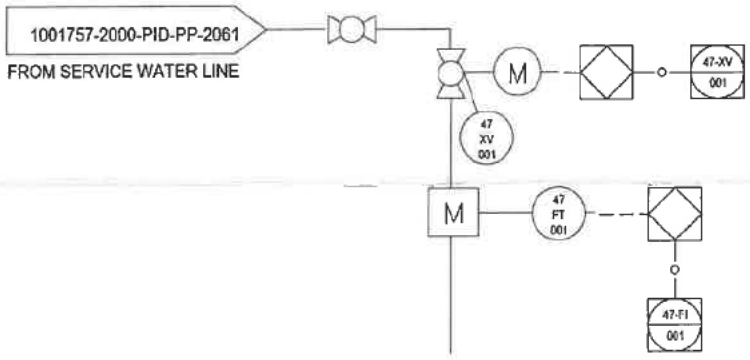


Figure 34: Service water supply pipework for calcium hypochlorite preparation system

The anticipated water flowrate is 24000 L/hr. The pipework shall be adequately sized based on the system capacity. The water supply pipework material of construction shall be stainless steel 316 complying with Clause D11.1.2 in Section D. The main process water

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supply line shall be fitted with a magnetic flow meter and a manual 3-piece ball isolation valve shall be included upstream of the flowmeter. An actuated ball isolation valve shall also be supplied downstream of the flowmeter. The actuated valve shall be fitted with an electric actuator which shall comply with Clause D16 of Section D. All valves shall comply with Clause D15.2. The main process water supply line shall feed the four (4) calcium hypochlorite hoppers individually via a dedicated water supply line.

6.10 CALCIUM HYPOCHLORITE HOPPERS

The Contractor shall supply four (4) chip/tablet based calcium hypochlorite hoppers. These hoppers are shown in Figure 35 below, as represented on the relevant P&ID.

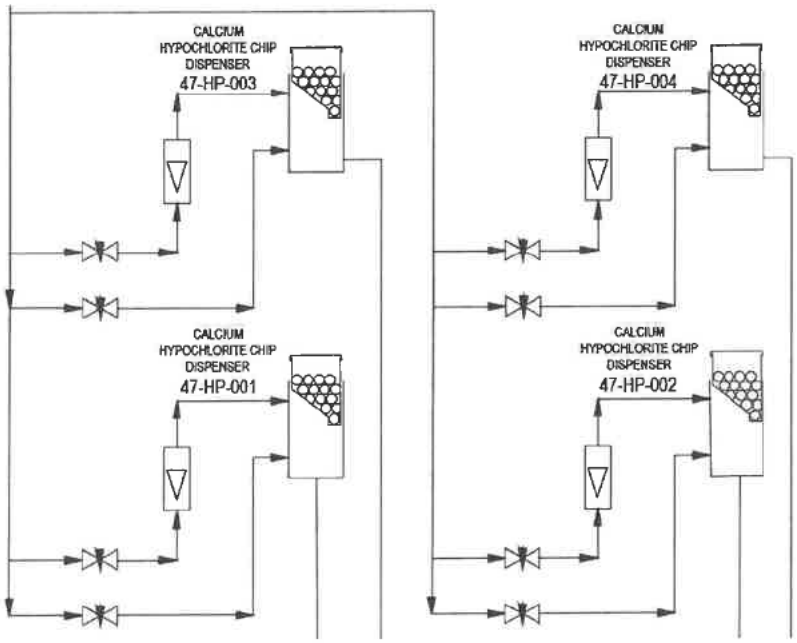


Figure 35: Calcium hypochlorite hoppers

Each hopper shall be constructed of LLDPE. Each hopper shall allow for a full refill load of 100 kg and a maximum allowable dosing rate of 800 ppm. 6 000 L/hr of calcium hypochlorite solution shall be dispensed from each hopper.

Each calcium hypochlorite hopper shall have connections for two inlet streams. One of the streams on the inlet side shall be fitted with a needle valve and a rotameter. The rotameter shall be sized to easily read over the range of flows. The second stream shall only be fitted with a needle valve.

Each calcium hypochlorite hopper shall come equipped with a single outlet connection to allow calcium hypochlorite solution to be conveyed to the calcium hypochlorite receiving tank. All valves shall comply with Clause D15.2.

6.11 CALCIUM HYPOCHLORITE HOPPERS MEZZANINE SUPPORT

The Contractor shall provide a mezzanine floor to support the calcium hypochlorite hoppers above the storage tanks. The mezzanine floor shall be in the form of GRP grating and shall comply with the relevant sections of Clause D8 of Section D. The mezzanine floor shall support a minimum loading of 350 kg/m^2.

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The Contractor shall finalise the support to be used beneath the mezzanine floor.

Furthermore, the Contractor shall supply a guard rail and kickplate along the one side of the mezzanine floor as indicated on the drawings. The guard rail and kickplate shall extend from the wall of the pump room to the wall of the dosing skids. The height of the guard rail shall be at least 900 mm. The kickplate shall have a height of at least 100mm.

The guard rail and kickplate shall be GRP or a similar corrosion resistant material and shall comply with the relevant sections of Clause D9 of Section D.

6.12 CALCIUM HYPOCHLORITE STORAGE TANKS

The generated calcium hypochlorite solution shall be routed into a receiving tank that will act as a settler for any sediment generated during the preparation process. The receiving tank shall feed two (2) downstream storage tanks.

In total, the contractor shall supply three (3) bulk storage tanks for the storage of calcium hypochlorite solution. These horizontal cylindrical storage tanks shall be constructed of LLDPE. Each tank shall have a useable volume of 5 m^3.

The base of the tank shall be flat, and suitable to be placed on a flat, hard surface. The roof of each tank shall be domed such that it does not visibly deflect when a load of 150 kg is imposed vertically on it. The storage tanks shall be bolted down to the plinth on which they will rest. Furthermore, the Contractor shall make allowance for access inside each storage tank for cleaning purposes.

The following connections shall be provided on the calcium hypochlorite receiving tank (Figure 36):

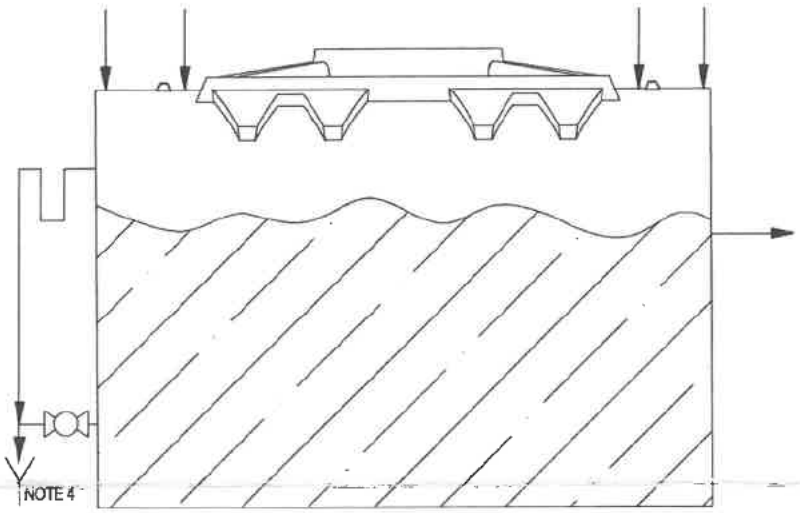


Figure 36: Calcium hypochlorite receiving tank

- Four (4) adequately sized filling nozzles to allow calcium hypochlorite solution to be directed into the tank from each calcium hypochlorite hopper.
- A nozzle for the installation of the overflow drainpipe.

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- A drainpipe and drain valve for the emptying of the tank.
- An outlet connection point to allow calcium hypochlorite solution to be conveyed to the second and third calcium hypochlorite storage tanks.

The following connections shall be provided on each calcium hypochlorite storage tank (Figure 37):

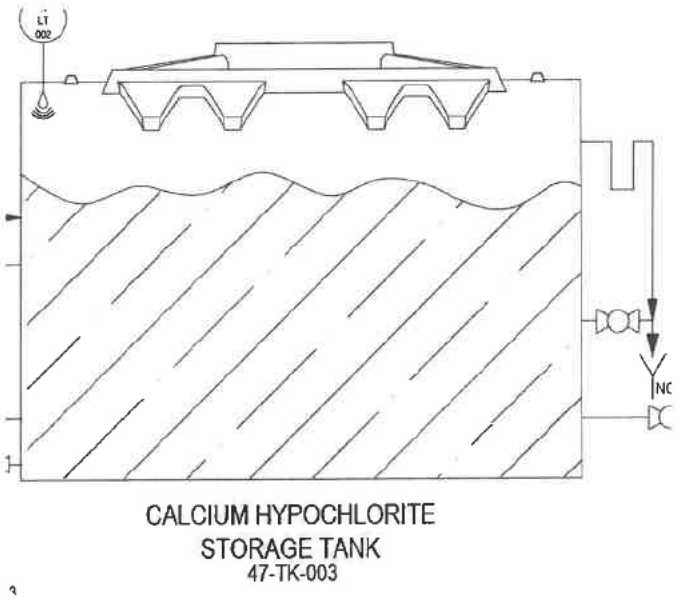


Figure 37: Calcium hypochlorite storage tank

- An inlet connection for calcium hypochlorite solution to be conveyed from the calcium hypochlorite receiving tank.
- A nozzle for the installation of the overflow drainpipe.
- A drainpipe and drain valve for the emptying of the tank.
- An outlet connection point to allow calcium hypochlorite solution to be conveyed to the inlet and outlet dosing pumps.
- Two adequately sized mounting points for the connection of a uPVC standpipe to allow for the installation of level instrumentation.

All pipework on the calcium hypochlorite receiving and storage tanks shall comply with Clause D11.1.9 in Specification D, unless otherwise specified. All valves shall comply with Clause D15.2.

6.13 PIPEWORK FOR LEVEL MONITORING SYSTEM

Each calcium hypochlorite storage tank shall be equipped with a standpipe which shall have two (2) connections for the mounting of the level monitoring instrumentation. This is shown in Figure 38 below.

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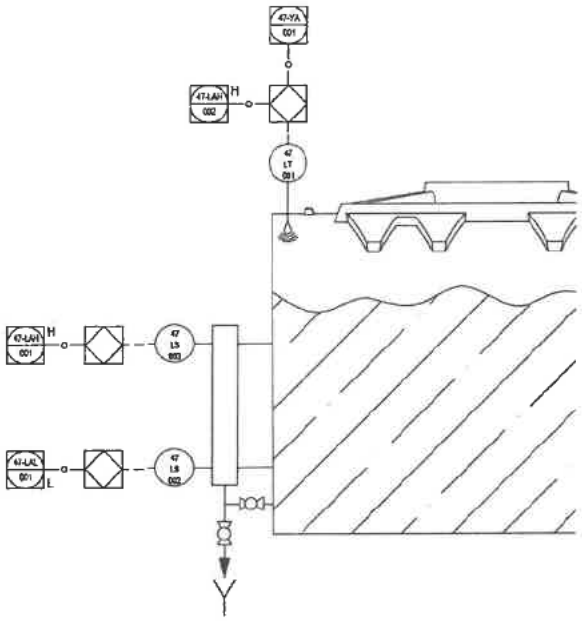


Figure 38: Pipework for level monitoring instrumentation on calcium hypochlorite tank

The standpipe shall be mounted onto the calcium hypochlorite make-up tanks via suitably sized brackets. These brackets shall be provided by the Contractor. Calcium hypochlorite solution shall be fed to the standpipe via a pipe that will be installed on the bottom of the calcium hypochlorite make-up tank. Furthermore, a manual isolation valve shall be installed on the line. The pipe and manual isolation valve shall be provided by the Contractor.

The Contractor shall also supply a drain valve and a drain line for the standpipe. All pipework on the calcium hypochlorite storage tanks shall comply with Clause D11.1.9 in Specification D, unless otherwise specified. All valves shall comply with Clause D15.2.

6.14 TRANSFER PIPEWORK

6.14.1 CALCIUM HYPOCHLORITE HOPPER UUTLET PIPEWORK

The Contractor shall supply all the pipework to direct 0.08 % calcium hypochlorite from each of the four (4) calcium hypochlorite hoppers to the calcium hypochlorite receiving tank.

6.14.2 CALCIUM HYPOCHLORITE RECEIVING TANK - TRANSFER PIPEWORK

The Contractor shall supply all the outlet pipework necessary to direct calcium hypochlorite solution from the receiving tank to the first and second storage tanks. On the outlet of the receiving tank, a main header pipe fitted with an isolation ball valve shall connect to a tee piece, allowing the calcium hypochlorite solution to be directed to the first and second storage tanks. The storage tanks shall be connected in parallel.

The anticipated installation is shown on the applicable drawings and P&IDs.

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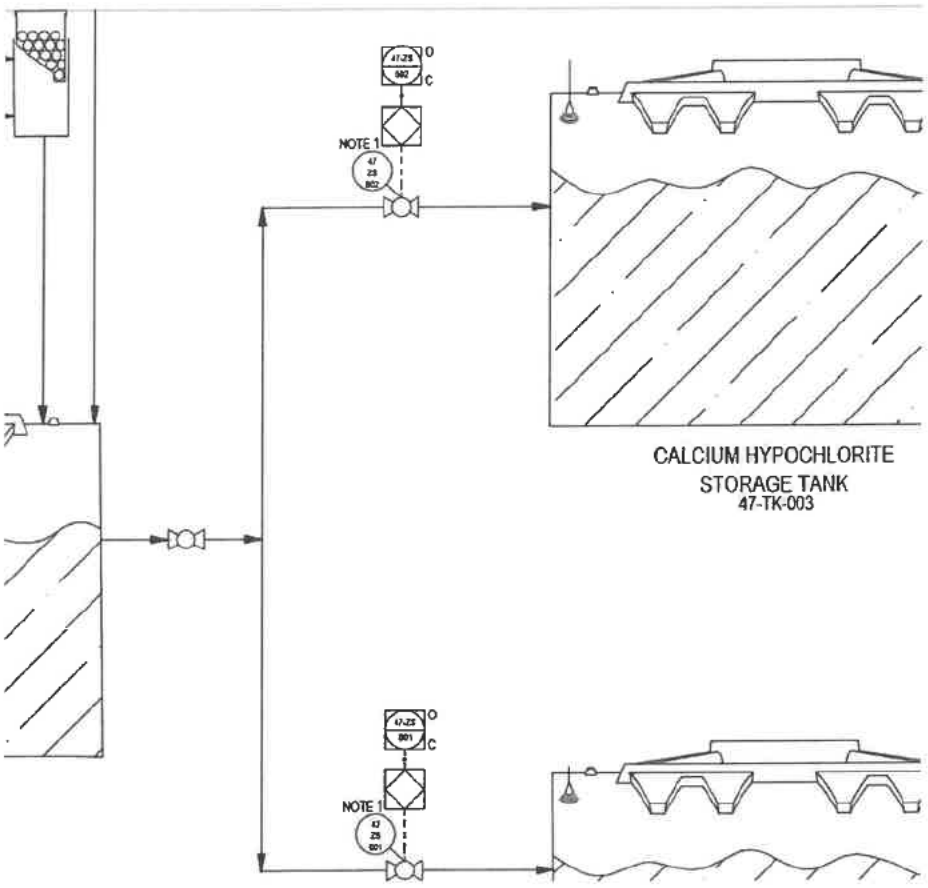


Figure 39: Transfer pipework between calcium hypochlorite storage tanks

The aforementioned isolation ball valve shall be supplied by the Contractor and shall have the same nominal size and pressure rating as the corresponding pipework. The isolation valve shall be accessible for an operator. The valve shall comply with Clause D15.1 &15.2 in Section D. All pipework and valves on the calcium hypochlorite storage tanks shall comply with Clause D11.1.9 in Specification D.

On the inlet stream feeding each calcium hypochlorite storage tank, a manual ball valve with a position switch shall be fitted. Each position switch shall incorporate a SCADA system on which the OPEN/CLOSED status shall be displayed.

6.15 OUTLET PIPEWORK

The Contractor shall supply all the outlet pipework necessary to direct calcium hypochlorite solution from the storage tanks to the dosing pumps. Each tank shall direct the calcium hypochlorite solution from an outlet connection consisting of an isolation ball valve to a common stream, where the calcium hypochlorite shall be directed to the inlet and outlet reservoir dosing pumps. All pipework and valves on the calcium hypochlorite storage tanks shall comply with Clause 11.1.9 and 15.2 in Specification D.

The anticipated installation is shown on the applicable drawings and P&IDs.

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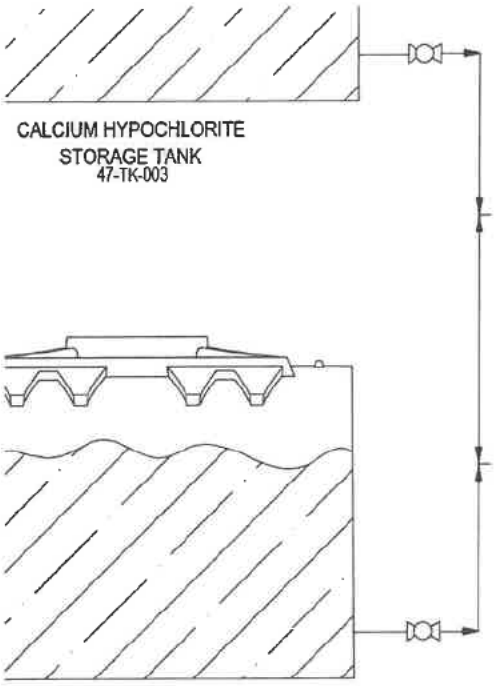


Figure 40: Outlet pipework from calcium hypochlorite storage tanks

6.16 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

6.17 FIRST FILL OF CHEMICALS

The Contractor shall provide one month's supply of 25kg drums of calcium hypochlorite tablets for start-up. The concentration of calcium hypochlorite shall be at least 65%.

6.18 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

6.19 SPARES

Not applicable

6.20 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

6.21 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

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6.22 MATERIALS AND CORROSION PROTECTION

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D. Corrosion protection shall comply with Clause D5 in Specification D.

ITEM	MATERIAL	COATING
Calcium hypochlorite hopper inlet pipework	EN Grade 1.4401 stainless steel (316)	Pickled and passivated
Calcium hypochlorite hopper outlet pipework	PP/uPVC	N/A
Calcium hypochlorite hoppers	LLDPE	N/A
Calcium hypochlorite make-up tanks	LLDPE	N/A
Calcium hypochlorite make-up tank drainpipes	PP/uPVC	N/A
Calcium hypochlorite standpipe	PP/uPVC	N/A
Calcium hypochlorite transfer and outlet pipework	PP/uPVC	N/A

6.23 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

6.24 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

6.25 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

6.26 INSTALLATION

Installation work shall comply with Section D

6.27 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures and plinths on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of such provided civil works.

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6.28 INSPECTIONS

6.28.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

6.28.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

6.29 TESTING REQUIREMENTS

6.29.1 FACTORY

Not applicable

6.29.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

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7. CALCIUM HYPOCHLORITE DOSING SYSTEM

7.1 SCOPE

7.1.1 INTRODUCTION

This specification covers the requirements for the dosing of 0.08% calcium hypochlorite solution at the inlet and outlet of the Muldersvlei Reservoir. The dosing system shall be supplied with peristaltic dosing pumps, pipework, pulsation dampener, suction and discharge isolation valves, pressure reducing valves, pressure gauges with chemical diaphragm seals and all ancillary items required for a complete working system.

7.1.2 CONFIGURATION

Calcium hypochlorite will be drawn from the calcium hypochlorite storage tanks and from one set of dosing pumps, from where it shall be dosed to the inlet reservoir pipeline. From a second set of pumps, calcium hypochlorite shall be dosed to the outlet reservoir pipeline.

The calcium hypochlorite dosing system is represented in the following drawings:

- 1001757-2000-PID-PP-2059 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2764 Isometric and Sectional Views
- 1001757-2000-DRG-CC-2260 Site Layout

7.1.3 KEY ELEMENTS

- Suction pipework
- Calcium hypochlorite dosing pumps
- Interconnecting pipework & fittings
- Delivery pipework
- Injection lances
- Chemical dosing pipe supports
- Non-electronic instrumentation
- Safety equipment

7.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

7.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

7.2 NORMATIVE REFERENCES

The following mechanical specifications are relevant to this section:

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[redacted]

- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

7.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

$Ca(OCl)_2$	Calcium hypochlorite
PVC	Polyvinylchloride
SANS	South African National Standards

7.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

7.5 GENERAL REQUIREMENTS

The chemical solution shall be pumped to the point of application via a 2 duty, 1 standby dosing pump arrangement. The Contractor shall supply the complete dosing pump arrangement for each point of application.

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

7.6 PERFORMANCE REQUIREMENTS

The dosing rates shall be accurate to ±5% of the required rate over the full specified range. Chemical dosing shall be proportional to the measured water flowrate.

Calcium hypochlorite shall be produced as a 0.08% solution. The Contractor shall size the dosing pumps to deliver a dosing rate of up to 1.5 mg/ℓ at a feed flowrate of 240 MLD. The anticipated max process flow is 19 m3/hr. The flow shall be met with at least two (2) pumps running. The average flow requirement for a single pump shall be at least 9500 L/hr.

7.7 OPERATION AND CONTROL

This description only serves to give a brief overview on the operation & control of the dosing pump arrangement. Notwithstanding this, the Contractor shall also refer to the Control Narrative which gives a more detailed description of the control requirements of the plant.

Chemical dosing control shall be proportional to the flow rate unless otherwise specified in the Project Specification. The operator will have to select the preferred dosing control option by logging in as a supervisor via the SCADA.

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[redacted]

For proportional flow rate dosing control, a flow meter or Coriolis mass flow meter shall be used to monitor the respective chemical feed rate to the process and a flow control loop shall control the dosing pump speed via an inverter drive to feed the chemical at the desired rate to the process.

The operator shall set the desired chemical dosing rate proportional to the main flow rate via the SCADA. The PLC shall calculate the desired mass dosing rate and the dosing pump shall maintain the desired mass rate via a PID control loop.

7.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

7.9 SUCTION PIPEWORK

The Contractor shall provide all suction pipework to the dosing pumps. For each dosing skid, the battery limit for the suction pipework shall begin at the ball type isolation valves branching off from the discharge manifold at the storage tanks. This is shown in Figure 41 below:

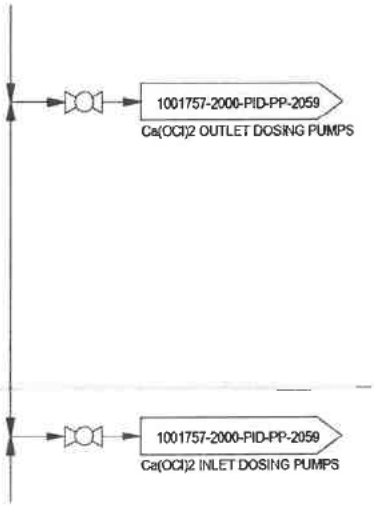


Figure 41: Ball isolation valves at the calcium hypochlorite storage tanks discharge manifold

Each dosing line shall be fitted with a water flushing point to flush the pumps and pipework. The water supply system is specified elsewhere. Pipework shall be provided from the supply point to a position within 1 m from the dosing pump suction line flushing point. The water supply line shall be fitted with a three-piece ball isolation valve. The final connection

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[redacted]

between the water line and the flushing point shall be via a flexible braided hose fitted with a quick coupling connection such as Kamlock or equivalent.

The flushing point shall be followed by a calibration tube in the pumps suction line. The calibration tube shall be in the form of a vertical cylinder of clear polycarbonate, 100 mm diameter and of at least 20 L capacity. The tube shall incorporate graduated markings on the side in 0.5 L increments and have a vent pipe at the top. The flushing point and calibration tube are presented in Figure 42.

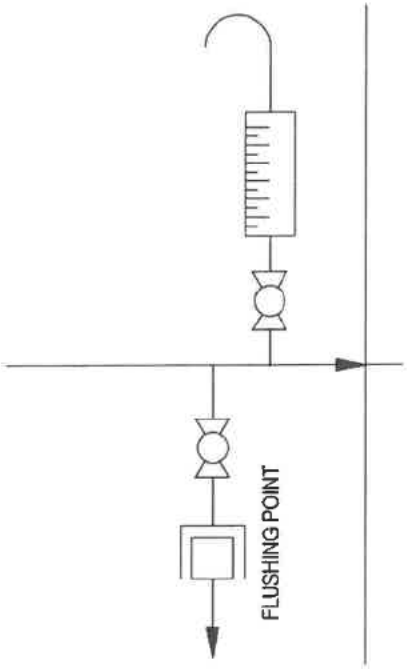


Figure 42: Flushing point and calibration tube for calcium hypochlorite dosing skid

The suction line of each dosing skid shall feed into the suction manifold which shall have three (3) take-offs to service the respective pumps. The suction pipework shall be polypropylene or any other equivalent plastic suitable for the application. The suction pipework and valves shall comply with Clause D11.1.9 in Section D.

7.10 CALCIUM HYPOCHLORITE DOSING PUMPS

7.10.1 GENERAL

For each dosing skid, the calcium hypochlorite dosing pumps shall be provided in a two (2) duty, one (1) standby configuration. The dosing pumps shall be positive displacement peristaltic type pumps (see Figure 43 below) suitable for pumping 0.08% calcium hypochlorite.

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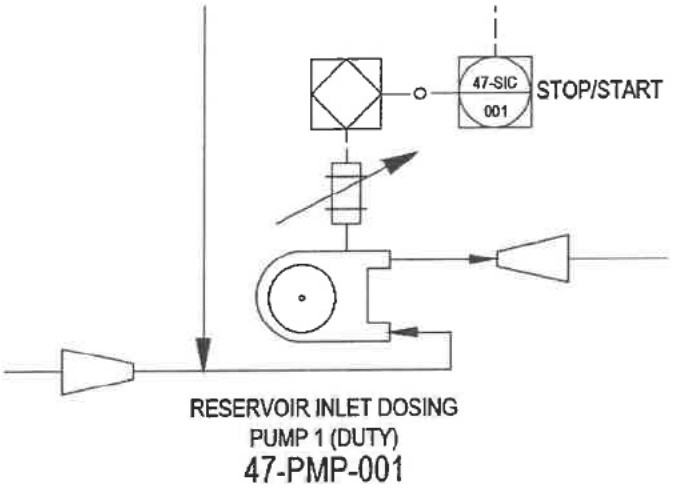


Figure 43: Peristaltic dosing pump used for calcium hypochlorite dosing

The pumps shall be complete with all suction piping and valves for connecting to the delivery pipework.

7.10.2 PERISTALTIC TYPE PUMPS

The peristaltic pumps shall be electric motor and gear driven and shall be selected to run at no more than 50% of the maximum design speed for that size of pump. They shall be totally enclosed, with glycerine lubricant to ensure minimal wear on the peristaltic hose and slider pads. A sight glass shall be installed on the outside of the pump to view lubricant level and top up the lubricant.

Pumps shall be driven direct through an oil lubricated helical or planetary type reduction gearbox with motor, which shall be speed controlled by frequency variation from a 4 to 20mA signal. The maximum pump design speed shall equate to a frequency of 50 Hz. The STOP/START status of each pump shall be displayed on the SCADA system.

Each pump shall be provided with a low flow switch to switch off the relevant pump and prevent any damage in the event of an isolating valve being closed.

The pump casing shall be designed such that in the event of a tube rupture the pumped liquid cannot escape or enter the gear mechanism of the pump. The pump shall be designed in such a way that a leakage detector probe can be installed at a later date. An easily removable cover shall be incorporated on the casing of the pump such that the pump tube can be easily replaced. The tube and casing coating shall be completely resistant to the chemical concerned.

7.11 INTERCONNECTING PIPEWORK AND FITTINGS

The pipework upstream and downstream of each dosing pump shall be constructed of polypropylene or similar suitable corrosion-resistant material, complying with Clause D11.1.9 in Section D. The material shall be resistant to direct sunlight. The pipe shall be PN10 rated and adequately sized for 9500 L/hr.

The Contractor shall provide all the necessary isolation valves and fittings required for a successful operating plant. All valves and fittings shall be of a high quality designed and

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proven for the application in which they are to be used. Manufacturers such as F.I.P., Stubbe, Jesco, Alldos or equivalent approved shall be used.

The Contractor shall supply the following fittings for each pump (see Figure 44 below):

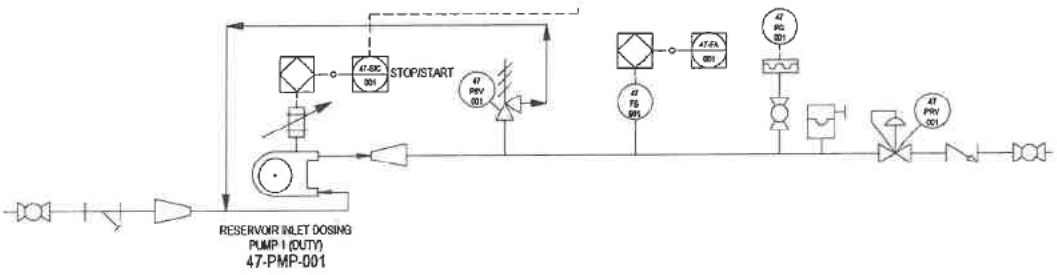


Figure 44: Interconnecting pipework and fittings for calcium hypochlorite dosing pumps

- An isolation valve shall be provided upstream and downstream of each pump. Isolating valves shall be manual and of the 90° operation ball type. All isolating valves shall be positioned such that they can be operated easily and safely from walkways etc.
- A strainer shall be provided upstream of each dosing pump. The strainers shall be complete with an easily removable element and incorporate a transparent casing so that the degree of blockage can be observed with the casing in place.
- A pressure relief valve shall be provided on the discharge line to each dosing pump. The relief valve shall relieve pressure at the pipe design pressure. The discharge line of the pressure relief valve shall be circulated back to the suction side of the dosing pump.
- A flow switch shall be fitted on the discharge line of each dosing pump.
- A pressure gauge shall be fitted on the discharge line of each dosing pump.
- Pulsation dampers shall be fitted on the discharge line of each dosing pump. The pulsation dampers shall have an FRP or other suitable plastic casing and incorporate a diaphragm and connection fitting which shall allow pressurisation of the damper with compressed air from a handheld type pump. The pulsation dampers shall be sized so as not to be classified as pressure vessels; i.e. multiple shall be provided if necessary.
- A pressure regulating valve shall be provided on the discharge line to ensure a constant supply pressure to the dosing point.
- Non-return valves shall be incorporated on the delivery side of each pump. The valves shall be an integral part of the pump and of the double-ball type. The balls shall be manufactured from glass or ceramic material, and the valve seats from PVC or other suitable and resistant material.
- Suitably sized reducers shall be fitted upstream and downstream of each dosing pump.

7.12 DELIVERY PIPEWORK

The Contractor shall provide all delivery pipework from the dosing pumps to the relevant dosing points. For each dosing skid, the delivery lines from each pump shall feed into a discharge manifold. The common discharge line shall be fitted with a Coriolis mass flow meter which shall be used to measure the flow rate from each dosing pump accurately. This flow meter is specified elsewhere in the Project Specification

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The delivery pipework inside the building shall be polypropylene or any other equivalent plastic suitable for the application. The battery limit shall be inside the trench at the sleeve where the pipeline will exit the building. Pipework inside the sleeve shall be flexible and is specified elsewhere. The delivery pipework and valves shall comply with Clause D11.1.9 in Section D and shall conform to the following:

- As far as possible all piping shall be surface run along the sides or on the top of structure walls, or along walkways to allow for easy removal and replacement. The pipework shall be adequately supported to the satisfaction of the Engineer, inside suitably sized steel trays or with clamps that will be mounted on the side of the structure to which the pipework will be secured.
- When dosing into a tank, the discharge feed pipe shall terminate such that the chemical cannot splash or be blown by the wind on to any concrete structure and cause corrosion.

All delivery pipework exiting the building shall be installed in sleeves with manholes connecting the sleeves at evenly-spaced points along the pipe route. The sleeves and manholes shall be provided by others. The flexible pipework between the building and the dosing point shall be food grade ultra-high molecular weight polyethylene (UHMWPE). The UHMWPE pipework shall comply with the following:

- The tube shall be transparent UHMWPE and shall be suitably reinforced using high tensile textile cords with embedded steel helix wire.
- The tube cover shall be opaque and shall be abrasion resistant.
- The pipe shall be crack resistant and shall not permit any material leaching out into the calcium hypochlorite.

The pipe shall be PN10 rated and adequately sized for 19000 L/hr.

7.13 INJECTION LANCES

The Contractor shall design, supply, and install a high-pressure chemical injection lance assembly for the controlled and effective injection of sodium hypochlorite into the main water pipeline.

7.13.1 FUNCTION AND COMPATIBILITY

The lance shall enable direct injection of disinfectant into the main process stream.

It shall be connected to a flexible UHMWPE chemical feed line from each sodium hypochlorite dosing pump skid.

The entire assembly shall be rated for continuous operation under the design pressure and temperature of the main pipeline.

7.13.2 LANCE CONSTRUCTION AND MATERIALS

The lance shall be constructed from corrosion-resistant materials compatible with sodium hypochlorite (e.g., Hastelloy C-276, titanium, or PVC-U/HDPE, depending on system pressure and chemical concentration).

The lance shall incorporate a retractable quill to allow for safe insertion and removal while the main pipeline remains in service and pressurized.

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[redacted]

7.13.3 RETRACTABLE MECHANISM AND SEALING

The retractable lance shall include a double-start jacking screw mechanism, capable of withstanding the hydraulic expulsion forces during both insertion and withdrawal from the pipeline.

The quill shall be fitted with a shock absorber packing system to minimize the mechanical impact of water pressure on the quill during operation. The shock absorber shall be constructed from EPDM or equivalent elastomer resistant to both chlorinated environments and mechanical fatigue.

The sealing assembly shall include a double O-ring gland to ensure leak-free operation under full system pressure.

7.13.4 QUILL AND DIFFUSER DESIGN

The tip of the injection quill shall incorporate a convex full-cone spray nozzle (refer to the figure below) designed to achieve even and effective dispersion of sodium hypochlorite within the flow stream.

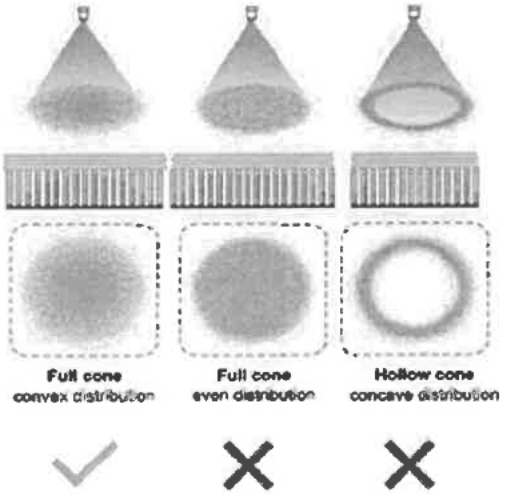


Figure 45: Full cone convex distribution nozzle

The diffuser shall be installed at a depth corresponding to 50% of the radius of the main pipeline to promote optimal mixing. The diffuser shall be of a removable type for maintenance or replacement, if required

7.13.5 FLOW ISOLATION AND MAINTENANCE

The lance shall feature isolation valves at both the inlet and outlet, enabling safe maintenance of the lance without the need to dismantle surrounding pipework or interrupt the operation of the main water pipeline.

7.13.6 CHEMICAL BACKFLOW PROTECTION

The lance shall be equipped with a non-return valve (check valve) of either the sprung ball or plunger type, installed on the chemical feed line or at the lance inlet, to prevent any backflow of water or contaminants into the dosing system.

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7.13.7 SIDE ENTRY CONNECTION

The lance shall include a side-entry port for connection to the sodium hypochlorite feed line (as indicated in the reference figure), ensuring smooth and secure chemical delivery into the quill.

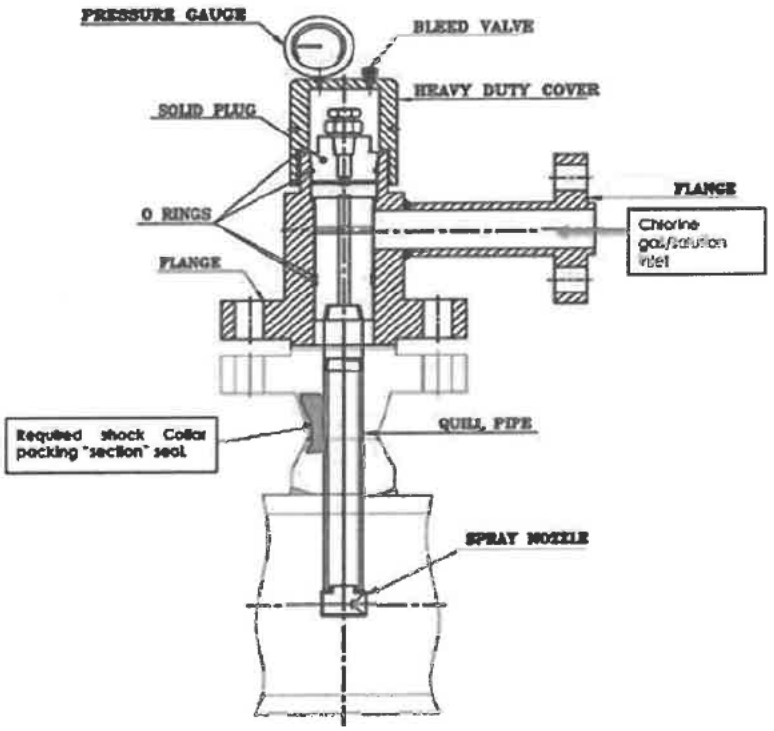


Figure 46: Injector quill design showing side entry for chlorine solution

Injection lances offered by Prochem, Calibre Life Sciences, Metagroup, NND Oil and gas, Evoqua and Mazzei & Cumberland, or similar reputable manufacturers, shall be provided.

7.14 CHEMICAL DOSING PIPE SUPPORTS

Where fixed along the sides or on the top of structure walls, all chemical dosing piping shall be mounted in open galvanized steel racks/trays at least 100mm deep, similar to those used for installing electric cables. The racks/trays shall be provided complete with all fixings, mountings and where necessary, support posts to adequately support the cable trays.

7.15 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

7.16 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

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7.17 SPARES

Two (2) sets of spare tubing for the peristaltic pumps.

7.18 MISCELLANEOUS

Not applicable.

7.19 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

7.20 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

7.21 MATERIALS AND CORROSION PROTECTION

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet the conditions and corrosive nature of the application and in line with Specification D. Corrosion protection shall comply with Clause D5 in Specification D.

ITEM	MATERIAL	COATING
Dosing cabinet enclosure	PVDF	N/A
Dosing cabinet doors	uPVC	N/A
Calibration tube	Polycarbonate	N/A
Calcium hypochlorite dosing pumps (housing)	Supplier standard	Supplier standard
Calcium hypochlorite suction pipework	PP/uPVC	N/A
Interconnecting pipework	PP/uPVC/HDPE	N/A
Calcium hypochlorite discharge piping in buildings	PP/uPVC/HDPE	N/A
Calcium hypochlorite delivery piping in sleeves	UHMWPE	N/A
Injection lances	Hastelloy C276	Pickled & passivated

7.22 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

7.23 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

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7.24 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

7.25 INSTALLATION

Installation work shall comply with Section D.

7.26 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures and plinths on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of such provided civil works.

7.27 INSPECTIONS

7.27.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

7.27.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

7.28 TESTING REQUIREMENTS

7.28.1 FACTORY

Not applicable

7.28.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

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8. SERVICE WATER SYSTEM

8.1 SCOPE

8.1.1 INTRODUCTION

This specification outlines the requirements for the service water pump system. The equipment installation to be provided shall be configured as shown on the applicable tender drawings.

The Contractor shall provide a fully functional ready-for-connection service water pump station complete with booster pumps, pipework, pressure accumulation reservoir, valves, and fittings. The service water pump station shall pump water from the service water wet well and reticulate it on site for general use.

8.1.2 CONFIGURATION

The installation shall be configured as shown on the following P&IDs:

- 1001757-2000-PID-PP-2060 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2061 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2762 Isometric and Sectional Views
- 1001757-2000-DRG-MM-2763 Isometric and Sectional Views

The service water pump station shall be located inside the pump room of the sodium hypochlorite generation building. The Contractor shall be responsible for the suction pipework from the bell mouth in the wet well to the pumps as well as the discharge pipework from the pumps to all the users inside the building. The Contractor shall also be responsible for the pipework from the bulk water supply line (starting at the puddle pipe in the pump room) which feeds the water wet well.

8.1.3 KEY ELEMENTS

- Supply pipework to service water wet well
- Service water pumps
- Pipework and valves
- Pressure accumulator
- Non-electronic instrumentation
- Safety equipment
- Spares

8.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

8.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable the works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element,

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this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

8.2 NORMATIVE REFERENCES

The following specifications are relevant to this section:

- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.

8.3 DEFINITIONS AND ABBREVIATIONS

Not applicable

8.4 EQUIPMENT ELIGIBILITY

Equipment provided shall be furnished by a Manufacturer with a minimum of ten years' experience in the design and supply of booster pump systems and with ten or more local operating installations of a similar nature. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

8.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

8.6 PERFORMANCE REQUIREMENTS

The system shall supply the plant's service water requirements.

The system shall be suitable for boosting and maintaining the water pressure of the system at the desired setpoint band.

The equipment installation shall be capable of performing the specified duties under continuous operating conditions.

All components of the pump station shall perform reliably over the specified range, shall have a long service life and shall be easy to maintain.

8.7 OPERATION AND CONTROL

The pumps shall automatically target maintaining a pressure setpoint.

The pumps shall operate on variable speed drives.

The pumpset shall consist of four (4) pumps that intelligently alternate operation for low flowrates and operate simultaneously for higher flow rates. An integrate HMI shall be supplied to control and monitor the pumpset.

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The pumps shall stop operating when the level in the reservoir is low.

Manual start and stop of each pump shall be provided. Protections shall be active during manual operation.

The pump shall be designed to shut down safely and without damage upon failure of the electrical supply.

8.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

- For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.
- For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

8.9 SUPPLY PIPEWORK TO SERVICE WATER WET WELL

The service water wet well shall be filled with potable water from the bulk water pipeline that feeds the Muldersvlei Reservoir. A tee-off from this bulk pipeline shall be routed through the fire water pump room in the sodium hypochlorite generation building and then routed to the service water wet well. The puddle pipe on the wall of the pump room shall be supplied by Others, and the battery limit for the supply pipework shall begin immediately after the puddle pipe. The puddle pipe on the wet well shall also be provided by Others.

The pipe shall be fitted with a manual resilient seal gate valve for isolation purposes followed by a swing check valve, a magnetic flow meter (specified elsewhere) and a hydraulic level control valve. The nominal sizes of these valves and fittings shall each be DN200.

The gate and check valve shall comply with Clauses D15.3 and D15.13.6 of Section D, respectively.

The level control valve shall ensure a constant water level in the wet well regardless of fluctuating demand. This valve shall be float-controlled and the pilot tube on the valve shall be provided with a strainer and a needle valve. The float shall have a pressure rating of at least 10 bar.

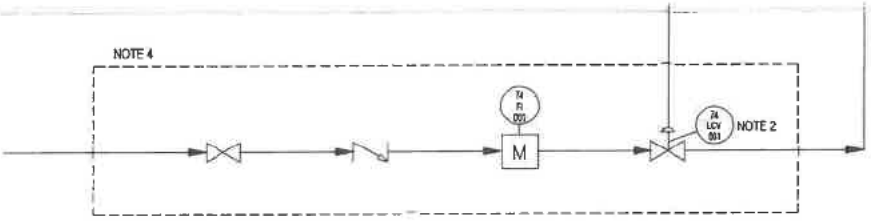


Figure 47 Valves and fittings on supply line to service water wet well

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An HDPE pipe shall convey the potable water to the wet well. The level control valve shall have a stainless-steel body and a stainless steel or brass float pilot.

The supply pipe shall comply with Clause D11 of Section D.

The service water wet well shall also be equipped with an overflow line that shall be routed to a safe location for drainage. Both the puddle pipe and the DN250 overflow pipe shall be supplied by Others.

8.10 SERVICE WATER PUMPS

8.10.1 GENERAL

The Contractor shall provide four, vertical in-line, centrifugal type pumps. Pumps shall be supplied with wear rings, mechanical seals, drive couplings and base frames.

8.10.2 PUMPING SYSTEM DESCRIPTION

The pumps shall abstract water from a wet well via a bell mouth intake through suction leg pipework. The water shall be discharged through a manifold to the following locations:

- Calcium hypochlorite make-up tanks
- Hydraulic-powered injectors
- Plate heat exchanger
- Internal use in the sodium hypochlorite generation system, including ablution facilities, interior cleaning taps, laboratory, and safety showers
- Irrigation system
- Admin building
- Guard house
- Reservoir cleaning taps

The head on the pumps' discharge at start-up may vary between 0 m and the maximum pressure setpoint of the system.

The minimum water level in the wet well shall be below the pump casing at start-up.

8.10.3 PUMP SYSTEM OPERATION

The system shall be set up such that the pumps are able to deliver between 5 and 80 m^3/hr at a constant pressure of 6 bar. The system of pumps shall be calibrated such that the number of pumps that are operating at a given time is varied based on the flow rate.

The duty pumps shall switch on when the manifold pressure drops below 5.5 bar and switch off when the manifold pressure registers 6.5 bar.

The control system shall alarm if the manifold pressure drops below 3.0 bar.

The pumps will shut off if the manifold pressure registers 6.5 bar.

8.10.4 PUMP SELECTION

The pumps shall be suitable to run on variable speed drives.

Each pump shall have rated duty point of 20 m^3/hr at a differential head of 60 m. This shall be the pump's best efficiency point and the point at which the Contractor shall guarantee flow, head, efficiency, power consumption and NPSHr. The duty point shall be achieved at no less than 90% the motor's highest rated speed.

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Additionally, each pump shall be able to operate reliably between 5 m^3/hr and 20 m^3/hr without exceeding the supplier's recommended operating limits.

At the pump's maximum operating speed, the pump shall also comply with the following:

- The shut off head of each pump shall be less than 10 m.
- The pump shall be suitable for the NPSH available at each operating point.

8.10.5 PUMPSET DESIGN

Castings

Castings shall comply with Clause D3.6.

Shaft Seals

The shaft seals shall be of the mechanical seal type and shall be rated for the pump shut off pressure.

Bearings

Pumps shall be provided with grease lubricated bearings. Plain bearings are preferred. Bearings shall comply with Clause D26.2.7.

Each bearing shall be provided with seals to exclude water and solids.

If rolling element bearings are supplied, they shall be designed for an L-10 life of not less than 100 000 hours.

Nameplate

Nameplates shall be of stamped or engraved stainless steel and shall indicate:

- Pump manufacturer.
- Model and/or serial number.
- Installation year.
- The duty head, flow, efficiency and absorbed power.
- Impeller diameter.
- Rated speed.
- Assembly mass.

Pump manufacturer's standard nameplates which do not comply may be left in position but a second, complying nameplate shall be provided and shall be securely attached to the installation.

Motors

The motors for the pumps are specified elsewhere.

Each motor shall be provided with an auxiliary constant speed fan motor for cooling.

The main motor rating shall include a margin of at least 20 percent above the pump highest power requirement.

Pump Testing

Pumps shall be tested, and reports presented to the Engineer.

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Non-conforming pumps shall be modified or replaced in order to achieve the performance requirements.

8.11 PIPEWORK & VALVES

8.11.1 PIPEWORK

Scope

The Contractor shall provide the following:

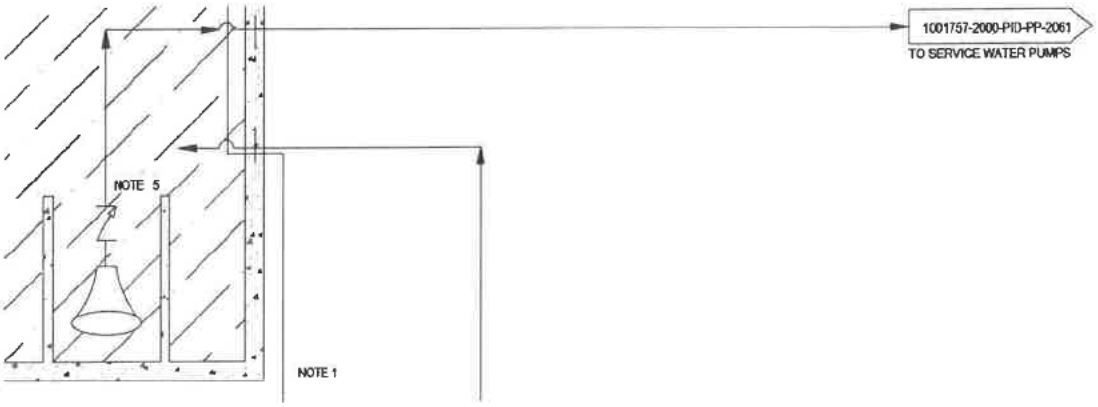
- Suction inlet bellmouth.
- Suction leg pipework.
- Discharge leg pipework.
- Discharge manifold pipework
- Pressure accumulator pipework
- Pipe couplings.
- Pipe anchors & supports.

General

Pipework shall comply with Clause D11 of Section D.

Suction inlet bellmouth

The Contractor shall provide a bellmouth to pull water from the wet well. The inlet velocity for the bellmouth shall not exceed 1 m/s.



Suction leg pipework

The Contractor shall provide suction leg pipework for each pumpset between the puddle pipe on the wet well and the pump inlet.

Pipework shall be rated PN10.

The Contractor shall provide one stainless steel tapping point at least 1 diameter length upstream of the pump inlet to mount a pressure gauge and its associated isolation valve.

Discharge leg pipework

The Contractor shall provide discharge leg pipework for each pumpset between the pump outlet and discharge manifold.

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Pipework shall be rated PN10.

The Contractor shall provide one stainless steel tapping point at least 1 diameter length downstream of the pump outlet to mount a pressure gauge and its associated isolation valve. The pressure gauge shall be upstream of the check valve.

Discharge manifold pipework

The Contractor shall provide the discharge manifold on the pumps to the battery limit as indicated on the drawings.

A tapping point shall be provided for a pressure gauge and pressure transmitter, which shall be used as active feedback by which the pumps are controlled.

The pipework shall include all the relevant pipework to exit the building, onto which the irrigation network will be connected. This is the battery limit of this system.

The manifold shall be rated PN10.

Pressure accumulator pipework

The Contractor shall provide pipework for the pressure accumulator. The pipework shall tee off from the discharge manifold vertically, so that the accumulator may also serve as the manifold's air collector.

Pipework shall be rated PN10.

Pipe couplings

The Contractor shall provide couplings at the following positions:

- Where indicated on the drawings.
- Between any two fixed positions or supports, a minimum of two couplings are required.
- On pump suction and discharge flanges.

Couplings shall have the same pressure rating as the pipework.

Pipe Anchors and Supports

The Contractor shall provide pipe anchors and supports at the following locations:

- In compliance with Clause D11.5 of Section D
- Where indicated on the drawings.
- At or close to valves.

8.11.2 VALVES

Scope

The Contractor shall provide the following:

- Suction foot valve
- Suction side isolation valves
- Suction side strainers
- Discharge check valves
- Discharge isolation valves
- Pressure accumulator isolation valves

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Suction inlet foot valve

The Contractor shall provide a suction foot valve for the pump suction leg to prevent the pump from losing prime.

Suction isolation valves

The Contractor shall provide a resilient seal butterfly valve on the suction side of each pump - upstream of the strainer. The Contractor shall also provide a resilient seal butterfly valve upstream of the suction manifold. The isolation valves shall comply with Clause D15.7 of Section D.

Valves shall have the same nominal size as corresponding pipework. Valves shall be flanged and rated PN10. Valves shall be manually operated with a hand lever. Indication of the valve opening position shall be provided.

The manufacturer's name, size and working pressure shall be cast on the valve body.

The valves shall be tested after coating. The Contractor shall submit reports for the specified tests to the Engineer prior to the equipment being delivered to Site.

Suction side drain and drain valve

The contractor shall supply a drainpipe complete with a drain valve on the suction side of each pump, downstream of the suction isolation valve. The drain valve shall be manual and of the ball type.

Suction side strainers

The Contractor shall provide a strainer on the suction side of each pump - upstream of each pump. The strainers shall comply with Clause D11.10 of Section D.

Discharge check valves

The Contractor shall provide a double door check valve on the discharge side of each pump - downstream of the pump. The valves shall comply with Clause D15.13 of Section D.

Valves shall have the same nominal size as corresponding pipework. Valves shall be flanged and rated PN10.

The manufacturer's name, size and working pressure shall be cast on the valve body.

The valves shall be tested after coating. The Contractor shall submit reports for the specified tests to the Engineer prior to the equipment being delivered to Site.

Discharge isolation valves

The Contractor shall provide a resilient seal butterfly valve on the discharge side of each pump - downstream of the check valve. The isolation valves shall comply with Clause D15.7 of Section D.

Valves shall have the same nominal size as corresponding pipework. Valves shall be flanged and rated PN10.

Valve shall be manually operated with a hand lever. Indication of the valve opening position shall be provided.

The manufacturer's name, size and working pressure shall be cast on the valve body.

The valves shall be tested after coating. The Contractor shall submit reports for the specified tests to the Engineer prior to the equipment being delivered to Site.

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Pressure accumulator isolation valves

The Contractor shall provide two, DN25 manual ball valves at the top and bottom of the Pressure accumulator to allow for draining and filling of the pressure vessel.

Valves shall comply with Clause D15 of Section D

Valves shall be flanged and rated PN10.

Valve shall be manually operated.

Indication of the valve opening position shall be provided.

The manufacturer's name, size and working pressure shall be cast on the valve body.

The valves shall be tested after coating.

The Contractor shall submit reports for the specified tests to the Engineer prior to the equipment being delivered to Site.

8.12 PRESSURE ACUMULATOR

8.12.1 SCOPE

The Contractor shall provide a 600L stainless steel pressure accumulator to serve as pressure dampening and regulating device.

8.12.2 DESIGN AND CONSTRUCTION

The accumulator shall be a thin-walled stainless steel pressure vessel. The vessel shall be cylindrical and have a domed top and bottom.

The accumulator shall comply with Clause D34 of Section D.

The vessel's pressure rating shall be at least 10 bar.

The effective volume of the vessel shall be 600 L.

Water shall enter the accumulator from the bottom. Tapping points with isolation valve shall be provided at the top and bottom of the vessel to allow the accumulator to drain.

Two tapping points, and corresponding isolation valves, shall be allowed on the side of the vessel. One close to the top, and one close to the bottom. The tapping points shall be connected by a clear high pressure, Perspex tube with which the operator will be able to see the water and air level in the tank. The tube shall have a free-floating piece which shall aid in indicating the level in the tank. The tube shall clearly indicate the "percentage full".

8.13 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere. Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified below or shown on the P&ID but required to ensure a safe and fully functional plant.

8.13.1 PRESSURE GAUGES

The Contractor shall provide pressure gauges on the suction and discharge side of each pump. A pressure gauge shall also be provided on the manifold.

A pressure transmitter shall be provided on the discharge manifold.

A differential pressure indicator on the suction and discharge side of each pump.

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Tapping points shall be stainless steel nozzles welded onto the pipe. Tapping points for pressure gauges and transmitters shall have accompanying isolating ball valves.

8.13.2 FLOW MEASUREMENT

The Contractor shall provide flow switches for each pump. The Contractor shall also provide a magnetic flow meter on the common discharge of the pumps (specified elsewhere).

8.14 SPARES

The Contractor shall provide the following spares:

One (1) hydraulic level control valve

8.15 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

8.16 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

8.17 MATERIALS AND CORROSION PROTECTION

8.17.1 GENERAL

Materials shall comply with Clause D3 of Section D, unless otherwise stated in the table below.

Corrosion protection shall comply with Clause D5 of Section D, unless otherwise specified in the table below. The Contractor shall design the works to prevent galvanic corrosion.

8.17.2 EQUIPMENT

Components not specified in the table shall be designed to meet high corrosivity category (C4) of SANS 12944 2.

ITEM	MATERIAL	COATING
Wet well supply pipe	HDPE	N/A
Pump casing	Cast or Ductile iron	As per manufacturer's requirements
Pump shaft and impeller	Stainless steel or similar approved	Pickle and passivate
Pump baseframe	Carbon steel	In-line with Clause D5.3.2
Puddle pipes	EN Grade 1.4401 Stainless steel	Pickle and passivate
Pump pipework	Grade 300WA, X42 or X46 Carbon steel	In-line with Clause D5.5.1. Final DFT shall be 500 micron and at no point less than 400 micron.
Suction and delivery pipework and fittings	EN Grade 1.4401 Stainless steel	Pickle and passivate

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ITEM	MATERIAL	COATING
Pipe supports and anchors	Carbon steel	In-line with Clause D5.3.2
Pipe couplings	EN Grade 1.4401 Stainless steel	Pickle and passivate
Valve and Strainer bodies	Cast or Ductile iron	Epoxy coated as per manufacturer's requirements
Pressure accumulator	EN Grade 1.4301 Stainless steel	Pickle and passivate

8.18 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

8.19 CONTRACTORS DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

8.20 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

8.21 INSTALLATION

Installation work shall comply with Section D. Figure 1: Pipework and actuated valve on softened water discharge line from duplex softener

8.22 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of civil infrastructure that has been provided.

8.23 INSPECTIONS

8.23.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

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8.23.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

8.24 TESTING REQUIREMENTS

8.24.1 FACTORY

Not applicable

8.24.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

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9. WATER TEMPERATURE CONTROL SYSTEM

9.1 SCOPE

9.1.1 INTRODUCTION

This specification covers the requirements for a process water cooling system to be provided by the Contractor.

The design is covered by the following drawings.

- P&ID 1001757-2000-PID-PP-2050 Process & Instrumentation Diagram
- 1001757-2000-DRG-MM-2760 Isometric Views
- 1001757-2000-DRG-MM-2761 General Arrangement
- 1001757-2000-DRG-MM-2767 Plan View

9.1.2 CONFIGURATION

Process water that enters the sodium hypochlorite generators shall pass through a plate & frame heat exchanger to ensure that the water temperature is within the operating band of the softener.

An air-cooled water chiller shall feed the plate & frame heat exchanger with chilled water.

9.1.3 KEY ELEMENTS

- Plate & frame heat exchanger
- Chiller
- Pipework and Valves
- Non-electronic instrumentation
- Safety Equipment
- Spares

9.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

9.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable the works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

9.2 NORMATIVE REFERENCES

The following mechanical specifications are relevant to this section:

- Standard Specifications for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.

9.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

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To

ALU-ZINC	A stainless steel sheet coated with an alloy of aluminium and zinc.
PLC	Programmable Logic Controller
SCADA	Supervisory Control and Data Acquisition

9.4 EQUIPMENT ELIGIBILITY

The plate & frame heat exchanger and chiller to be provided shall have a successful record of use locally in similar applications and shall also have had at least three to five years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

9.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect, and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

9.6 PERFORMANCE REQUIREMENTS

The ideal operating temperature for the sodium hypochlorite generation plant is between 13 °C and 26 °C. The process water cooling system shall be designed to ensure that the desired working temperature is continually maintained.

The equipment shall be capable of performing the specified duties, and unless specified, it shall be rated for continuous operation at those duties. All components shall perform reliably over the specified range.

9.7 OPERATION AND CONTROL

Operation and control are specified elsewhere in the Project Specification.

9.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

- For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.
- For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

9.9 PLATE & FRAME HEAT EXCHANGER

Figure 48 below shows the plate & frame heat exchanger as presented on the P&ID.

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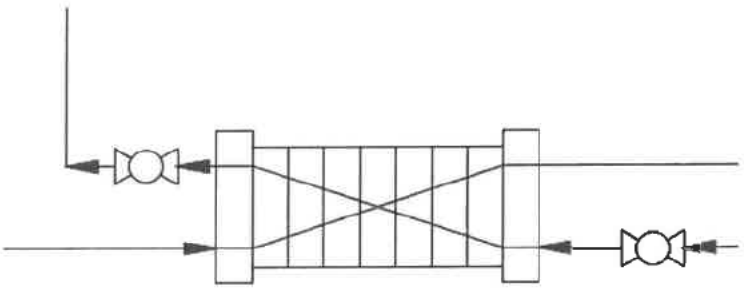


Figure 48: Plate heat exchanger and associated fittings

The Contractor shall provide a counter-flow plate & frame heat exchanger. The heat exchanger plates shall be constructed from high quality stainless steel 316. The plate heat exchanger shall be sized such that it allows for a process water flow rate of up to 2500 L/hr. Furthermore, the plate & frame heat exchanger shall provide sufficient heat transfer area to allow the process water to be cooled from 26 °C to 16 °C.

The system shall be designed to handle the specified flow rates at a maximum pressure differential of one (1) bar. If flow regulators and/or pressure reducers are required to maintain specified values, they shall also be provided.

The plate & frame heat exchanger shall be installed horizontally and shall be equipped with access ports for easy maintenance and cleaning.

As the number of plates contained within the heat exchanger is determined by the flow rate, fluid properties, pressure drop in the system and the desired temperature change, the Contractor shall be responsible for ensuring that the plate heat exchanger is designed in accordance with the abovementioned criteria.

The heat exchanger shall be sized assuming the following dirty surface fouling factor (DSFF):

Dirty Surface Fouling Factor (DSFF): 0.01 $m^2 \cdot K/W$

9.10 CHILLER

The Contractor shall provide an air-cooled chiller constructed from a corrosion resistant material such as ALU-ZINC coated steel, or similar approved, painted with epoxy-polyester powder, and complete with air filters.

Figure 49 below shows the water chiller and associated connections as presented on the P&ID.

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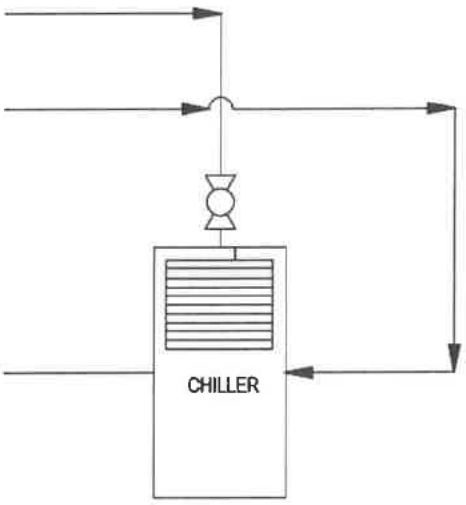


Figure 49 Air cooled water chiller and associated fittings

The chiller shall be equipped with an internal reservoir and circulation pump and shall be capable of circulating chilled service water at a rate of 5000 L/hr to the plate & frame heat exchanger. The chiller shall be designed to handle a minimum cooling capacity of 29 kW and shall allow for the process water to be cooled from 16 °C to 11 °C between inflow and outflow, respectively.

The chiller shall be complete with compressor(s), condenser(s), fan(s), controls, refrigerant and lubrication, including full commissioning and 12 months warranty and maintenance.

The unit shall have capacity control to vary its capacity in response to varying load conditions.

The chiller shall be fitted with a IP54 rated standard electric panel. The control panel shall be a microprocessor with a digital display allowing the operation levels and the alarms to be controlled. The chiller measured variables and alarms shall be integrated with the PLC & SCADA system.

The water chiller shall be a standard catalogued product of a reputable manufacturer. The documentation shall include performance curves and selection tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory.

Performance data are to be provided at 10% intervals from 10% to 100%.

Certified detailed selection shown on these performance curves and tables shall be submitted, including:

- The specified duty.
- A 10% overload.
- Part unloaded conditions at 35°C and varying ambient conditions.

The chiller shall be fully protected and shall be fail-safe. Minimum safety protection shall be provided for the following possible external abnormal and overload conditions:

- No or reduced chilled water flow.

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- Low chilled water temperature.
- High discharge pressure.
- Low suction pressure.
- Low oil differential pressure.
- Voltage drops, phase reversal and power interruption.
- Combined thermal overload and phase failure.

9.11 PIPEWORK AND VALVES

9.11.1 GENERAL

The Contractor shall provide all the required pipework and valves from the heat exchanger to the necessary delivery points and between the chiller and the heat exchanger. This is shown in Figure 50.

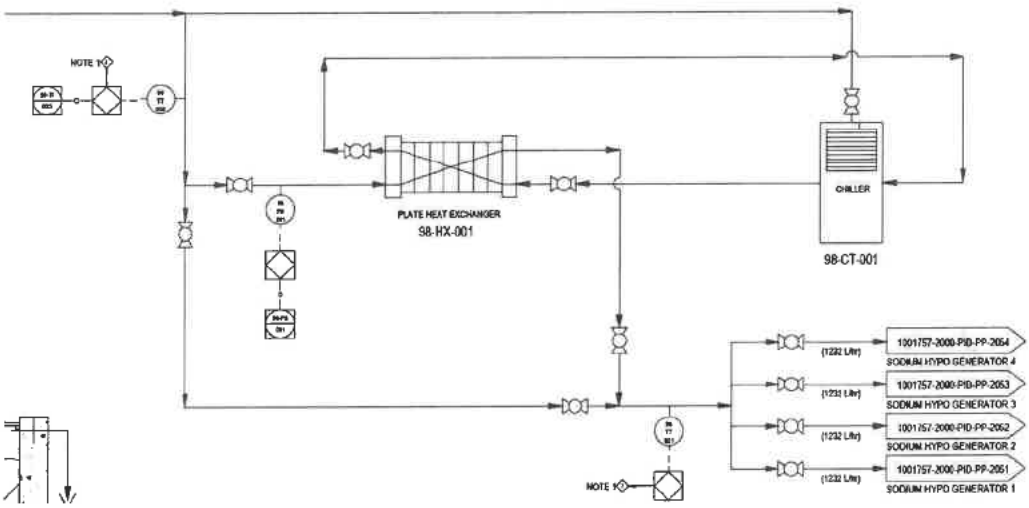


Figure 50: Pipework and valves for temperature control system

9.11.2 PIPEWORK

The pipework shall be constructed of 316 stainless steel and shall comply with the relevant sections in Clause D11 of Section D. In addition, the Contractor shall supply the necessary insulation for the pipework to ensure that the water temperature in the system remains within the design parameters upon reaching the skid. The pipework design is presented in P&ID 1001757-2000-PID-PP-2050. Detailed pipe routes inside the building shall be designed by the Contractor and submitted to the Engineer for approval.

The outlet pipework from the plate heat exchanger shall have an isolation ball valve and shall connect to a tee piece connecting the bypass line of the heat exchanger to a manifold. Two isolation ball valves shall be fitted on the bypass line. From the manifold, process water shall be conveyed to each of the four (4) sodium hypochlorite generators. Each of the four streams shall be fitted with an isolation 3-piece ball valve. Isolation valves shall be of the same pressure class and nominal size as the associated pipework.

Furthermore, the Contractor shall provide all the necessary pipework and associated fittings for the process water supply from the main process water supply header to each of the water softeners. This shall include a ball valve for manual isolation and a balancing

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valve. The balancing valve shall have pressure tap in points to measure the pressure drop over the valve. The pressure drop reading shall be used to read off the flowrate through the valve via the valve manufacturer's graphs to enable setting of the process water flow precisely to a flow rate of 1232 L/hr at an accuracy of ±5% or better. Once the flowrate has been set, the balancing valve shall be locked in this position.

These valves are shown in Figure 51.

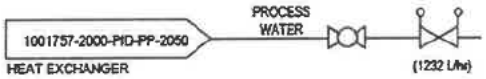


Figure 51: Isolation valve and balancing valve on water supply line to softener

9.11.3 INSULATION

All chilled water piping & valves as well as piping from the heat exchanger to the sodium hypochlorite generation skids shall be insulated with phenolic foam, ensuring a snug fit and minimizing air gaps.

Insulation material shall not constitute a fire hazard, be soluble in or react with the contents of the insulated equipment, should leakage or spillage occur.

Insulation material shall be limited to Phenolic Foam for temperatures up to 120°C.

Pipes shall generally be insulated with moulded pipe sections. Bends and elbows may be insulated with either mitre cut, moulded pipe sections or blocks.

A vapor barrier shall be applied directly onto the insulation material, ensuring a continuous and airtight seal to prevent vapor transmission.

The installation shall be finished by applying aluminium metal cladding over the vapor barrier, securely fastened to the insulated pipe surface to provide protection.

Cladding is to be lap jointed and sealed with mastic sealer when required. Sheet metal cladding shall be installed so that all seams shed water.

The minimum clearance between insulation and any obstruction, such as stairs, platforms, structural steel work and piping shall be 50mm.

The insulation system specification shall comply with the following:

Insulation Material:

Material: Phenolic foam insulation (BS3927)

Density: [40-80 kg/m³]

Thermal Conductivity: [0.020 W/m·K at 24°C]

The minimum insulation thicknesses for pipework shall be as follows:

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Pipe Size NB	Insulation Thickness [mm]
15	20
20	20
25	20
40	25
50	25
80	30
100	30

Vapor Barrier:

Material: Polyethylene or similar vapor barrier

Thickness: [0.1 mm]

Permeability: Impermeable to water vapor transmission

Aluminum Metal Cladding:

Material: Aluminum cladding

Thickness: [0.6 mm]

Finish: Stucco embossed or smooth finish for enhanced durability and aesthetics

Joining and Sealing:

All joints, seams, and penetrations in the vapor barrier shall be sealed with compatible adhesive or tape, maintaining a tight vapor seal.

All joints in the aluminium cladding shall be sealed with appropriate sealant to prevent water ingress.

Compliance:

The installation shall comply with relevant industry standards and codes, such as ASTM C1126/C1126M for phenolic foam insulation and ASTM C1136 for aluminium cladding.

9.11.4 ISOLATION VALVES

The Contractor shall provide all the necessary isolation valves and fittings required for a successful operating system. All isolating valves shall be positioned such that they can be operated easily and safely from walkways etc. Isolating valves shall be of the 90° operation ball type. All valves and fittings shall be of a high quality designed and proven for the application in which they are to be used.

Valves shall have the same nominal size as corresponding pipework. Ball valves shall comply with Clause D15.1 of Specification D.

9.12 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. Electronic instrumentation is dealt with elsewhere.

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Tot[redacted]

Furthermore, the Contractor shall provide any additional non-electronic instrumentation not specified above or shown on the P&ID but required to ensure a safe and fully functional plant.

9.13 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

9.14 SPARES

Not applicable

9.15 MISCELLANEOUS

Not applicable

9.16 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

9.17 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

9.18 MATERIALS AND CORROSION PROTECTION

9.18.1 GENERAL

All materials shall comply with Clause D11.1.2 in Section D.

Corrosion protection shall comply with Clause D5 in Specification D.

The Contractor shall design the works to prevent galvanic corrosion.

9.18.2 EQUIPMENT

The material of construction shall be as indicated in the below table. Equipment shall comply with the table below.

ITEM	MATERIAL	COATING
Pipework	EN Grade 1.4401 stainless steel (316)	Pickled and passivated
Heat Exchanger plates	EN Grade 1.4401 stainless steel (316)	Pickled and passivated
Heat Exchanger Frame	EN Grade 1.4401 stainless steel (316)	Pickled and passivated
Chiller Housing	Supplier Standard	Epoxy coted

9.19 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

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9.20 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

9.21 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during transportation and delivery.

9.22 INSTALLATION

Installation work shall comply with Section D.

9.23 TOLERANCES

Not applicable

9.24 INSPECTIONS

9.24.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

9.24.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

9.25 TESTING REQUIREMENTS

9.25.1 FACTORY

The following testing shall be witnessed by the Engineer:

- The heat exchanger shall be hydraulically tested to a pressure of 1000 kPa or to 1,5 times the pressure rating, whichever is greater, to ensure that the heat exchanger can handle unexpected pressure fluctuations without its integrity being compromised.

Commissioning test shall be witnessed by the Engineer and shall demonstrate that the plate heat exchanger and related control system operate in accordance with the specifications, including all operating, monitoring, and shutdown functions.

Non-destructive testing shall be carried out to identify potential internal defects of raw materials and welds. Additionally, mechanical performance analysis testing and weld chemical composition testing shall be performed by an experienced technician to ensure the reliability and optimal operation of the plate heat exchanger.

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[redacted]

The Contractor shall make all arrangements and shall be responsible for all costs for attendance of the Engineer for the witness tests specified.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

9.25.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

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[redacted]

10. LIFTING EQUIPMENT

10.1 SCOPE

10.1.1 INTRODUCTION

This section specifies the requirements for lifting equipment inside the sodium hypochlorite generation building.

10.1.2 CONFIGURATION

The installation shall be configured as shown on applicable drawings.

10.1.3 KEY ELEMENTS

The Contractor shall provide the following lifting equipment:

- Overhead travelling crane for the sodium hypochlorite generation building
- Digital hanging scale
- Service water pumps electrical gantry crane
- Fire water pumps electrical gantry cranes
- Hand operated winch for scour and outlet plugs
- Miscellaneous
- Safety Equipment

10.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

10.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable the works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

10.2 NORMATIVE REFERENCES

The following forms part of the Contract Document:

- Occupational Health and Safety Act of 1993
- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.
- SANS 12944 Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 2: Classification of environments

10.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

SWL Safe Working Load

HDG Hot-dip Galvanised

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IP	Ingress Protection
NaOCl	Sodium Hypochlorite

10.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

10.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Lifting equipment test load shall be permanently displayed.

Lifting equipment shall comply with Clause D37 of Section D.

10.6 PERFORMANCE REQUIREMENTS

10.6.1 GENERAL

The lifting equipment shall safely lift any load between zero and the test load and shall be capable of moving freely whilst holding the specified load. Lifting equipment shall be accessible, easy to operate and serviced easily.

All travel movements shall be free of snatching, shuddering, and crabbing over their full travel distances.

10.6.2 LIFTING EQUIPMENT FOR SODIUM HYPOCHLORITE GENERATION BUILDING

The Contractor shall supply an overhead travelling crane to lift the salt bags in the sodium hypochlorite generation building. The overhead travelling crane shall be capable of lifting a 1 tonne bag of salt from a truck and position it inside the building or lowering the bag into the salt dissolution tanks. The overhead traveling crane shall not interfere or clash with the building ventilation system.

The Contractor shall also supply overhead gantry cranes for the service water pumpset and for each of the centrifugal fire water pumps. For each of these pumpsets, a fixed gantry shall be supplied, and the trolley shall be motorised.

Lifting equipment safe working load (SWL) shall be confirmed by the Contractor upon confirmation of the bulk bag weight and shall exceed the heaviest expected operational load by at least 30 %. The minimum SWL shall be as follows:

Lifting Equipment	Location	Minimum Safe Working Load (tonne)
Overhead travelling crane	Salt bags storage area	2.0
Electrical gantry crane	Service water pump room	1.0

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Two (2) electrical gantry cranes	Fire water pump room	2.0 (each)

10.7 OPERATION AND CONTROL

Operation and control are specified elsewhere in Section D.

10.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

- For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.
- For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

10.9 OVERHEAD TRAVELLING CRANE FOR THE SODIUM HYPOCHLORITE GENERATION BUILDING

10.9.1 SCOPE

The Contractor shall provide an overhead travelling crane as lifting equipment for the NaOCl generation building.

10.9.2 CONFIGURATION

The crane shall span the sodium hypochlorite generation building (approximately 12 m) and have a long travel length from the loading bay area to the lay down area and salt dissolution tanks as indicated on the drawings, which is approximately 15 m. A single girder crane is preferred, but a double girder crane may be acceptable provided it can access all areas required.

The crane shall move clear of ductwork and air terminals and not clash with its installation at any point.

The crane's long travel rails shall be mounted on hot-dip galvanised crane rail I-beams. The I-beams shall provide a level surface for the long travel crane rails to be mounted on. The I-beams shall be anchored to the loading bay concrete beams as indicated in the applicable drawings. The Contractor shall ensure that the components of the overhead travelling crane system suitably sized to fit on the concrete support.

Electric cables for cranes shall be of the insulated, festooned type. Winding drum cables shall be provided with protection for the full length of the cable lay so that accidental damage is prevented; e.g. it shall not be possible to walk on the cable. Travelling brush contacts are not acceptable. Cabling shall be suitable for the applicable hazardous zone classification.

The materials of construction and material coatings of the lifting equipment shall be suitably selected for high levels of humidity and potential chloride contamination, as would be expected in a brine handling facility. Although provisions shall be made to reduce humidity

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in this area (i.e. the lifting equipment shall not come into contact with the brine solution, the salt tanks shall be covered, and HVAC shall be supplied), this requirement shall be met to ensure adequate protection of all mechanical parts.

10.9.3 OPERATION AND CONTROL

All three directions of travel, namely hook or lifting direction, cross travel, and long travel directions, shall be electrically powered by motors with a minimum of two speeds. Drives shall preferably be by electronic variable speed drives to assist in the control of slowing down the motors. Starting and stopping shall be smooth. Inching capability shall be provided for all three directions of travel. Both long and cross travel shall revert to low speed prior to contact with the end stops.

A control pendant shall be used to control the hook travel, cross travel, and long travel of the crane. The pendant shall move independently along the length of the crane beam and shall hang to 1 m above the loading bay floor level.

10.9.4 MAINTENANCE

The Contractor shall review the crane design to determine its compatibility with the structure to service the entire length of the crane. The crane shall be provided with a maintenance platform and shall be accessed with a cage ladder. The platform shall be positioned above the trenches adjacent to the salt dissolution tanks on the northern side of the building. The platform shall conform to Clause D37.3.6 in Section D.

10.10 DIGITAL HANGING SCALE

The Contractor shall equip the overhead travelling crane with a digital hanging scale to allow for the mass of the salt bags to be measured when lifted. The scale shall be constructed from cast aluminium that is durable and shall have a digital readout with backlit LCD display. Furthermore, the crane shall come complete with an oversized steel hook and shackle with a safety catch to provide strength and flexibility to safely weigh suspended loads.

The digital hanging scale shall be remote controlled to allow scale operation from a safe distance.

The digital hanging scale must be able to operate successfully in 95% relative humidity.

Additionally, the digital hanging scale shall have the following properties:

Capacity: 2000 kg

Power: 7.2VDC 50/60Hz 2A adapter / Internal rechargeable battery

IP Rating: IP54

Operating temperature: 0° to 40°C

10.11 SERVICE WATER PUMPS ELECTRIC GANTRY CRANE

10.11.1 SCOPE

The Contractor shall provide a fixed gantry crane with a motorised trolley as lifting equipment for the service water pumps.

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[redacted]

10.11.2 CONFIGURATION

The gantry shall span the width of the pump room, which is approximately 11 m. A single girder crane is preferred. The Contractor shall make provision for the crawl beams to be anchored to the underside of the three concrete beams (installed by Others) running across the building.

A motorised hoist and a motorised trolley shall be used. The gantry, hoist, and hoist trolley shall comply with the relevant sections of Clause D37 in Section D.

Electric cables for cranes shall be of the insulated, festooned type. Winding drum cables shall be provided with protection for the full length of the cable lay so that accidental damage is prevented; e.g. it shall not be possible to walk on the cable. Travelling brush contacts are not acceptable. Cabling shall be suitable for the applicable hazardous zone classification.

10.11.3 OPERATION AND CONTROL

A control pendant shall be used to control the hook travel and long travel of the crane. The pendant shall move independently along the length of the crane beam and shall hang to 1 m above the pump room floor level.

10.12 FIRE WATER PUMPS ELECTRIC GANTRY CRANE

10.12.1 SCOPE

The Contractor shall provide a fixed gantry crane with a motorised trolley as lifting equipment for each of the centrifugal fire water pumps.

10.12.2 CONFIGURATION

The two gantries shall span the width of the pump room, which is approximately 11 m. A single girder crane is preferred. The Contractor shall make provision for the crawl beams to be anchored to the underside of the three concrete beams (installed by Others) running across the building.

A motorised hoist and a motorised trolley shall be used. The gantry, hoist, and hoist trolley shall comply with the relevant sections of Clause D37 in Section D.

Electric cables for cranes shall be of the insulated, festooned type. Winding drum cables shall be provided with protection for the full length of the cable lay so that accidental damage is prevented; e.g. it shall not be possible to walk on the cable. Travelling brush contacts are not acceptable. Cabling shall be suitable for the applicable hazardous zone classification.

10.12.3 OPERATION AND CONTROL

A control pendant shall be used to control the hook travel, long travel of the crane. The pendant shall move independently along the length of the crane beam and shall hang to 1 m above the pump room floor level.

10.13 HAND CRANKED WINCH

10.13.1 SCOPE

The Contractor shall provide a hand cranked winch as lifting equipment for each of the scour and outlet plugs. A cover shall be provided to protect the winch from weathering and theft.

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[redacted]

10.13.2 CONFIGURATION

The four hand cranked winches shall be fixed to the concrete reservoir roof beside the scour and outlet plug openings. The winch shall have a 1-ton safe working load (SWL) and comply with all the relevant sections of Clause D37 in Section D.

The Contractor shall make provision for a hot dipped galvanised (HDG) removable cover for each of the four winches to protect it from weathering and potential theft. It will be securely fixed to the concrete roof of the reservoir. The removable portion of the cover shall be secured to the base with a padlock.

10.13.3 OPERATION AND CONTROL

The winch shall be manually operated with a hand lever to lower and lift the scour and outlet plugs. The cable of the winch shall be attached to the centre point of the plugs to ensure that it is held horizontal during lifting and lowering procedures.

10.14 MISCELLANEOUS

The Contractor shall provide a pallet jack as mobile lifting equipment in the sodium hypochlorite generation building. The pallet jack shall have a loading capacity of 3 tonnes.

10.15 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

The overhead travelling crane shall emit a sound, similar to a truck when backing up, when in use to alert personnel that the crane is being operated.

10.16 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

10.17 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

10.18 MATERIALS AND CORROSION PROTECTION

10.18.1 GENERAL

Materials shall comply with Clause D3 of Section D.

Corrosion protection shall comply with Clause D5 of Section D.

10.18.2 EQUIPMENT

Equipment shall comply with the table below. Components not specified in the table shall be designed to meet a high corrosivity category as defined in (C4) of SANS 12944-2.

ITEM	MATERIAL	COATING
Gantry structure	Structural Steel, grade S 355 JR or 355 JO	In-line with Clause D5.3.2
Crawl Beam	Structural Steel, grade S 355 JR or 355 JO	In-line with Clause D5.3.2
End carriages	Low carbon steel	In-line with Clause D5.3.2

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ITEM	MATERIAL	COATING
Crane rail beams	Structural Steel, grade S 355 JR or 355 JO	In-line with Clause D5.3.2
Crane Rails	Structural Steel, grade S 355 JR or 355 JO	In-line with Clause D5.3.2
Small items such as covers, brackets, etc.	Low carbon steel	In-line with Clause D5.3.2
Platform	Low carbon steel	In-line with Clause D5.3.2
Digital hanging scale	Die cast aluminium	N/A

10.19 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

10.20 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

In addition, the Contractor shall ensure that the drawings submitted for lifting equipment show the vertical and horizontal limits of the hook bowl.

10.21 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

10.22 INSTALLATION

Installation work shall comply with Clause D6 and D37 of Section D.

10.23 INSPECTIONS

10.23.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

10.23.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

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10.24 TESTING REQUIREMENTS

Lifting equipment shall be load-tested in accordance with Clause D37 of Section D. The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority to witness the load test.

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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11. MISCELLANEOUS STRUCTURES, PIPEWORK & VALVES

11.1 SCOPE

11.1.1 INTRODUCTION

This section specifies the requirements for miscellaneous mechanical equipment and mechanicals systems within Civil structures to be provided by the Contractor.

11.1.2 CONFIGURATION

The installation is represented in the following drawings:

- 1001757-2000-PID-PP-2062 Process & Instrumentation Diagram
- 1001757-2000-PID-PP-2063 Process & Instrumentation Diagram

11.1.3 KEY ELEMENTS

- Submersible sump system
- Leakage water return system
- Non-electronic instrumentation
- Safety Equipment
- Spares

11.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

11.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

11.2 NORMATIVE REFERENCES

The following forms part of the Contract Document:

- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D

11.3 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

IP Ingress Protection

11.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

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11.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

Where valves are specified, the valves shall comply with Clauses D15.1 and D15.2 of Section D.

11.6 OPERATION AND CONTROL

All submersible pumps described in this section will operate independently. The pumps will be designed for intermittent operation to drain the sumps as required. Pump switching shall be done in accordance with the water level in the sump. It shall be triggered by a float switch on cable or by vertically mounted moisture probes (pivoting arms attached directly to the pump are not acceptable).

In addition to this, the sump pumps will also be provided with manual on and off switches as well as dry-running protection.

If more than one pump is installed, the duty shall be cycled to ensure that both pumps operate on a regular basis.

11.7 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

a) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

b) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the mechanical works interfaces with the civil works, it is the Contractor's responsibility to ensure these interfaces are accounted for while constructing the civil works. Examples of such interfaces includes pipes and sleeves through concrete walls, concrete pump plinths, holding down bolts to be casted into concrete, etc.

11.8 SUBMERSIBLE SUMP PUMP SYSTEM

The Contractor shall supply a submersible sump pump and all associated discharge pipework, valves, and fittings for each of the valve chambers that house motorised valves and electrical equipment. One such sump pump is shown in Figure 52 below.

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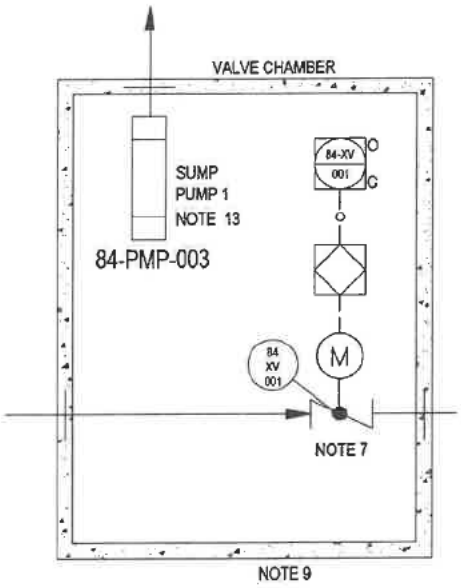


Figure 52: Submersible sump pump in valve chamber

The pump shall comply with Clause D26.4 of Section D.

Each sump pump shall be sized to remove at least 10 m^3/hr of water at a head of 6 m.

The pump shall be capable of performing reliably at any point in the specified range. No perceptible signs of cavitation shall be present across the full specified operating range.

The pump shall be selected to operate close to best efficiency at the duty point. Preference shall be given to pumps which:

- operate at or to the left of the best efficiency point.
- have an impeller which does not exceed 95 % of the maximum impeller diameter for the volute/diffuser.

The materials of construction shall be selected to suit the performance requirements.

The pumps shall be designed to shut down safely and without damage upon failure of the electrical supply. Each pump set shall be provided with an emergency stop station in an appropriate position.

The pump shall be supplied with a built-in float switch and operate as described in the Operation and Control specification above.

Moisture ingress to the pump's separation chamber shall be alarmed and shall cause the pump to shut down. Thermal protection of the motor windings shall be provided. The pump motor shall have a degree of protection of IP68 suitable for continuous immersion.

The uPVC discharge pipework shall be in accordance with SANS 966. The discharge pipework will be routed through the wall of the chamber to discharge outside the chamber above ground level. The Contractor shall fix the pipework to the concrete surfaces in the chamber by using suitable supports.

The check valve to be provided on the pump discharge shall be in accordance with Clause D15.13 of Section D.

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11.9 LEAKAGE WATER RETURN SYSTEM

The Contractor shall supply two (2) leakage water return systems: one (1) for each of the reservoirs outlet valve chambers. One leakage water return system is shown in Figure 53 below.

The leakage water return system shall be in accordance with Clause D26.4 of Section D. In addition to the requirements of this clause, the systems will also have a mechanical water meter and isolation valve.

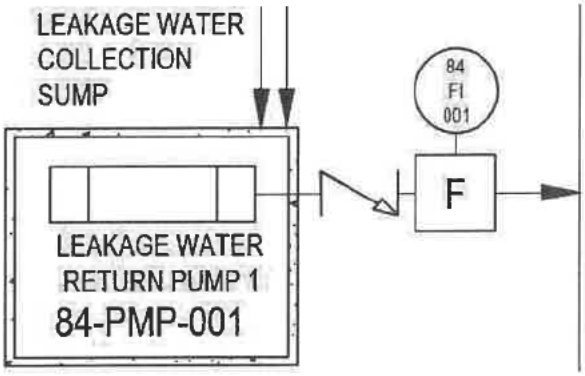


Figure 53: Leakage water return system on reservoir outlet

Each sump pump shall be sized to remove at least 15 m^3/hr of water at a head of 15 m.

The pump shall be capable of performing reliably at any point in the specified range. No perceptible signs of cavitation shall be present across the full specified operating range. The pump shall be selected to operate close to best efficiency at the duty point. Preference shall be given to pumps which:

- operate at or to the left of the best efficiency point.
- have an impeller which does not exceed 95 % of the maximum impeller diameter for the volute/diffuser.

The materials of construction shall be selected to suit the performance requirements.

The pump shall be supplied with a built-in float switch and operate as described in the Operation and Control specification above.

Moisture ingress to the pump's separation chamber shall be alarmed and shall cause the pump to shut down. Thermal protection of the motor windings shall be provided. The pump motor shall have a degree of protection of IP68 suitable for continuous immersion.

The uPVC discharge pipework shall be in accordance with SANS 966. The discharge pipework will be routed to the air valve stub on the outlet pipework as shown on the drawings. The Contractor shall fix the pipework to the concrete surfaces in the chamber by using suitable supports.

The check valve to be provided on the pump discharge shall be in accordance with Clause D15.13 of Section D.

The isolation valve shall be in accordance with Clause D15.3 of Section D.

The mechanical water meter shall be in accordance with SANS 1529. The water meter shall be installed such that it is easily accessible to take safely take the water meter readings.

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The submersible pumps for the leakage return water system shall be provided with suitable lifting device to facilitate the removal of the pump from the sump.

11.10 NON-ELECTRONIC INSTRUMENTATION

The Contractor shall provide all non-electronic instrumentation shown on the P&IDs. The leakage return water sump shall use electronic level measurement as specified elsewhere.

11.11 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

11.12 SPARES

The Contractor shall provide the following spares:

- One (1) submersible sump pump as defined in section 11.8.
- One (1) submersible leakage water return pump as defined in section 11.9.

11.13 MISCELLANEOUS

Not applicable

11.14 FABRICATION

Fabrication shall comply with Section D.

11.15 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

11.16 MATERIALS AND CORROSION PROTECTION

11.16.1 GENERAL

Components shall be designed for corrosion resistance to the high corrosivity category (C4) of sans 12944-2.

Materials shall comply with Clause D3 of Section D, unless otherwise stated in the table below.

Corrosion protection shall comply with Clause D5 of Section D, unless otherwise specified in the table below.

11.16.2 EQUIPMENT

Equipment shall comply with the table below:

ITEM	MATERIAL	COATING
Pump casing	Cast iron	As per manufacturer's requirements
Pipe supports and anchors	Carbon steel	HDG in-line with Clause D5.3.2
Auxiliary metal components	EN Grade 1.4401 (316)	Pickle and passivate
Fasteners	EN Grade 1.4401 (316)	N/A

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11.17 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

11.18 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

11.19 INSTALLATION

Installation work shall comply with Clause D6 of Section D.

11.20 TOLERANCES

The Contractor shall confirm all final dimensions of any civil structures on site before proceeding with the construction of mechanical items and shall further ensure that all equipment offered will fit into the tolerances of the water retaining structures.

11.21 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

11.22 INSPECTIONS

11.22.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

11.23 TESTING REQUIREMENTS

11.23.1 FACTORY

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

11.23.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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12. SODIUM HYPOCHLORITE GENERATION BUILDING HVAC

12.1 SCOPE

12.1.1 INTRODUCTION

The following section details the HVAC system for the Muldersvlei Sodium Hypochlorite Generation Building at the 300 ML Reservoir. The section is to be read in conjunction with any other relevant specification documents. The details described herein are for the Sodium Hypochlorite Generation Building HVAC systems only and should not be applied to other parts of the site.

12.1.2 CONFIGURATION

The HVAC system for the sodium hypochlorite generation building shall incorporate different systems for different spaces:

- The salt storage shall be served by extract air system complete with make-up air system to keep the space under negative pressure.
- The chemical generation and storage areas shall be equipped with three (3) hideaway split inverter air conditioning units complete with condensers and one (1) fresh air system.
- The laboratory shall be equipped with one (1) midwall split air conditioning unit complete with stainless steel drip tray and condensate drain pump and a separate fresh air system.
- There shall be one (1) extract air system used to service the toilet.

12.1.3 KEY ELEMENTS

- Fresh air system
- Extract air system
- Make-up air system
- Hideaway split air conditioning units complete with condenser.
- Midwall spilt air conditioning unit complete with condenser.
- Instrumentation
- Safety equipment

12.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

12.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillaries to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

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[redacted]

12.2 NORMATIVE REFERENCES

12.2.1 ENGINEER'S DRAWINGS AND SPECIFICATION

The drawings, prepared by the Engineer, show general layouts of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the Sub-Contractor to cost and determine how the system must be installed, tested, balanced, inspected, operated, serviced and maintained.

These drawings are not dimensioned installation drawings and cannot be used as construction/shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

The following forms part of the Contract Document:

- SPE-MM-001-HVAC Particular Specification
- S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises
- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.
- SANS 10400-O The application of the National Building Regulations Part O: Lighting and ventilation
- SANS 10400-XA The application of the National Building Regulations Part X: Environmental sustainability Part XA: Energy usage in buildings
- SANS 204 Energy efficiency in buildings

12.3 DEFINITIONS AND ABBREVIATIONS

HVAC	Heating, Ventilation and Air Conditioning
EAF	Extract Air Fan
FAF	Fresh Air Fan

12.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

12.5 GENERAL REQUIREMENTS

The Sub-Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Sub-Contractor shall provide all plant and equipment necessary to deliver, install, inspect and test the Works.

It shall be the responsibility of the Sub-Contractor to ensure that all equipment and methods used in the installation, comply with all relevant statutory regulations, and amendments thereto in particular the following:

S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises.

The Occupational Health & Safety Act of 1993, as amended.

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Government, Provincial and Local Authorities Ordinances, Regulations, By-laws, Rules and other Statutory requirements.

Specifications and Codes of Practice issued by the South African Bureau of Standards and British Standards Institute. The former shall have precedence over the latter where both bodies have issued conflicting specifications or codes of practice.

The Sub-Contractor warrants the software contained in the equipment or systems that the Sub-Contractor provides for use by the Employer shall include, at no additional costs to the Employer, design and performance features and capabilities to ensure that the software will not be inaccessible, and that the software will not provide invalid or incorrect results.

12.6 PERFORMANCE REQUIREMENTS

12.6.1 SALT STORAGE SYSTEM

The Sub-Contractor shall supply a system that comprise of the following major equipment:

1 x Extract Air System, and

1 x Make-up Air System.

The extract air system comprising of the corrosion resistant extract air fan (complete with VSD), PVC ducting and PVC double deflection grilles which allow for 3550l/s of fowl air to be extracted shall be installed on the side of the wall to allow for cross flow of air. The air shall be extracted at high level.

The make-up air shall be supplied to the salt storage at low level by a Ø750 uninsulated spiral galvanised ducted system running outside the building at low level and the corrosion-free stainless steel double deflection supply air grilles complete with opposed blade dampers (OBD).

The fans, dampers and grilles shall be fully catalogued, or supplier selected products, and the documentation shall include type and number of filters, sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Fan(s) performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

12.7 OPERATION AND CONTROL

12.7.1 SPLIT AIR CONDITIONING UNITS

The midwall and hideaway split air conditioning units shall be of the inverter type. The units shall be able to operate completely independently from the rest of the building and all other systems present. The units shall be controlled remotely per space.

Controls and protective devices shall be factory wired and located in a readily accessible location. Control box shall be removable from front of unit.

12.7.2 FRESH AIR SYSTEM

The fresh air system shall supply air to the split air conditioning units.

The operation of these fans shall be able to be time clock controlled on a 365-day basis by a 7-day timer.

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12.7.3 EXTRACT AIR SYSTEMS

Extract air system shall be installed for the ventilation within all ablutions and within the salt storage area.

The operation of these fans shall be able to be time clock controlled on a 365-day basis by a 7-day timer.

12.7.4 MAKE-UP AIR SYSTEM

The make-up air system shall supply air to the salt storage at low level.

The operation of these fans shall be able to be time clock controlled on a 365-day basis by a 7-day timer.

12.8 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed in or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

c) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

d) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

12.9 FRESH/MAKE-UP AIR SYSTEM

12.9.1 FRESH/MAKE-UP AIR FAN

The Contractor shall supply two (2) fresh air fans and one make-up air fan; One 160mm diameter silent type inline fan for the laboratory and one (1) 315mm diameter axial flow fan for the fresh air system in the sodium hypochlorite generation building. One 500mm diameter corrosion resistant (PRF/axial) fan for the make-up air in the salt storage area. The axial fan shall be installed at the roof slab of the building while the inline fan will be installed within the ceiling void of the laboratory. The make up air shall be by the side of the building as shown on the drawing.

The fan shall comply with Clause D45.2 of Section D as well as sections V.D4.06.03 and V.D4.06.04 of the SPE-MM-001-HVAC.

The fans shall be fully catalogued products, and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

12.9.2 DUCTING (AIR DISTRIBUTION SYSTEM)

The Contractor shall supply adequately sized ducting, air terminals and accessories as part of the fresh air system. The ducting shall be as galvanised spiral (unless otherwise specified on the drawing) and shall be exposed.

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The ducting, air terminals and accessories shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

12.10 HIDEAWAY SPLIT AIR CONDITIONING UNITS COMPLETE WITH CONDENSERS

12.10.1 GENERAL

The Contractor shall provide three (3) 22kW hideaway direct expansion split air conditioning units and their respective condenser units to service the chemical generation and storage areas. The Contractor shall also supply the piping, and ancillary equipment, for these systems. The units shall be of the air-cooled, split type complete with inverter compressor(s), fan(s), filters, coils (remote condenser) electrics and safety controls.

The units shall not drum, vibrate or leak under any operating conditions. Parts used in the construction of the units shall have adequate strength and the overall construction and installation shall ensure satisfactory operation under normal service conditions.

Units shall be capable of operating safely (at reduced capacity) without tripping at an ambient temperature of 40°C.

The refrigerant used in the system shall be R410a or other approved, shall be non-toxic, non-flammable and odourless, with a zero-ozone depletion potential and low global warming potential. R-22 gas will not be accepted. In the event the contractor was to recommend the use of a different refrigerant, approval shall be obtained from the Mechanical Engineer. The hideaway split air conditioning units shall also comply with section V.D10.01.04 of the SPE-MM-001-HVAC.

12.10.2 EVAPORATORS

The evaporator fan shall be of the direct-drive centrifugal type.

Units shall be furnished with washable filters, filtering the evaporator air. Mounting arrangements for filter shall obviate bypass of untreated air. Filters shall be easily removable from units.

The Sub-contractor shall submit, based on the unit manufacturer's noise criteria curves, certified sound insulation calculations from a noise expert for the enclosure including detailed construction and acoustic insulation drawings. The noise expert shall guarantee a noise level not exceeding the design values.

12.10.3 CONDENSERS

All condenser coils shall be protected from possible damage by hail-guards.

Outdoor units shall be suitable for outdoor operating conditions in a corrosive environment.

Condenser coils and fins shall be coated against corrosion. The applied coating shall not inhibit the heat transfer capacity of the unit. Coatings such as BluGuard or equivalent are acceptable and shall have a nominal dry film thickness of 30 µm.

Outdoor units shall be securely placed at the plant area slab.

12.10.4 DUCTING (AIR DISTRIBUTION SYSTEM)

The Contractor shall supply adequately sized ducting to providing cooling to the chemical generation and storage areas. The ducting shall be exposed, internally insulated and spiral in shape. The grilles shall be of the volume control (opposed blade dampers), or volumetric flowrate control type in line with the specification.

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The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

12.11 MIDWALL SPLIT AIR CONDITIONING UNIT COMPLETE WITH CONDENSER

12.11.1 GENERAL

The Contractor shall provide one (1) 3.5kW midwall direct expansion split air conditioning unit and its corresponding condenser unit to cool the laboratory. The Contractor shall also supply the refrigerant piping, condensate drain piping, and ancillary equipment, for these systems. The units shall be of the air-cooled, split type complete with inverter compressor(s), fan(s), filters, coils (remote condenser) electrics and safety controls. The air conditioning unit shall be equipped with an insulated stainless stain drip try of sufficient size to trap condensate.

The unit shall not drum, vibrate or leak under any operating conditions. Stainless steel drip tray complete with condensate pump and piping shall be installed to protect any equipment that in the laboratory. Parts used in the construction of the unit shall have adequate strength and the overall construction and installation shall ensure satisfactory operation under normal service conditions.

The unit shall be capable of operating safely (at reduced capacity) without tripping at an ambient temperature of 40°C.

The refrigerant used in the system shall be R410a or other approved, shall be non-toxic, non-flammable and odourless, with a zero-ozone depletion potential and low global warming potential. R-22 gas will not be accepted. In the event the contractor was to recommend the use of a different refrigerant, approval shall be obtained from the Mechanical Engineer. The midwall split air conditioning units shall also comply with section V.D10.01.04 of the SPE-MM-001-HVAC.

12.11.2 EVAPORATOR

The evaporator fan shall be of the direct-drive centrifugal type.

The unit shall be furnished with washable filters, filtering the evaporator air. Mounting arrangements for filter shall obviate bypass of untreated air. Filters shall be easily removable from the unit.

The Sub-contractor shall submit, based on the unit manufacturer's noise criteria curves, certified sound insulation calculations from a noise expert for the enclosure including detailed construction and acoustic insulation drawings. The noise expert shall guarantee a noise level not exceeding the design values.

12.11.3 CONDENSER

All condenser coils shall be protected from possible damage by hail by hail-guards.

Outdoor units shall be suitable for outdoor operating conditions in a corrosive environment.

Condenser coils and fins shall be coated against corrosion. The applied coating shall not inhibit the heat transfer capacity of the unit. Coatings such as BluGuard or equivalent are acceptable and shall have a nominal dry film thickness of 30 µm.

Outdoor units shall be securely mounted to the outside wall and be encased and locked in a HDG steel cage to protect the units against theft and vandalism.

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12.12 EXTRACT AIR SYSTEM

The Contractor shall supply five (5) extract air fans. There is one (1) silent type in-line fan for air extraction system for the toilet and two (2) wall mounted extract air fans for the pumphouse, one (1) wall extract air fan for the MCC room and one (1) PRF centrifugal extract air fan for the salt storage.

The 160 mm diameter silent type fan shall extract 50 L/s of air at an estimated system pressure (ESP) of 150 Pa and located in the ceiling void. Two (2) 400 mm diameter wall extract air fans shall extract 500 L/s of air at an estimated system pressure (ESP) of 50 Pa and mounted on the wall from the pump room. One (1) 400 mm diameter wall extract air fans shall extract 350 L/s of air at an estimated system pressure (ESP) of 50 Pa and mounted on the wall from the MCC room. One (1) 355 mm diameter PRF extract air corrosion-free fan with 423 L/s of air at an estimated system pressure (ESP) of 150 Pa and mounted on the wall from the salt storage.

The fan shall comply with Clause D45.2 of Section D and section V.D4.06.03 & V.D4.06.04 of the SPE-MM-001-HVAC.

The fan shall be a fully catalogued product and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

12.12.1 DUCTING FOR AIR EXTRACTION SYSTEM

The Contractor shall supply adequately sized ducting as part of the extract air system. The ducting shall be round or spiral in shape and shall be exposed.

The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

12.13 INSTRUMENTATION

All instruments for a complete system shall be provided by the Contractor, including for those specified, those required to perform the specified control functions and those necessary to operate safely. The equipment and/or sub system supplier/assembler shall provide under the overall responsibility of the air conditioning sub-contractor, all permanently installed instrumentation necessary for logging and monitoring of status and performance of equipment and components.

In addition, a sling psychrometer shall be provided at handover for use by the Employer.

All instruments shall be of such dimensions and mounted in position so that they are easily and accurately readable by an operator standing on the floor.

Test instruments shall be checked for accuracy by the manufacturer or by an approved laboratory with certificates being submitted prior to site tests, showing the degree of accuracy over a life of 15 years.

12.14 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

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12.15 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

12.16 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

12.17 MATERIALS AND CORROSION PROTECTION

12.17.1 GENERAL

Materials shall comply with Clause D3 of Section D.

Corrosion protection shall comply with Clause D5 of Section D.

12.17.2 EQUIPMENT

Outdoor units and air handling units located on exterior plant rooms shall be corrosion treated with Bluchem/Blygold inclusive of coils, electrical panels and casing.

12.18 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

12.19 INSTALLATION

Installation work shall comply with Clause D6 of Section D.

12.20 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

12.21 INSPECTIONS

12.21.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

12.22 TESTING REQUIREMENTS

12.22.1 FACTORY

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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12.22.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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13. ADMIN BUILDING HVAC

13.1 SCOPE

13.1.1 INTRODUCTION

The following section details the HVAC system for the Muldersvlei Admin Building at the 300 ML Reservoir. The section is to be read in conjunction with any other relevant specification documents; the details described herein are for the Admin Building HVAC system only and should not be applied to other parts of the site.

13.1.2 CONFIGURATION

The HVAC system for the admin building shall incorporate split air conditioning, and air extraction. Seven (7) hideaway split air conditioning units shall service the kitchen, sick bay, the offices, and the control room. There shall be two (2) midwall split air conditioning units installed above the doors of the battery and server rooms.

Furthermore, an air extraction system shall be used for the ablution facilities.

13.1.3 KEY ELEMENTS

- Fresh air system
- Hideaway split air conditioning units
- Midwall split air conditioning units
- Extraction air system
- Instrumentation
- Safety Equipment

13.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

13.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

13.2 NORMATIVE REFERENCES

13.2.1 ENGINEER'S DRAWINGS AND SPECIFICATION

The drawings, prepared by the Engineer, shows general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the Sub Contractor to cost and determine how the system must be installed, tested, balanced, inspected, operated, serviced and maintained.

These drawings are not dimensioned installation drawings and cannot be used as construction/shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

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The following forms part of the Contract Document:

- SPE-MM-001-HVAC Particular Specification
- S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises
- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.
- SANS 10400-O The application of the National Building Regulations Part O: Lighting and ventilation
- SANS 10400-XA The application of the National Building Regulations Part X: Environmental sustainability Part XA: Energy usage in buildings
- SANS 204 Energy efficiency in buildings

13.3 DEFINITIONS AND ABBREVIATIONS

HVAC Heating Ventilation and Air Conditioning

13.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

13.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect, and test the Works.

It shall be the responsibility of the Sub-Contractor to ensure that all equipment and methods used in the installation, comply with all relevant statutory regulations, and amendments thereto in particular the following:

S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises.

The Occupational Health & Safety Act of 1993, as amended.

Government, Provincial and Local Authorities Ordinances, Regulations, By-laws, Rules, and other Statutory requirements.

Specifications and Codes of Practice issued by the South African Bureau of Standards and British Standards Institute. The former shall have precedence over the latter where both bodies have issued conflicting specifications or codes of practice.

The Sub-Contractor warrants the software contained in the equipment or systems that the Sub-Contractor provides for use by the Employer shall include, at no additional costs to the Employer, design and performance features and capabilities to ensure that the software will not be inaccessible, and that the software will not provide invalid or incorrect results.

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13.6 OPERATION AND CONTROL

13.6.1 SPLIT AIR CONDITIONING UNITS

The midwall and hideaway split air conditioning units shall be of the inverter type. The units shall be able to operate completely independently from the rest of the building and all other systems present. The units shall be controlled remotely per space.

Controls and protective devices shall be factory wired and located in a readily accessible location. Control box shall be removable from front of unit.

13.6.2 FRESH AIR SYSTEM

The fresh air system shall supply air to the split air conditioning units.

The operation of these fans shall be able to be time clock controlled on a 365-day basis and 7-day timer.

13.6.3 EXTRACT AIR SYSTEM

Extract air systems shall be installed for the ventilation within all ablutions.

The operation of these units shall be able to be time clock controlled on a 365-day basis and 7-day timer.

13.7 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

e) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

f) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

13.8 FRESH AIR SYSTEM

13.8.1 FRESH AIR FAN

The Contractor shall supply one (1) 500mm diameter mixed flow fan for the fresh air system in the admin building. The fan shall supply 320 L/s of fresh air at an estimated system pressure (ESP) of 400 Pa shall be installed at the roof slab of the building.

The fan shall comply with Clause D45.2 of Section D and section V.D4.06.04.

The fan shall be a fully catalogued product, and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

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13.8.2 DUCTING

The Contractor shall supply adequately sized ducting as part of the fresh air system. The ducting shall be rectangular in shape and shall be installed within the ceiling voids. The fresh air system shall connect to the hideaway units using flexible ducting.

The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

13.9 HIDEAWAY SPLIT AIR CONDITIONING UNITS COMPLETE WITH CONDENSERS

13.9.1 GENERAL

The Contractor shall provide seven (7) hideaway direct expansion split air conditioning units and their respective condenser units to service various areas in the admin building. The following capacities are calculated design capacities, but the Contractor shall confirm the derated capacities:

Location	Air conditioning requirement (kW)
Meeting room	4.5
Weighbridge staff offices	3.6
Office 1	3.6
Office 2	3.6
Control room	3.6
Sick bay	1.5
Canteen	9.0

The Contractor shall also supply the piping, and ancillary equipment, for these systems. The units shall be of the air-cooled, split type complete with inverter compressor(s), fan(s), filters, coils (remote condenser) electrics and safety controls.

The units shall not drum, vibrate or leak under any operating conditions. Parts used in the construction of the units shall have adequate strength and the overall construction and installation shall ensure satisfactory operation under normal service conditions.

Units shall be capable of operating safely (at reduced capacity) without tripping at an ambient temperature of 40°C.

The refrigerant used in the system shall be R410a or other approved, shall be non-toxic, non-flammable and odourless, with a zero-ozone depletion potential and low global warming potential. R-22 gas will not be accepted. In the event the contractor was to recommend the use of a different refrigerant, approval shall be obtained from the Mechanical Engineer. The hideaway split air conditioning units shall also comply with section V.D10.01.04 of the SPE-MM-001-HVAC.

13.9.2 EVAPORATORS

The evaporator fan shall be of the direct-drive centrifugal type and shall be installed within the ceiling void of the building.

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Units shall be furnished with washable filters, filtering the evaporator air. Mounting arrangements for filter shall obviate bypass of untreated air. Filters shall be easily removable from units.

The Sub-contractor shall submit, based on the unit manufacturer's noise criteria curves, certified sound insulation calculations from a noise expert for the enclosure including detailed construction and acoustic insulation drawings. The noise expert shall guarantee a noise level not exceeding the design values.

13.9.3 CONDENSERS

The condensers shall be installed at the roof slab of the building.

All condenser coils shall be protected from possible damage by hail by hail-guards.

Outdoor units shall be suitable for outdoor operating conditions in a corrosive environment.

Condenser coils and fins shall be coated against corrosion. The applied coating shall not inhibit the heat transfer capacity of the unit. Coatings such as BluGuard or equivalent are acceptable and shall have a nominal dry film thickness of 30 µm.

Outdoor units shall be securely mounted to the outside wall and be encased and locked in a HDG steel cage to protect the units against theft and vandalism.

13.9.4 DUCTING

The Contractor shall supply adequately sized ducting as part of the supply air system. The ducting shall be rectangular in shape, externally insulated, and shall installed within the ceiling void.

The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

The ducts in the supply air system shall each be equipped with a suitably sized square plate ceiling diffusers to allow for adjustment of air flow. Supply air diffusers shall be ceiling and shall have an adjustable core.

13.10 MIDWALL SPLIT AIR CONDITIONING UNITS COMPLETE WITH CONDENSERS

13.10.1 GENERAL

The Contractor shall provide two (2) midwall split air conditioning units and their respective condenser units complete with stainless steel drip tray and condensate pumps to service the battery room and server room, respectively. The following capacities are calculated design capacities, but the Contractor shall confirm the derated capacities:

Location	Air conditioning requirement (kW)
Server room	2.8
Battery room	2.2

The Contractor shall also supply the piping, and ancillary equipment, for these systems. The units shall be of the air-cooled, split type complete with inverter compressor(s), fan(s), filters, coils (remote condenser) electrics and safety controls.

Each air conditioning unit shall be equipped with an insulated stainless stain drip try of sufficient size to trap condensate.

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The units shall not drum, vibrate or leak under any operating conditions. Parts used in the construction of the units shall have adequate strength and the overall construction and installation shall ensure satisfactory operation under normal service conditions.

Units shall be capable of operating safely (at reduced capacity) without tripping at an ambient temperature of 40°C.

The refrigerant used in the system shall be R410a or other approved, shall be non-toxic, non-flammable and odourless, with a zero-ozone depletion potential and low global warming potential. R-22 gas will not be accepted. In the event the contractor was to recommend the use of a different refrigerant, approval shall be obtained from the Mechanical Engineer. The midwall split air conditioning units shall also comply with section V.D10.01.04 of the SPE-MM-001-HVAC.

13.10.2 EVAPORATORS

The evaporator fan shall be of the direct-drive centrifugal type and shall be installed above the doors of the server room and control room.

Units shall be furnished with washable filters, filtering the evaporator air. Mounting arrangements for filter shall obviate bypass of untreated air. Filters shall be easily removable from units.

The Sub-contractor shall submit, based on the unit manufacturer's noise criteria curves, certified sound insulation calculations from a noise expert for the enclosure including detailed construction and acoustic insulation drawings. The noise expert shall guarantee a noise level not exceeding the design values.

13.10.3 CONDENSERS

The condensers shall be installed at the roof slab of the building.

All condenser coils shall be protected from possible damage by hail by hail-guards.

Outdoor units shall be suitable for outdoor operating conditions in a corrosive environment.

Condenser coils and fins shall be coated against corrosion. The applied coating shall not inhibit the heat transfer capacity of the unit. Coatings such as BluGuard or equivalent are acceptable and shall have a nominal dry film thickness of 30 µm.

Outdoor units shall be securely mounted to the outside wall and be encased and locked in a HDG steel cage to protect the units against theft and vandalism.

13.11 EXTRACT AIR FAN

The Contractor shall supply one (1) 500 mm diameter mixed flow type fan for the extract air system in the ablution facilities and wash closets of the admin building. The fan shall extract 840 L/s of air at an estimated system pressure (ESP) of 250 Pa to be installed at the roof slab of the building.

The fan shall comply with Clause D45.2 of Section D and section V.D4.06.04.

The fan shall be a fully catalogued product, and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

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13.11.1 DUCTING FOR AIR EXTRACTION SYSTEM

The Contractor shall supply adequately sized ducting as part of the air extraction system. The ducting shall be rectangular in shape and shall installed within the ceiling void.

The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

The ducts in the air extraction system shall each be equipped with a suitably sized disc valves to allow for adjustment of air flow. Valves shall be ceiling and shall have an adjustable core.

13.12 INSTRUMENTATION

All instruments for a complete system shall be provided by the Contractor, including for those specified, those required to perform the specified control functions and those necessary to operate safely. The equipment and/or sub system supplier/assembler shall provide under the overall responsibility of the air conditioning sub-contractor, all permanently installed instrumentation necessary for logging and monitoring of status and performance of equipment and components.

In addition, a sling psychrometer shall be provided at handover for use by the Employer.

All instruments shall be of such dimensions and mounted in position so that they are easily and accurately readable by an operator standing on the floor.

Test instruments shall be checked for accuracy by the manufacturer or by an approved laboratory with certificates being submitted prior to site tests, showing the degree of accuracy over a life of 15 years.

13.13 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

13.14 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

13.15 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

13.16 MATERIALS AND CORROSION PROTECTION

13.16.1 GENERAL

Materials shall comply with Clause D3 of Section D.

Corrosion protection shall comply with Clause D5 of Section D.

13.16.2 EQUIPMENT

Outdoor units and air handling units located on exterior plant rooms shall be corrosion treated with Bluchem/Blygold inclusive of coils, electrical panels and casing.

13.17 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

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Care shall be taken to prevent damage to equipment during delivery.

13.18 INSTALLATION

Installation work shall comply with Clause D6 of Section D.

13.19 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

13.20 INSPECTIONS

13.20.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

13.21 TESTING REQUIREMENTS

13.21.1 FACTORY

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

13.21.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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14. GUARDHOUSE HVAC

14.1 SCOPE

14.1.1 INTRODUCTION

The following section details the HVAC system for the Muldersvlei Guardhouse at the 300 ML Reservoir. The section is to be read in conjunction with any other relevant specification documents; the details described herein are for the Guardhouse HVAC system only and should not be applied to other parts of the site.

14.1.2 CONFIGURATION

The HVAC system for the guardhouse will consist of a midwall split air conditioning unit complete with a condenser, an air extract system for ablution and kitchen, and fresh air system.

14.1.3 KEY ELEMENTS

- Midwall split air conditioning
- Extract air system
- Fresh air system
- Instrumentation
- Safety Equipment

14.1.4 ELECTRICAL AND ELECTRONIC ELEMENTS

Electronic instrumentation is dealt with elsewhere, as is all other electrical and electronic work.

14.1.5 OTHER ELEMENTS

Other work, materials and equipment ancillary to the key elements above, which are required to enable to works to be installed correctly and as specified, function safely and pass tests on completion, shall be provided. Unless explicitly specified as a key element, this shall include for all fasteners, supports, brackets, safety guards, piping, valves, instruments and so forth.

14.2 NORMATIVE REFERENCES

14.2.1 ENGINEER'S DRAWINGS AND SPECIFICATION

The drawings, prepared by the Engineer, shows general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the Sub Contractor to cost and determine how the system must be installed, tested, balanced, inspected, operated, serviced and maintained.

These drawings are not dimensioned installation drawings and cannot be used as construction/shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

The following forms part of the Contract Document:

- SPE-MM-001-HVAC Particular Specification
- S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises

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- Standard Specification for Design-Build of Mechanical Equipment (Version 2020), hereinafter referred to as Section D.
- SANS 10400-O The application of the National Building Regulations Part O: Lighting and ventilation
- SANS 10400-XA The application of the National Building Regulations Part X: Environmental sustainability Part XA: Energy usage in buildings
- SANS 204 Energy efficiency in buildings

14.3 DEFINITIONS AND ABBREVIATIONS

HVAC Heating Ventilation and Air Conditioning

14.4 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

14.5 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect, and test the Works.

It shall be the responsibility of the Sub-Contractor to ensure that all equipment and methods used in the installation, comply with all relevant statutory regulations, and amendments thereto in particular the following:

S.A.N.S. Code of Practice 10142, as amended, for the Wiring of Premises.

The Occupational Health & Safety Act of 1993, as amended.

Government, Provincial and Local Authorities Ordinances, Regulations, By-laws, Rules, and other Statutory requirements.

Specifications and Codes of Practice issued by the South African Bureau of Standards and British Standards Institute. The former shall have precedence over the latter where both bodies have issued conflicting specifications or codes of practice.

The Sub-Contractor warrants the software contained in the equipment or systems that the Sub-Contractor provides for use by the Employer shall include, at no additional costs to the Employer, design and performance features and capabilities to ensure that the software will not be inaccessible, and that the software will not provide invalid or incorrect results.

14.6 OPERATION AND CONTROL

14.6.1 SPLIT AIR CONDITIONING UNIT

The split air conditioning unit shall be of the inverter type. The units shall be able to operate completely independently from the rest of the building and all other systems present. The units shall be controlled remotely per space.

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Controls and protective devices shall be factory wired and located in a readily accessible location. Control box shall be removable from front of unit.

14.6.2 FRESH AIR SYSTEM

The fresh air system shall supply air to the split air conditioning units.

The operation of these fans shall be able to be time clock controlled on a 365-day basis and 7-day timer.

14.6.3 AIR EXTRACTION FANS

Exhaust (or extraction) systems shall be installed for the ventilation within all ablutions.

The operation of these units shall be able to be time clock controlled on a 365-day basis and 7-day timer.

14.7 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Where the Works will be installed or connect to civil infrastructure or equipment provided by others, the Contractor shall design and execute the Works to allow for and accommodate the following level of accuracy and associated tolerances:

g) For concrete work: Degree of Accuracy II in terms of SANS 1200 G, unless otherwise specified or noted on the drawings.

h) For structural steelwork: Degree of Accuracy II in terms of SANS 1200 H, unless otherwise specified or noted on the drawings.

Where the Works will be installed in or connect to existing civil infrastructure or equipment, the Contractor shall take measurements and shall design and execute the Works to allow for and accommodate such.

14.8 MIDWALL SPLIT AIR CONDITIONING UNIT COMPLETE CONDENSER

14.8.1 GENERAL

The Contractor shall provide one (1) 3.5kW midwall direct expansion split air conditioning unit and its corresponding condenser unit. The Contractor shall also supply the piping, and ancillary equipment, for these systems. The units shall be of the air-cooled, split type complete with inverter compressor(s), fan(s), filters, coils (remote condenser) electrics and safety controls. The air conditioning unit shall be equipped with an insulated stainless stain drip try of sufficient size to trap condensate.

The unit shall not drum, vibrate or leak under any operating conditions. Parts used in the construction of the unit shall have adequate strength and the overall construction and installation shall ensure satisfactory operation under normal service conditions.

The unit shall be capable of operating safely (at reduced capacity) without tripping at an ambient temperature of 40°C.

The refrigerant used in the system shall be R410a or other approved, shall be non-toxic, non-flammable and odourless, with a zero-ozone depletion potential and low global warming potential. R-22 gas will not be accepted. In the event the contractor was to recommend the use of a different refrigerant, approval shall be obtained from the Mechanical Engineer. The midwall split air conditioning units shall also comply with section V.D10.01.04 of the SPE-MM-001-HVAC.

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14.8.2 EVAPORATOR

The evaporator fan shall be of the direct-drive centrifugal type.

The unit shall be furnished with washable filters, filtering the evaporator air. Mounting arrangements for filter shall obviate bypass of untreated air. Filters shall be easily removable from the unit.

The Sub-contractor shall submit, based on the unit manufacturer's noise criteria curves, certified sound insulation calculations from a noise expert for the enclosure including detailed construction and acoustic insulation drawings. The noise expert shall guarantee a noise level not exceeding the design values.

14.8.3 CONDENSER

All condenser coils shall be protected from possible damage by hail by hail-guards.

Outdoor units shall be suitable for outdoor operating conditions in a corrosive environment.

Condenser coils and fins shall be coated against corrosion. The applied coating shall not inhibit the heat transfer capacity of the unit. Coatings such as BluGuard or equivalent are acceptable and shall have a nominal dry film thickness of 30 µm.

Outdoor units shall be securely mounted to the outside wall and be encased and locked in a HDG steel cage to protect the units against theft and vandalism.

14.9 FRESH AIR SYSTEM

14.9.1 FRESH AIR FAN

The Contractor shall supply one (1) 250mm diameter silent type inline fan for the fresh air system for the building. The fan shall supply 130 L/s of fresh air at an estimated system pressure (ESP) of 250 Pa and shall be installed within the ceiling void of the building.

The fan shall comply with Clause D45.2 of Section D and section V.D4.06.04.

The fan shall be a fully catalogued product and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

14.9.2 DUCTING

The Contractor shall supply adequately sized ducting as part of the fresh air system. The ducting shall be spiral or round and shall be installed within the ceiling void.

The ducting shall comply with Clause D45.3 of Section D and section V.D6.01 of the SPE-MM-001-HVAC.

The ducts in the supply air system shall each be equipped with a suitably sized square plate ceiling diffusers to allow for adjustment of air flow. Supply air diffusers shall be ceiling and shall have an adjustable core.

14.10 EXTRACT AIR FAN

The Contractor shall supply two (2) 150mm diameter wall mounted extract air fans shall extract 55 L/s and 40 L/s of air at an estimated system pressure (ESP) of 50 Pa for the toilet cubicle and basin in the kitchen, respectively.

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The fan shall comply Clause D45.2 in Section D and section V.D4.06.03.

The fan shall be a fully catalogued product and the documentation shall include sound power level spectrums, performance curves and/or tables for the expected range of operational conditions. Performance curves and selection tables shall be based on a reproducible and certified test in an approved laboratory. Fan selection shall be in the stable part of the curve.

14.11 INSTRUMENTATION

All instruments for a complete system shall be provided by the Contractor, including for those specified, those required to perform the specified control functions and those necessary to operate safely. The equipment and/or sub system supplier/assembler shall provide under the overall responsibility of the air conditioning sub-contractor, all permanently installed instrumentation necessary for logging and monitoring of status and performance of equipment and components.

In addition, a sling psychrometer shall be provided at handover for use by the Employer.

All instruments shall be of such dimensions and mounted in position so that they are easily and accurately readable by an operator standing on the floor.

Test instruments shall be checked for accuracy by the manufacturer or by an approved laboratory with certificates being submitted prior to site tests, showing the degree of accuracy over a life of 15 years.

14.12 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the equipment installation.

14.13 FABRICATION

Fabrication shall comply with Clause D4 of Section D.

14.14 FASTENERS

Fasteners shall comply with Clause D7 of Section D.

14.15 MATERIALS AND CORROSION PROTECTION

14.15.1 GENERAL

Materials shall comply with Clause D3 of Section D.

Corrosion protection shall comply with Clause D5 of Section D.

14.15.2 EQUIPMENT

Outdoor units and air handling units located on exterior plant rooms shall be corrosion treated with Bluchem/Blygold inclusive of coils, electrical panels and casing.

14.16 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

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14.17 INSTALLATION

Installation work shall comply with Clause D6 of Section D.

14.18 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

14.19 INSPECTIONS

14.19.1 FACTORY

The Contractor shall make all arrangements and carry all costs for the Engineer, or an Engineer approved inspection authority, to inspect equipment for acceptance prior to despatch to Site and prior to payment being made.

If the equipment is manufactured locally, the Contractor shall arrange for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured locally, the Contractor shall arrange for the Engineer or an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The Contractor shall submit the report by the inspection authority to the Engineer for acceptance. This report shall confirm compliance of the equipment with the specifications prior to despatch from the manufacturer's works.

14.20 TESTING REQUIREMENTS

14.20.1 FACTORY

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

14.20.2 SITE

The Contractor shall demonstrate the correct operation of the equipment and achievement of the specified performance requirements to the Engineer prior to the Works being considered as commissioned.

The Contractor shall submit test reports for all tests to the Engineer and shall provide copies in the Manual.

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15. SUNDRIES

15.1 SCOPE

15.1.1 INTRODUCTION

This specifies the requirements for sundry equipment to be provided by the Contractor.

15.1.2 CONFIGURATION

The offered laboratory instruments shall be manufactured from a suitable material with a supplier epoxy coat finish for installation inside a working laboratory along with other analyser instruments.

15.1.3 KEY ELEMENTS

- Step ladder
- Safety showers and eye baths
- Handheld residual chlorine analyser
- Handheld pH analyser
- Conductivity analyser
- Laboratory glassware and titration equipment
- Safety Equipment
- Spares

15.2 DEFINITIONS AND ABBREVIATIONS

The following definitions and abbreviations shall apply:

DPD	Dichlorophenolindophenol
EDTA	Ethylenediaminetetraacetic acid
MSDS	Material Safety Datasheet

15.3 EQUIPMENT ELIGIBILITY

The equipment provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

15.4 GENERAL REQUIREMENTS

The Contractor shall design and provide the Works to meet the requirements of this specification, to integrate with other components of the Works and with civil infrastructure or equipment provided by others.

The Contractor shall provide all plant and equipment necessary to deliver, install, inspect, and test the Works.

All equipment offered shall be furnished by a manufacturer with a minimum of ten years' experience in the design and supply of laboratory analyser stations and with ten or more local operating installations of a similar nature. Suppliers whose main field of expertise is not related to such processes shall not be considered as the system manufacturer.

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[redacted]

All laboratory equipment and systems supplied shall be CE certified.

15.5 ALLOWANCE FOR CIVIL INFRASTRUCTURE AND EQUIPMENT BY OTHERS

Not applicable.

15.6 STEPLADDER

The Contractor shall supply a step ladder for general maintenance purposes in the sodium hypochlorite generation building, including the maintenance of and access to the wall-mounted chemical injectors. The ladder shall be constructed of corrosion resistant material such as stainless steel 316 (or better) or fibreglass with non-slip PVC feet.

The reach height of the ladder shall be at least 4.0 m. An A-frame step ladder or push-up ladder shall be provided. The minimum static loading of the step ladder shall be 150 kg.

15.7 SAFETY SHOWERS AND EYE BATHS

Two (2) full body, double column safety showers shall be provided in the sodium hypochlorite generation building.

The shower shall be platform operated. An eye bath shall also be provided. The eye bath shall be lever operated and shall spray upwards towards the face.

The complete unit shall be of stainless steel 316.

The Contractor shall make the necessary connections from the potable water reticulation network to the safety shower and eye bath.

15.8 HANDHELD RESIDUAL CHLORINE ANALYSER

15.8.1 GENERAL REQUIREMENTS

The Contractor shall provide one (1) handheld residual chlorine analyser that shall be used for undertaking residual chlorine analyses on water samples. The chlorine analyser shall meet the following general requirements:

- The analyser must offer a high degree of analysis flexibility for wastewater, surface water, sewerage, and potable water.
- The analyser offered must be complete and include delivery, installation, and commissioning.
- Tenderers must provide reference details of users of the offered equipment within Southern Africa.
- The analyser offered must employ colorimetry methodology.
- The analyser offered must be handheld and battery operated.
- The analyser shall be provided with reagents required for the analysis in powder, tablet, or liquid form.

15.8.2 HARDWARE/COMMUNICATION

The chlorine sensor shall include the following communication specifications, but not limited to:

- Power requirement: 1.5V AAA battery (1)
- Light source: LED @ 525 nm
- Light detector: Silicon photocell

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- The sensor shall display clear error or warning messages when the measurement appears to be outside the expected range.

15.8.3 PERFORMANCE REQUIREMENTS

General

- Measuring Range: 0 to 3.50 mg/L Cl_2
- Accuracy: ±0.03 mg/L ±3% of reading
- Resolution: ±0.01 mg/L
- Environmental Conditions:
  - Operating Temperature: 0 to 50 °C
  - Relative Humidity: 0 to 95% (non-condensing)

Result Reports

Collated by sample, manual entry of off-line results allowing for fully collated result reports, results calculated from both measured and off-line results.

Data Management

Optional Windows® workstation with graphical user interface. Data input online, via mouse, touchscreen, keyboard, and barcode reader. Different user groups can have different access rights. Different user interface language versions available.

Performance Guarantees

All parts and components of the system shall be guaranteed to be free of defects in workmanship and materials for twelve (12) months from the date of installation. During the warranty period any defective parts will be replaced at no additional cost.

15.8.4 OPERATION & CONTROL

Operating principle

The residual chlorine in the water will react with dichlorophenolindophenol (DPD) at pH 6.2 - 6.5 to form a red complex. The photometer in the analyser determines the intensity of this red complex at 520 nm and correlates it to the concentration of chlorine in the sample.

Maintenance

The analyser shall deliver the best accuracy while minimizing variability from test to test. The analyser shall also be able to alert the user to maintenance needs such as battery replacement timeously.

15.9 HANDHELD PH ANALYSER

15.9.1 GENERAL REQUIREMENTS

The Contractor shall provide one (1) laboratory pH analyser that shall be capable of undertaking analyses on water samples for pH tests. The pH analyser shall meet the following general requirements:

- The analyser must offer a high degree of analysis flexibility for wastewater, surface water, sewerage, and potable water

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[redacted]

- The analyser offered must be complete and include delivery, installation and commissioning.
- Tenderers must provide reference details of users of the offered equipment within Southern Africa.
- The pH sensor shall be of Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.

15.9.2 HARDWARE/COMMUNICATION

The pH sensor shall include the following communication specifications, but not limited to:

- Communications: Multiple alarm/control schemes should be available, for example using three relays and two PID control outputs. Communications use analog 4-20 mA and digital MODBUS®/RS485, MODBUS®/RS232 protocols.
- Equipped with wireless communication through an infrared port.
- Sensors should be available with integral digital electronics or with a gateway module for high temperature (above 70 °C) applications.
- The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m.

15.9.3 PERFORMANCE REQUIREMENTS

General

- Measuring Range: -2 to 14 pH
- Sensitivity: ± 0.01 pH
- Stability: 0.03 pH per 24 hours, non-cumulative
- Operating Temperature:
  - Digital Sensor: -5 to 70 °C
  - Analog Sensor with Digital Gateway: -5 to 105 °C
  - Immersion Sensor: 0 to 50 °C
- Flow Rate: 3 m per second, maximum
- Sensor Pressure/Temperature Limits:
  - Digital: 6.9 bar at 70 °C
  - Analog: 6.9 bar at 105 °C

Result Reports

Collated by sample, manual entry of off-line results allowing for fully collated result reports, results calculated from both measured and off-line results. A built-in data logger collects measurement data, calibration, verification points, and alarm history for up to 6 months.

Data Management

Optional Windows® workstation with graphical user interface. Data input online, via mouse, touchscreen, keyboard and barcode reader. Different user groups can have different access rights. Different user interface language versions available.

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Performance Guarantees

All parts and components of the system shall be guaranteed to be free of defects in workmanship and materials for twelve (12) months from the date of installation. During the warranty period any defective parts will be replaced at no additional cost.

15.9.4 OPERATION & CONTROL

The sensor signal shall have an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in process temperature.

15.10 CONDUCTIVITY ANALYSER

15.10.1 GENERAL

The Contractor shall provide one (1) desktop laboratory conductivity analyser that shall be capable of undertaking analyses on water samples for conductivity tests.

15.10.2 GENERAL REQUIREMENTS

The following points list the general requirements of the conductivity analyser:

- The Analyser must offer a high degree of analysis flexibility for wastewater, surface water, sewerage, and potable water.
- The Analyser offered must be complete and include delivery, installation, and commissioning.
- Tenderers must provide reference details of users of the offered equipment within Southern Africa.
- Sensors are manufactured to exacting tolerances using high quality, rugged materials for demanding applications, including ultra-pure water, clean-in-place (CIP), and boiler/condensate monitoring.

15.10.3 HARDWARE/COMMUNICATION

The conductivity analyser shall include the following communication specifications, but not limited to:

- Temperature Compensator: Pt 1000 RTD (for exceptionally fast response to changes in temperature with ±0.1°C accuracy)
- Transmission Distance: 100 m, maximum 1000 m, maximum when used with a termination box
- Standard Probe Cable: Digital Probe: 7 m
- Length (integral): Analog Probe: 6 m
- Sensor Cable: Digital: PUR (polyethylene) 5-conductor, shielded, rated to 150 °C (302 °F)
- Analog: Integral (no junction box), 6 wire cable (4 conductors and two isolated shield wires)
- Analog with Junction Box Head: (optional) 6-position terminal strip supplied in integrally mounted junction box (polypropylene, aluminium, or 316 stainless steel)

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15.10.4 PERFORMANCE REQUIREMENTS

General

Performance sensors measure from 0.057 µS/cm or 18.2 MΩ (theoretically pure water) up to 200,000 µS/cm.

Temperature Measurement Range: –20 to 200 °C

Accuracy: ±2% of reading above 200 µS/cm

Sensitivity: ±0.5% of reading

Response Time: 90% of reading within 30 seconds of step change

Repeatability: ±0.5% of reading

Operating Temperature: –20 to 200 °C

The following table summarises the cell constants & measuring ranges:

SENSOR CELL CONSTANT	MEASURING RANGE (µS/CM)	RESISTIVITY (MOHM)
0.05	0-100	0.002-20
0.5	0-1000	0.001-20
1	0-2000	not applicable
5	0-10000	not applicable
10	0-200000	not applicable

Result Reports

Collated by sample, manual entry of off-line results allowing for fully collated result reports, results calculated from both measured and off-line results.

Data Management

Optional Windows® workstation with graphical user interface. Data input online, via mouse, touchscreen, keyboard and barcode reader. Different user groups can have different access rights. Different user interface language versions available.

Performance Guarantees

All parts and components of the system are unconditionally guaranteed to be free of defect in workmanship and materials for twelve (12) months from the date of installation. During the warranty period any defective parts will be replaced at no additional cost, but freight, taxes, labour and travel will be charged for

15.10.5 OPERATION & CONTROL

The sensor signal shall have an integral temperature sensor. The sensor shall automatically compensate measured values for changes in process temperature.

15.11 LABORATORY GLASSWARE AND TITRATION EQUIPMENT

The Contractor shall provide laboratory glassware and all supporting equipment that is required for undertaking laboratory analyses of total hardness, calcium, and magnesium by titration, as well as glassware for dilution of 0.8% NaOCl. High-quality Class A glassware made of borosilicate glass or similar shall be used. As a minimum, the following glassware shall be provided:

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Beakers:

- Two (2) x 50 mL
- Two (2) x 100 mL
- Two (2) x 250 mL
- Two (2) x 500 mL
- Two (2) x 1000 mL

Graduated Cylinders:

- Two (2) x 10 mL
- Two (2) x 25 mL
- Two (2) x 50 mL
- Two (2) x 100 mL
- Two (2) x 250 mL
- Two (2) x 500 mL

Volumetric Flasks:

- Two (2) x 10 mL
- Two (2) x 25 mL
- Two (2) x 50 mL
- Two (2) x 100 mL
- Two (2) x 250 mL
- Two (2) x 500 mL
- Two (2) x 1000 mL

Pipettes:

- Two (2) x 10 mL volumetric pipettes
- Two (2) x 2 mL volumetric pipettes

Erlenmeyer Flasks:

- Two (2) x 50 mL
- Two (2) x 100 mL
- Two (2) x 250 mL
- Two (2) x 500 mL
- Two (2) x 1000 mL

Test Tubes:

- Four (4) x 10 mL
- Four (4) x 15 mL
- Four (4) x 25 mL

Burettes:

- Two (2) x burettes for accurate titrations
- Two (2) x retort stands for mounting the burettes

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[redacted]

- Eight (8) x clamps for the retort stands

Glass stirring rods:

- Four (4) x Glass stirring rods

Laboratory hot plate & stirrer:

Additionally, a laboratory hot plate with a magnetic stirrer shall be provided. The hot plate shall have a ceramic top plate and a degree of protection of IP54 or better. The hot plate shall have an accuracy of ±1 °C or better. Two (2) magnetic stirrers shall be supplied with the hot plate. The contractor shall also provide two (2) autopipettes with a range of 0.1-1ml.

The reagents and other consumables used in the titrations shall be supplied by Others.

15.12 SAFETY EQUIPMENT

The Contractor shall provide all safety signage required for the laboratory.

This shall also include signage for the safety showers in the building. One sign shall be provided 'SAFETY SHOWER' for each shower installed or directions to the safety shower and eyebath, whichever is applicable. The Safety Shower sign shall measure at least 300 mm x 500 mm. Other signs shall measure at least 450 mm x 600 mm.

15.13 SPARES

All laboratory apparatus offered shall be supplied with a recommended spares list.

15.14 SAFE DESIGN

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

15.15 CONTRACTOR'S DOCUMENTS

General documents and requirements for Contractors Documents are specified elsewhere.

In addition, the Contractor shall provide the following:

- Material safety datasheets (MSDSs) for reagents to be used in the titrations

15.16 DELIVERY

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) and reassembly on site of all equipment.

Care shall be taken to prevent damage to equipment during delivery.

15.17 INSTALLATION

Installation work shall comply with Clause D6 in Section D.

15.18 INSPECTIONS

15.18.1 FACTORY

Not applicable

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[redacted]

15.18.2 SITE

The Contractor shall make arrangements for the Engineer to inspect the completed installation on Site prior to commissioning.

15.19 TESTING REQUIREMENTS

15.19.1 FACTORY

Not applicable.

15.19.2 SITE

Not applicable.

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3.7.7.2 MECHANICAL DATA SHEETS

The Mechanical Datasheets are included immediately hereafter, comprising 125 pages.

[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Salt Dissolution Tanks Datasheet**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0001	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0001
Discipline	Mechanical (MM)
Process Area/Unit	0001

	EQUIPMENT	DATASHEET NR
1	Actuated Ball Valves	1001757-2000-DST-MM-0001-001
2	Salt Tank Internal Filters	1001757-2000-DST-MM-0001-002
3	Salt Tank Lid	1001757-2000-DST-MM-0001-003
4	Dilution Water Manual Isolation Ball Valves	1001757-2000-DST-MM-0001-004
5	Brine Manual Isolation Ball Valves	1001757-2000-DST-MM-0001-005

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Actuated Ball Valves**	CLIENT Nº. 194C-BW-WP037	PAGE
	ZUTARI Nº. 1001757-2000-DST-MM-0001-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Actuated Ball Valves	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-			
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	-		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated pressure	bar	10		
2.2	Body test pressure	bar	1.5 x PN rating		
2.3	Response time	s	-		
2.4	Actuating voltage	V	400		
2.5	Power consumption	W	-		
2.6	Fluid flow rate	l/s	0.05		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	SS316		
3.2	Internals	-	-		
3.3	Flange	-	-		
3.4	Seal	-	EPDM Rubber or similar		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Coil	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Salt Tank Internal Filters**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0001-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Salt Tank Internal Filters	B.M.	D.M.	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 45-FL-001 TO -006 AND 45-FL-009 TO -014	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FILTER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Proposed design code	-	-		
1.5	Size (DN)	mm	-		
1.6	Connection type	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Type	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design flow per filter	m³/h	-		
2.2	Pressure drop	kPa	-		
2.3	Design temperature	°C	-		
2.4	Mesh size	micron	150		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Filter body	-	Polypropylene		
3.2	Rest plate for manifold	-	PMMA		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Salt Tank Lid**	CLIENT N°. 194C-BW-WP037	PAGE
	ZUTARI N°. 1001757-2000-DST-MM-0001-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Salt Tank Lid	B.M.	D.M.	T.R.	L.K	26/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): N/A	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**TANK LID DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Length	mm	2000		
1.5	Width	mm	2000		
1.6	Thickness	mm	-		
1.7	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Maximum static loading of lid	kg	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Tank lid	-	HDPE		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Dilution Water Manual Isolation Ball Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0001-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Dilution Water Manual Isolation Ball Valves	B.M.	D.M.	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	N/A	**Quantity:**	Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	l/s	0.03 - 0.11		
2.2	Reduces/full bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Brine Manual Isolation Ball Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0001-005	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Brine Manual Isolation Ball Valves	B.M.	D.M.	T.R.	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	N/A	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	l/s	0.06 - 0.11		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	-		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **On-site Sodium Hypochlorite Generation Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0002
Discipline	Mechanical (MM)
Process Area/Unit	0002

	EQUIPMENT	DATASHEET NR
1	Saturated Brine Filters	1001757-2000-DST-MM-0002-001
2	Duplex Water Softener	1001757-2000-DST-MM-0002-002
3	Brine Pump	1001757-2000-DST-MM-0002-003
4	Electrolytic Reactor	1001757-2000-DST-MM-0002-004
5	Mobile HCl Cleaning Circulation Pump	1001757-2000-DST-MM-0002-005
6	Process Water Manual Ball Valves	1001757-2000-DST-MM-0002-006
7	Actuated Ball Valves	1001757-2000-DST-MM-0002-007
8	Needle Valves	1001757-2000-DST-MM-0002-008
9	Chemically Resistant Manual Ball Valves	1001757-2000-DST-MM-0002-009
10	Actuated Diaphragm Valves	1001757-2000-DST-MM-0002-0010

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Saturated Brine Filters**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Saturated Brine Filters	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	45-FL-007, -008, -015, -016	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FILTER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Proposed design code	-	-		
1.5	Size (DN)	mm	-		
1.6	Connection type	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Type	-	Filter nozzle		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design flow per filter	m^3/h	0.384		
2.2	Pressure drop	bar	0.2		
2.3	Design temperature	°C	-		
2.4	Mesh size	micron	100		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Filter body	-	Polypropylene or similar		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Duplex Water Softener**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0002-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Duplex Water Softener	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): 45-SPE-001 TO -004	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**SOFTENER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Softener resin volume	kg	-		
1.5	Dimensions (diameter × height)	m	-		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Brine consumption per regeneration	ℓ	-		
2.2	Backwash water per regeneration	ℓ	-		
2.3	Vessel thickness	mm	-		
2.4	Pressure rating	kPa	-		
2.5	Bed expansion in backwashing	%	50		
2.6	Softener freeboard volume	m^3	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Softener vessel	-	FRP		
4	**GENERAL DETAILS**				
4.1	Description of exterior reinforcing	-	Continuous roving glass filament		
4.2	Paint details	-	-		
4.3	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

[redacted]

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Brine Pump**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Brine Pump	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	45-PMP-001 TO -004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type	-	Diaphragm pump		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Type of lubrication	-	-		
1.1.8	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Rated dosing capacity	ℓ/h	96		
1.2.2	Maximum dosing capacity	ℓ/h	-		
1.2.3	Power required at duty point	kW	-		
1.2.4	Maximum stroke frequency	s/min	-		
1.2.5	Stroke volume	mℓ	-		
1.2.6	Maximum turndown ratio	-	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Diaphragm	-	uPVC/PP/PVDF		
1.3.2	Housing	-	uPVC/PP/PVDF		
1.4	**GENERAL DETAILS**				
1.4.1	Corrosion protection	-	N/A		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Installed power	kW	-		
2.1.5	Class of insulation	-	-		
2.1.6	Enclosure IP rating	-	IP55		
2.1.7	Power supply	pH/Hz	3phase/50 Hz		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Method of speed control	-	-		
2.2.3	Output signal for speed control	-	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Electrolytic Reactor**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Electrolytic Reactor	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	45-ER-001 TO -004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**REACTOR DETAILS**				
1.1	Manifacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Orientation	-	Horizontal		
1.6	Reactor configuration	-	Two cells in series		
1.7	Connection type	-	-		
1.8	Flanges	-	Refer to specification		
1.9	Generator length	mm	-		
1.10	Generator diameter	mm	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Equivalent Cl_2 production per unit	kg/h	10		
2.2	Design sodium hypochlorite production per unit	ℓ/h	1230		
2.3	Free chlorine in product solution	% wt.	0.8 ± 0.05		
2.4	Saturated brine flow per unit	ℓ/h	96		
2.5	Sodium chloride requirement per unit	kg	30		
2.6	Dilution water flow per unit	ℓ/h	1136		
2.7	Minimum inlet temperature	°C	12.7		
2.8	Maximum inlet temperature	°C	26.7		
2.9	Maximum temerature increase of product stream (relative to dilution water)	°C	20		
2.10	Design pressure	kPa	-		
2.11	Frequency	Hz	50		
2.12	Power factor	-	-		
2.13	Sound level	dB	-		
2.14	Fuse Safety	-	-		
2.16	Electrolysis direct current	A	730		
2.17	Electrolysis voltage	V	72		
2.18	Power rating	kW	44		
2.18	Input voltage for rectifer	V	-		
2.18	Rectifier Phase (1 or 3)	-	-		
4	**MATERIAL OF CONSTRUCTION**				
4.1	Reactor body	-	Plexiglass		
4.2	Material thickness	mm	-		
4.3	Bipolar electrodes	-	Titanium		
4.3	Ingress Protection	-	IP 21		
5	**GENERAL DETAILS**				
5.1	Spare supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Mobile HCl Cleaning Circulation Pump**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Mobile HCl Cleaning Circulation Pump	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	45-CIP-001	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type (centrifugal, rotary, axial etc.)	-	Positive displacement		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Impeller diameter	mm	-		
1.1.8	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Flowrate at duty point	m^3/h	-		
1.2.2	Delivery head at duty point	kPa	-		
1.2.3	Shut-off head	kPa	-		
1.2.4	Efficiency at duty point	%	-		
1.2.5	Power required at duty point	kW	-		
1.2.6	Best efficiency point	%	-		
1.2.7	Flowrate at best efficiency point	m^3/h	-		
1.2.8	Delivery head at best efficiency point	kPa	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Impeller	-	-		
1.3.2	Casing	-	-		
1.3.3	Shaft	-	-		
1.3.4	Wear ring	-	-		
1.3.5	Suction sleeve	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Corrosion protection	-	-		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Type of frame	-	-		
2.1.5	Type of bearings	-	-		
2.1.6	Installed power	kW	-		
2.1.7	Class of insulation	-	-		
2.1.8	Enclosure IP rating	-	-		
2.1.9	Power supply	pH/V/Hz	-		
2.1.10	Mass	kg	-		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Splash protection	-	-		
2.2.3	Starter type	-	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Process Water Manual Ball Valves**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0002-006**	REV. **T0**

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Process Water Manual Ball Valves	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): N/A	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.03 - 0.34		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Actuated Ball Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0002-007**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Actuated Ball Valves	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	-		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated pressure	bar	10		
2.2	Body test pressure	bar	1.5 x PN rating		
2.3	Temperature rating	°C	-		
2.4	Response time	s	-		
2.5	Actuating voltage	V	400		
2.6	Power consumption	W	-		
2.7	Rated flow rate	ℓ/s	0.05		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	PVC or similar		
3.2	Internals	-	-		
3.3	Flange	-	-		
3.4	Seal	-	EPDM Rubber or similar		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Coil	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Needle Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0002-008	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Needle Valves	B.M.	D.M.	T.R.	L.K.	28/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**NEEDLE VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.16		
2.2	Reduces/full bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Internals	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Chemically Resistant Manual Ball Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0002-009	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Chemically Resistant Manual Ball Valves	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.03 - 0.34		
2.2	Reduces/full bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	EPDM or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757
TITLE **Actuated Diaphragm Valves**	CLIENT N°. 194C-BW-WP037	PAGE
	ZUTARI N°. 1001757-2000-DST-MM-0002-0010	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Actuated Diaphragm Valves	B.M.	D.M.	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED DIAPHRAGM VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	Straight-through type diaphragm valve		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated pressure	bar	10		
2.2	Body test pressure	bar	1.5 x PN rating		
2.3	Temperature rating	°C	-		
2.4	Response time	s	-		
2.5	Actuating voltage	V	-		
2.6	Power consumption	W	-		
2.7	Fluid flow rate	L/s	0.11		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	uPVC or similar		
3.2	Gates	-	-		
3.3	Diaphragm	-	EPDM or similar		
3.4	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Sodium Hypochlorite Storage Datasheet**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0003**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0003
Discipline	Mechanical (MM)
Process Area/Unit	0003

	EQUIPMENT	DATASHEET NR
1	Sodium Hypochlorite Storage Tanks	1001757-2000-DST-MM-0003-001
2	Dilution Blowers	1001757-2000-DST-MM-0003-002
3	Manual ball valves	1001757-2000-DST-MM-0003-003
4	Check valves	1001757-2000-DST-MM-0003-004

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Sodium Hypochlorite Storage Tanks**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0003-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Sodium Hypochlorite Storage Tanks	B.M	D.M	T.R.	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	46-TK-001 TO -004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**TANK DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Design code	-	-		
1.4	Mass	kg	-		
1.5	Working volume	m^3	15		
1.6	Nominal internal diameter	mm	-		
1.7	Height	mm	3300		
	Tank nozzles				
1.8	Inlet	mm	40		
1.9	Outlet	mm	50		
1.10	Overflow	mm	40		
1.11	Drain	mm	-		
1.12	Vent	mm	-		
1.13	Sight glass (if applicable)	mm	-		
1.14	Access hatch	mm	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating temperature	°C	0 - 50		
2.2	Design temperature	°C	-		
2.3	Design pressure	bar	-		
2.4	Overpressure	mbar	4.5		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Tank body	-	uPVC/HDPE/GFRP		
4	**GENERAL DETAILS**				
4.1	Protective coating and colour	-	-		
4.2	Supplier address	-	-		
4.3	Details of lifting lugs/eyes	-	-		
5	**INSTRUMENTATION**				
5.1	Level transmitter nozzle	mm	-		
5.2	Level switch high nozzle	mm	-		
5.3	Level switch low nozzle	mm	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Dilution Blowers**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0003-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Dilution Blowers	B.M	D.M	T.R.	L.K	20/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	46-BL-001 TO -004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BLOWER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Inlet diameter	mm	-		
1.6	Outlet diameter	mm	-		
1.7	Enclosure size (L x W x H)	mm	-		
1.8	Insulation thickness	mm	-		
1.9	L10 life	hours	-		
2	**SILENCER DETAILS**				
2.1	Intake silencer dimensions	mm	-		
2.2	Discharge silencer dimensions	mm	-		
2.3	Intake silencer volume	m^3/s	-		
2.4	Discharge silencer volume	m^3/s	-		
2.5	Discharge silencer design pressure	kPa	-		
2.6	Does intake silencer qualify as a pressure vessel in terms of OHS Act (Y/N)	-	-		
2.7	Does discharge silencer qualify as a pressure vessel in terms of OHS Act (Y/N)	-	-		
3	**BLOWER CHARACTERISTICS AND PERFORMANCE**				
3.1	Design air flowrate	m^3/h	-		
3.2	Flow rate at duty point	m^3/h	1040		
3.3	Delivery head at duty point	kPa	0.325		
3.4	Duty torque at duty speed	Nm	-		
3.5	Shaft speed	rpm	-		
3.6	Power required at duty point	kW	-		
3.7	No. of lobes on rotors	No.	-		
3.8	Power required at duty point	kW	-		
4	**MATERIAL OF CONSTRUCTION**				
4.1	Fan	-	uPVC/HDPE or similar		
4.2	Casing	-	-		
4.3	Rotors	-	-		
4.4	Bearings	-	-		
4.5	Insulation material	-	-		
5	**GENERAL DETAILS**				
5.1	Description of corrosion protection	-	-		
5.2	Description of pulsation reduction	-	-		
5.3	Details of anti-vibration feet	-	-		
5.4	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Manual ball valves**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0003-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual ball valves	B.M	D.M	T.R.	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.04 - 0.53		
2.2	Reduces/full bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	kPa	-		
2.5	Seat test pressure	kPa	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	EPDM or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Check valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0003-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Check valves	B.M	D.M	T.R.	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHECK VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type and design	-	Ball check valve		
1.5	Description of anti-slam features	-	-		
1.6	External indication of position	Yes/No	-		
1.7	Length of side lever	mm	-		
1.8	Mass of lever	kg	-		
1.9	Size (DN)	mm	-		
1.10	Face to face dimension	mm	-		
1.11	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Volumetric operating range	Nm³/h	1040		
2.2	Pressure operating range	kPa	-		
2.3	Pressure rating (nominal)	bar	10		
2.4	Body Test pressure	kPa	-		
2.5	Seat Test pressure	kPa	-		
2.6	Minimum flow rate required to open fully	m³/h	-		
2.7	Installation volumetric operating range	m³/h	-		
2.8	Installation pressure operating range	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	PVC or similar		
3.2	Ball	-	-		
3.3	Seat	-	-		
3.4	Blade (or equivalent)	-	-		
3.5	Spring	-	-		
3.6	Fasteners	-	-		
3.7	Other components	-	-		
3.8	Type of interior lining (2-pack Epoxy, FBE, etc.)	-	-		
3.9	Type of exterior lining (2-pack Epoxy, FBE, etc.)	-	-		
4	**GENERAL DETAILS**				
4.1	Internal corrosion protection	-	-		
4.2	Spares supplier and address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Check valves**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0003-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Check valves	B.M	D.M	T.R.	L.K	20/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed
REFERENCE DOCUMENTS				

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Sodium Hypochlorite Dosing Datasheet**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-ZUT-DST-MM-0004**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-ZUT-DST-MM-0004
Discipline	Mechanical (MM)
Process Area/Unit	0004

	EQUIPMENT	DATASHEET NR
1	Sodium Hypochlorite Dosing Pumps	1001757-ZUT-DST-MM-0004-001
2	Pressure Safety Valves	1001757-ZUT-DST-MM-0004-002
3	Check Valves	1001757-ZUT-DST-MM-0004-003
4	Manual Ball Valves	1001757-ZUT-DST-MM-0004-004
5	Pressure Reducing Valves	1001757-ZUT-DST-MM-0004-005
6	Injection Lances	1001757-ZUT-DST-MM-0004-006

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Sodium Hypochlorite Dosing Pumps**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-ZUT-DST-MM-0004-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Sodium Hypochlorite Dosing Pumps	B.M	D.M	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	46-PMP-001 TO -006	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**DOSING PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type	-	-		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Type of lubrication	-	Oil		
1.1.8	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Rated dosing capacity	ℓ/h	950		
1.2.2	Maximum dosing capacity	ℓ/h	-		
1.2.3	Power required at duty point	kW	0.2		
1.2.4	Maximum stroke frequency	s/min	-		
1.2.5	Stroke volume	mℓ	-		
1.2.6	Maximum turndown ratio	-	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Dosing head	-	-		
1.3.2	Diaphragm	-	-		
1.3.3	Housing	-	PVC or similar		
1.3.4	Valve ball	-	-		
1.3.5	Connecting shaft	-	-		
1.3.6	Gear box	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Protective coating	-	-		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Installed power	kW	0.37		
2.1.5	Class of insulation	-	-		
2.1.6	Enclosure IP rating	-	-		
2.1.7	Power supply	pH/V/Hz	3phase/50Hz		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Method of speed control	-	-		
2.2.3	Output signal for speed control	-	-		
2.2.4	Range for speed control	rpm	-		
2.2.5	Method of stroke control	-	-		
2.2.6	Range for stroke control	rpm	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Pressure Safety Valves**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0004-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Pressure Safety Valves	B.M	D.M	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**PRESSURE SAFETY VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Discharge passage connection size	mm	-		
1.7	Inlet passage size	mm	-		
1.8	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	bar	-		
2.2	Test pressure	bar	1.5 x PN rating		
2.3	Body pressure rating	bar	10		
2.3	Rated flow rate	L/s	0.26		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	-		
3.2	Liner	-	-		
3.3	Spring	-	-		
3.4	Diaphragm	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Check Valves**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-ZUT-DST-MM-0004-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Check Valves	B.M	D.M	T.R.	L.K.	29/11/2023

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHECK VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type and design	-	Ball check valve		
1.5	Description of anti-slam features	-	-		
1.6	External indication of position	Yes/No	-		
1.7	Length of side lever	mm	-		
1.8	Mass of lever	kg	-		
1.9	Size (DN)	mm	-		
1.10	Face to face dimension	mm	-		
1.11	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Volumetric operating range	m³/h	0.95		
2.2	Pressure operating range	bar	-		
2.3	Pressure rating (nominal)	bar	10		
2.4	Minimum flow rate required to open fully	m³/h	-		
2.5	Installation volumetric operating range	m³/h	-		
2.6	Installation pressure operating range	bar	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	PVC		
3.2	Blade (or equivalent)	-	-		
3.3	Spring	-	-		
3.4	Fasteners	-	-		
3.5	Other components	-	-		
4	**GENERAL DETAILS**				
4.1	Internal corrosion protection	-	-		
4.2	Spares supplier and address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Manual Ball Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-ZUT-DST-MM-0004-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual Ball Valves	B.M	D.M	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.26		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	EPDM or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Pressure Reducing Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-ZUT-DST-MM-0004-005	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Pressure Reducing Valves	B.M	D.M	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**PRESSURE REDUCING VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Internal or external pilot	-	-		
1.8	Diaphragm type (if applicable)	-	-		
1.9	Piston type (if applicable)	-	-		
1.10	Valve patterns	-	-		
1.11	Plug types	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Test pressure	kPa	-		
2.3	Body pressure rating	kPa	-		
2.4	Temperature rating	°C	-		
2.5	Minimum adjustable flow rate/adjustment range	-	-		
2.6	Max allowable pressure difference	kPa	-		
2.7	Rated flow rate	L/s	0.26		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Polysulfone or similar		
3.2	Internals	-	-		
3.3	Diaphragm	-	EPDM or similar		
3.4	Seal	-	Polyurethane or similar		
3.5	Coating	-	-		
3.6	Spring	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Injection Lances**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-ZUT-DST-MM-0004-006	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Injection Lances	B.M	D.M	T.R.	L.K.	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**INJECTION LANCE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Lance diameter	mm	Closest to DN30		
1.5	Connection to main water line	-	Flanged		
1.6	Lance connection	-	-		
1.7	Mass	kg	-		
1.8	Non-return valve type	-	Spring ball or plunger		
1.9	Diffuser type	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Test pressure	kPa	-		
2.3	Body pressure rating	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Lance	-	Hastelloy C276		
3.2	Lance seals	-	-		
3.3	Diffuser	-	-		
3.4	Non-return valve	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Commercial Sodium Hypochlorite System Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0005**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0005
Discipline	Mechanical (MM)
Process Area/Unit	0005

	EQUIPMENT	DATASHEET NR
1	Hydraulic-Powered Chemical Injectors	1001757-2000-DST-MM-0005-001
2	Chemically Resistant Manual Isolation Ball Valves	1001757-2000-DST-MM-0005-002
3	Chemically Resistant Actuated Ball Valves	1001757-2000-DST-MM-0005-003
4	Needle Valves	1001757-2000-DST-MM-0005-004
5	Dilution Water Manual Isolation Ball Valves	1001757-2000-DST-MM-0005-005
6	Dilution Water Actuated Ball Valves	1001757-2000-DST-MM-0005-006
7	IBC Centrifugal Pump	1001757-2000-DST-MM-0005-007

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Hydraulic-Powered Chemical Injectors**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0005-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Hydraulic-Powered Chemical Injectors	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	46-VTR-001, 46-VTR-002	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**INJECTOR DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Design code	-	-		
1.4	Mass	kg	-		
1.5	Diameter	mm	≤ 130		
1.6	Total height	mm	≤ 550		
1.7	Width	mm	≤ 160		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Maximum operating temperature	°C	40		
2.2	Operating pressure	kPa	-		
2.3	Minimum injection rate	%	3		
2.4	Maximum injection rate	%	10		
2.5	Minimum chemical injection rate	ℓ/h	0.3		
2.6	Maximum chemical injection rate	ℓ/h	200		
2.7	Maximum dilution water flow rate	ℓ/h	2000		
2.6	Required chemical injection rate	ℓ/h	127		
2.7	Required dilution water flow rate	ℓ/h	1773		
2.7	Required product flow rate	ℓ/h	1900		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Injector housing	-	Polypropylene or similar		
3.2	Piston	-	Polypropylene or similar		
3.3	Injection area	-	Polypropylene or similar		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
5	**ACCESSORIES**				
5.1	Chemical suction hose diameter	mm	-		
5.2	Connector for chemical suction hose	-	-		
5.3	Water suction line filter mesh size	micron	50-60		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Chemically Resistant Manual Isolation Ball Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0005-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Chemically Resistant Manual Isolation Ball Valves	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	Proposal:
Identification (TAG):	Quantity: Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	ℓ/s	0.53		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	-		
3.5	Stem	-	-		
3.6	Seals	-	FPM		
3.7	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.8	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.9	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Chemically Resistant Actuated Ball Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0005-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Chemically Resistant Actuated Ball Valves	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&IDs	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	-		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Body pressure rating	kPa	-		
2.3	Temperature rating	°C	-		
2.4	Response time	s	-		
2.5	Actuating voltage	V	-		
2.6	Power consumption	W	-		
2.7	Rated flow rate	L/s	0.04		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	PVC		
3.2	Internals	-	-		
3.3	Flange	-	-		
3.4	Seal	-	PTFE or similar		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Coil	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Needle Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0005-004**	REV. **T0**

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Needle Valves	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**NEEDLE VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.50		
2.2	Reduces/full bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Internals	-	-		
3.4	Seats	-	-		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Dilution Water Actuated Ball Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0005-006	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Dilution Water Actuated Ball Valves	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&IDs	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	-		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Body pressure rating	kPa	-		
2.3	Temperature rating	°C	-		
2.4	Response time	s	-		
2.5	Actuating voltage	V	-		
2.6	Power consumption	W	-		
2.7	Rated flow rate	L/s	0.50		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Internals	-	-		
3.3	Flange	-	-		
3.4	Seal	-	EPDM Rubber or similar		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Coil	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Dilution Water Manual Isolation Ball Valves**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0005-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Dilution Water Manual Isolation Ball Valves.	B.M	D.M	T.R	LK	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	ℓ/s	0.50		
2.2	Reduced/full bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel		
3.6	Seals	-	-		
3.7	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.8	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.9	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **IBC Centrifugal Pump**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0005-006	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	IBC Centrifugal Pump	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&IDs	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type (centrifugal, rotary, axial etc.)	-	-		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Impeller diameter	mm	-		
1.1.8	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Flowrate at duty point	m^3/h	3		
1.2.2	Delivery head at duty point	bar	2-3		
1.2.3	Shut-off head	bar	-		
1.2.4	Efficiency at duty point	%	-		
1.2.5	Power required at duty point	kW	-		
1.2.6	Best efficiency point	%	-		
1.2.7	Flowrate at best efficiency point	m^3/h	-		
1.2.8	Delivery head at best efficiency point	bar	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Impeller	-	-		
1.3.2	Casing	-	-		
1.3.3	Shaft	-	-		
1.3.4	Wear ring	-	-		
1.3.5	Suction sleeve	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Corrosion protection	-	-		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Type of frame	-	-		
2.1.5	Type of bearings	-	-		
2.1.6	Installed power	kW	-		
2.1.7	Class of insulation	-	-		
2.1.8	Enclosure IP rating	-	-		
2.1.9	Power supply	pH/V/Hz	-		
2.1.10	Mass	kg	-		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Splash protection	-	-		
2.2.3	Starter type	-	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure
TITLE **Summary Sheet:** **Calcium Hypochlorite Storage Datasheet**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0006**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0006
Discipline	Mechanical (MM)
Process Area/Unit	0006

	EQUIPMENT	DATASHEET NR
1	Calcium Hypochlorite Storage Tank	1001757-2000-DST-MM-0006-001
2	Calcium Hypochlorite Hopper	1001757-2000-DST-MM-0006-002
3	Actuated Ball Valves	1001757-2000-DST-MM-0006-003
4	Dilution Water Manual Ball Valves	1001757-2000-DST-MM-0006-004
5	Needle Valve	1001757-2000-DST-MM-0006-005
6	Mezzanine Floor	1001757-2000-DST-MM-0006-006
7	Calcium Hypochlorite Solution Manual Ball Valves	1001757-2000-DST-MM-0006-007

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Calcium Hypochlorite Storage Tank**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0006-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Calcium Hypochlorite Storage Tank	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	47-TK-001, 47-TK-002, 47-TK-003	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**TANK DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Design code	-	-		
1.4	Mass	kg	-		
1.5	Working volume	m^3	5		
1.6	Nominal internal diameter	mm	-		
1.7	Height	mm	1530		
	Tank nozzles				
1.8	Inlet	mm	-		
1.9	Outlet	mm	50		
1.10	Overflow	mm	-		
1.11	Drain	mm	-		
1.12	Vent	mm	-		
1.13	Sight glass (if applicable)	mm	-		
1.14	Access hatch	mm	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design temperature	°C	-		
2.2	Design pressure	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Tank body	-	LLDPE		
4	**GENERAL DETAILS**				
4.1	Protective coating and colour	-	GRP		
4.2	Supplier address	-	-		
4.3	Details of lifting lugs/eyes	-	-		
5	**INSTRUMENTATION**				
5.1	Level transmitter nozzle	mm	-		
5.2	Level switch high nozzle	mm	-		
5.3	Level switch low nozzle	mm	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Calcium Hypochlorite Hopper**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0006-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Calcium Hypochlorite Hopper	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	47-HP-001 - 47-HP-004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**HOPPER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Design code	-	-		
1.8	System type	-	Chip/Tablet		
1.4	Mass of contents	kg	100		
1.5	Working volume	m^3	0.5		
1.7	Height	mm	≤ 1200		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Calcium hypochlorite dosing rate	PPM	800		
2.2	Maximum flow rate	L/hr	6000		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Hopper Body	-	LLDPE		
4	**GENERAL DETAILS**				
4.1	Protective coating and colour	-	GRP		
4.2	Supplier address	-	-		
4.3	Details of lifting lugs/eyes	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Actuated Ball Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0006-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Actuated Ball Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**ACTUATED BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Type	-	-		
1.8	Internal or external pilot (if applicable)	-	-		
1.9	Diaphragm type (if applicable)	-	-		
1.10	Piston type (if applicable)	-	-		
1.11	Actuator type	-	Electric		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Body pressure rating	kPa	-		
2.3	Temperature rating	°C	-		
2.4	Response time	s	-		
2.5	Actuating voltage	V	-		
2.6	Power consumption	W	-		
2.7	Rated flow rate	L/s	6.7		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Internals	-	-		
3.3	Flange	-	-		
3.4	Seal	-	-		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Coil	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Dilution Water Manual Ball Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0006-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Dilution Water Manual Ball Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	6.7		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Needle Valve**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0006-005	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Needle Valve	D.M	B.M	T.R	L.K	29/11/2023

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III - The explenatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**NEEDLE VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	1.7		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Internals	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Mezzanine Floor**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0006-006**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Mezzanine Floor	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**GRATING DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Total floor length	mm	~ 4700		
1.5	Total floor width	mm	~ 4300		
1.6	Grating height	mm	-		
1.7	Surface finish (grit top, solid top, plain sanding surface,etc.)	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Loading capacity of grating (evenly distributed)	kg/m^2	350		
2.2	Deflection at maxmium loading	mm			
3	**MATERIAL OF CONSTRUCTION**				
3.1	Grating material	-	GRP or FRP		
3.2	Fasteners	-	Stainless steel 316		
3.3	Support brackets	-	Stainless steel 316		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Calcium Hypochlorite Solution Manual Ball Valves**	CLIENT N°. 194C-BW-WP037	PAGE
	ZUTARI N°. 1001757-2000-DST-MM-0006-007	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Calcium Hypochlorite Solution Manual Ball Valves	D.M	B.M	T.R	L.K	29/11/2023

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	6.7 - 3.3		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	EPDM or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Calcium Hypochlorite Dosing Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-ZUT-DST-MM-0007**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Aurecon ref. No.:	1001757-ZUT-DST-MM-0007

Discipline	Mechanical (MM)
Process Area/Unit	0007

	EQUIPMENT	DATASHEET NR
1	Calcium Hypochlorite Dosing Pumps	1001757-ZUT-DST-MM-0007-001
2	Pressure Safety Valves	1001757-ZUT-DST-MM-0007-002
3	Check Valves	1001757-ZUT-DST-MM-0007-003
4	Pressure Reducing Valves	1001757-ZUT-DST-MM-0007-004
5	Manual Ball Valves	1001757-ZUT-DST-MM-0007-005
6	Injection Lances	1001757-ZUT-DST-MM-0007-006

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Calcium Hypochlorite Dosing Pumps**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-ZUT-DST-MM-0007-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Calcium Hypochlorite Dosing Pumps	D.M	B.M	T.R	L.K	28/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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Supplier:	**Proposal:**
Identification (TAG): 47-PMP-001 - 47-PMP-006	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**DOSING PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type	-	Peristaltic		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Type of lubrication	-	Oil		
1.1.8	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Rated dosing capacity	L/hr	9500		
1.2.2	Maximum dosing capacity	L/hr	-		
1.2.3	Power required at duty point	kW	3.75		
1.2.4	Maximum stroke frequency	s/min	-		
1.2.5	Stroke volume	mℓ	-		
1.2.6	Maximum turndown ratio	-	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Dosing head	-	-		
1.3.2	Diaphragm	-	-		
1.3.3	Housing	-	-		
1.3.4	Pump casing	-	-		
1.3.5	Connecting shaft	-	-		
1.3.6	Gear box	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Protective coating	-	-		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Installed power	kW	-		
2.1.5	Class of insulation	-	-		
2.1.6	Enclosure IP rating	-	-		
2.1.7	Power supply	pH/V/Hz	3phase/50 Hz		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Method of speed control	-	-		
2.2.3	Output signal for speed control	-	-		
2.2.4	Range for speed control	rpm	-		
2.2.5	Method of stroke control	-	-		
2.2.6	Range for stroke control	rpm	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Calcium Hypochlorite Dosing Pumps**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0007-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Calcium Hypochlorite Dosing Pumps	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	47-PMP-001 - 47-PMP-006	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Pressure Safety Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-ZUT-DST-MM-0007-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Pressure Safety Valves	D.M	B.M	T.R	L.K	29/11/2023

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Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**PRESSURE SAFETY VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Discharge passage connection size	mm	-		
1.7	Inlet passage size	mm	-		
1.8	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	bar	-		
2.3	Body pressure rating	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Rated flow rate	L/s	2.6		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Liner	-	-		
3.3	Spring	-	-		
3.4	Diaphragm	-	-		
3.5	Type of interior lining (2-pack Epoxy, FBE, etc.)	-	PTFE or similar corrosion resistant material		
3.6	Type of exterior lining (2-pack Epoxy, FBE, etc.)	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Check Valves**	CLIENT Nº. 194C-BW-WP037	PAGE
	ZUTARI Nº. 1001757-ZUT-DST-MM-0007-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Check Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHECK VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type and design	-	Ball check valve		
1.5	Description of anti-slam features	-	-		
1.6	External indication of position	Yes/No	-		
1.7	Length of side lever	mm	-		
1.8	Mass of lever	kg	-		
1.9	Size (DN)	mm	-		
1.10	Face to face dimension	mm	-		
1.11	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Volumetric operating range	m³/h	9.5		
2.2	Pressure operating range	kPa	-		
2.3	Pressure rating (nominal)	bar	10		
2.4	Body Test pressure	bar	1.5 x PN rating		
2.5	Seat Test pressure	bar	-		
2.6	Minimum flow rate required to open fully	m³/h	-		
2.7	Installation volumetric operating range	m³/h	-		
2.8	Installation pressure operating range	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	PVC		
3.2	Ball	-	Glass or ceramic		
3.3	Seat	-	PVC		
3.4	Blade (or equivalent)	-	-		
3.5	Spring	-	-		
3.6	Fasteners	-	-		
3.7	Other components	-	-		
3.8	Type of interior lining (2-pack Epoxy, FBE, etc.)	-	-		
3.9	Type of exterior lining (2-pack Epoxy, FBE, etc.)	-	-		
4	**GENERAL DETAILS**				
4.1	Internal corrosion protection	-	-		
4.2	Spares supplier and address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Pressure Reducing Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-ZUT-DST-MM-0007-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Pressure Reducing Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**PRESSURE REDUCING VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size (DN)	mm	-		
1.5	Connection type	-	-		
1.6	Flanges (BS, SABS, ANSI, etc)	-	-		
1.7	Internal or external pilot	-	-		
1.8	Diaphragm type (if applicable)	-	-		
1.9	Piston type (if applicable)	-	-		
1.10	Valve patterns	-	-		
1.11	Plug types	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Test pressure	kPa	-		
2.3	Body pressure rating	kPa	-		
2.4	Body Test pressure	kPa	-		
2.5	Seat Test pressure	kPa	-		
2.6	Temperature rating	°C	-		
2.7	Minimum adjustable flow rate/adjustment range	-	-		
2.8	Max allowable pressure difference	kPa	-		
2.1	Rated flow rate	L/s	2.6		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Polysulfone or similiar		
3.2	Internals	-	-		
3.3	Diaphragm	-	EPDM or similar		
3.4	Seal	-	Polyurethane or similiar		
3.5	Coating	-	-		
3.6	Spring	-	-		
3.7	Type of interior lining (2-pack Epoxy, FBE, etc.)	-	-		
3.8	Type of exterior lining (2-pack Epoxy, FBE, etc.)	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		
4.2	Corrosion protection of valve body	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Manual Ball Valves**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0007-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual Ball Valves	D.M	B.M	T.R	L.K	28/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	2.6		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	PVC or similar		
3.2	Lever	-	-		
3.3	Ball	-	PVC or similar		
3.4	Seats	-	EPDM or similar		
3.5	Stem	-	-		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)	No.	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Injection Lances**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-ZUT-DST-MM-0007-006**	REV. T0

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G – AS BUILT
H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Injection Lances	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**INJECTION LANCE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Lance diameter	mm	Closest to DN80		
1.5	Connection to main water line	-	Flanged		
1.6	Lance connection	-	-		
1.7	Mass	kg	-		
1.8	Non-return valve type	-	Spring ball or plunger		
1.9	Diffuser type	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Operating pressure	kPa	-		
2.2	Test pressure	kPa	-		
2.3	Body pressure rating	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Lance	-	Hastelloy C276		
3.2	Lance seals	-	-		
3.3	Diffuser	-	-		
3.4	Non-return valve	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

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REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Service Water System Datasheet**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-ZUT-DST-MM-0008**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-ZUT-DST-MM-0008

Discipline	Mechanical (MM)
Process Area/Unit	0008

	EQUIPMENT	DATASHEET NR
1	Service Water Pumps	1001757-ZUT-DST-MM-0008-001
2	Double Door Check Valves	1001757-ZUT-DST-MM-0008-002
3	Manual Ball Valves	1001757-ZUT-DST-MM-0008-003
4	Manual Butterfly Valves	1001757-ZUT-DST-MM-0008-004
5	Pressure Accumulator	1001757-ZUT-DST-MM-0008-005
6	Resilient Seal Gate Valves	1001757-ZUT-DST-MM-0008-006
7	Hydraulic Level Control Valve	1001757-ZUT-DST-MM-0008-007
8	Swing Check Valves	1001757-ZUT-DST-MM-0008-008

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Service Water Pumps**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0008-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Service Water Pumps	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): 74-PMP-001 To 74-PMP-004	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1.1	**PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type (centrifugal, rotary, etc.)	-	Centrifugal		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Impeller diameter	mm	-		
1.1.8	Bearings used	-	-		
1.1.9	Method of lubrication for the bearings	-	Oil		
1.1.10	Mass	kg	-		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Flow rate at duty point (Single Pump)	m^3/h	20		
1.2.2	Delivery head at duty point (Single Pump)	kPa	600		
1.2.1	Flow rate at duty point	m^3/h	80		
1.2.2	Delivery head at duty point	kPa	600		
1.2.3	Shut-off head	kPa	-		
1.2.4	Efficiency at duty point	%	71.0		
1.2.5	Absorbed power	kW	4.7		
1.2.5	Rated power	kW	7.5		
1.2.6	Best efficiency point	%	-		
1.2.7	Flow rate at best efficiency point	m^3/h	-		
1.2.8	Delivery head at best efficiency point	kPa	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Impeller	-	Stainless steel or similar		
1.3.2	Casing	-	Cast or ductile Iron		
1.4	**GENERAL DETAILS**				
1.4.1	Protective coating	-	-		
1.4.2	Spares address	-	-		
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Type of frame	-	-		
2.1.5	Type of bearings	-	-		
2.1.6	Installed power	kW	-		
2.1.7	Class of insulation	-	-		
2.1.8	Enclosure IP rating	-	IP54		
2.1.9	Power supply	pH/V/Hz	50 Hz		
2.1.10	Mass	kg	-		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Max speed of rotation	rpm	1500		
2.2.2	Splash protection	-	-		

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Service Water Pumps**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0008-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Service Water Pumps	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): 74-PMP-001 To 74-PMP-004	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Double Door Check Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-ZUT-DST-MM-0008-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Double Door Check Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHECK VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type	-	Double door check valve		
1.5	Description of anti-slam features	-	-		
1.6	External indication of position	Yes/No	-		
1.7	Length of side lever	mm	-		
1.8	Mass of lever	kg	-		
1.9	Size (DN)	mm	-		
1.10	Face to face dimension	mm	-		
1.11	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Volumetric operating range	m^3/h	20		
2.2	Pressure operating range	kPa	-		
2.3	Pressure rating (nominal)	bar	10		
2.4	Body Test pressure	bar	1.5 x PN rating		
2.5	Seat Test pressure	bar	-		
2.6	Minimum flow rate required to open fully	m^3/h	-		
2.7	Installation volumetric operating range	m^3/h	-		
2.8	Installation pressure operating range	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Blade (or equivalent)	-	-		
3.3	Spring	-	-		
3.4	Fasteners	-	316 stainless steel		
3.5	Other components	-	-		
4	**GENERAL DETAILS**				
4.1	Internal corrosion protection	-	-		
4.2	Spares supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Manual Ball Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-ZUT-DST-MM-0008-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual Ball Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.005 - 6.7		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	Epoxy		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Life expectancy (# open/close cycles)		-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Manual Butterfly Valves**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-ZUT-DST-MM-0008-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual Butterfly Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BUTTERFLY VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Body configuration	-	-		
1.5	Valve size (DN)	mm	-		
1.6	Face to face dimension	mm	-		
1.7	Piping connection type	-	Flanged		
1.8	Flanges (BS, SABS, ANSI, etc.)	-	-		
1.9	Mass of valve	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Max required operating torque at valves rated pressure	Nm	-		
2.2	Max required operating torque at for this application	Nm	-		
2.3	Differential pressure rating	kPa	-		
2.4	Design pressure rating for body	kPa	-		
2.5	Body test pressure	kPa	-		
2.6	Seat test pressure	kPa	-		
2.7	Actuation torque	Nm	No actuation		
2.8	Rated flow rate	L/s	5.6		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Seal	-	-		
3.3	Disc	-	-		
3.4	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Corrosion protection of valve body	-	-		
4.2	Description of gland sealing arrangement & material	-	-		
4.3	Grade of stainless steel for fasteners	-	316		
4.4	Description of blade scrapper device and materials	-	-		
4.5	Spare supplier & address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Water Accumulator**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-ZUT-DST-MM-0008-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Water Accumulator	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**WATER ACCUMULATOR DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Fluid type	-	Potable water		
1.5	Accumulator type (Piston, Bladder, Diaphragm)	-	Bladder		
1.6	Nominal volume	L	-		
1.6	Effective gas volume	L	600		
1.7	Accumulator flow rate	L/hr	-		
1.8	Accumulator mass	kg	-		
1.8	Gas bottle size	L	-		
1.9	Process connection type	-	Flanged		
1.10	Flanges (BS, SABS, ANSI, etc.)	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design Pressure	bar	10		
2.2	Minimum operating pressure	bar	-		
2.3	Design temperature	°C	-		
2.4	Bladder design temperature (Max)	°C	-		
2.5	Bladder design temperature (Min)	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Shell	-	Stainless Steel		
3.2	Bladder	-	Butyl		
3.3	Charging valve	-	-		
3.4	Fasteners	-	-		
4	**GENERAL DETAILS**				
4.1	Corrosion protection of shell	-	-		
4.2	Grade of stainless steel for fasteners	-	-		
4.3	Spare supplier & address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Resilient Seal Gate Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-ZUT-DST-MM-0008-006	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Resilient Seal Gate Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**GATE VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type	-	Resilient seal gate valve		
1.5	Size (DN)	mm	200		
1.6	Face to face dimension	mm	-		
1.7	Flange drilling	No.	-		
1.8	Mass	kg	-		
1.9	Handwheel diameter	mm	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Maximum permissible velocity through valve	m/s	-		
2.2	Body pressure rating	kPa	-		
2.3	Gearbox ratio (if applicable)	-	-		
2.4	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Handwheel	-	Cast iron		
3.3	Spindle	-	Stainless steel 316		
3.4	Spindle nut	-	-		
3.5	Blade	-	-		
3.6	Blade trim	-	-		
3.7	Blade shoe	-	-		
3.8	Blade channel guide	-	-		
3.9	Fasteners	-	Stainless steel 316		
4	**GENERAL DETAILS**				
4.1	Corrosion protection	-	Refer to Specification		
4.2	Description of spindle sealing arrangement	-	-		
4.3	Method of indicating gate position	-	-		
4.4	Description of gearbox over-torque limiting device	-	-		
4.5	Method of indicating gate position	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Hydraulic Level Control Valve**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-ZUT-DST-MM-0008-007	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Hydraulic Level Control Valve	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): Refer to P&ID	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LEVEL CONTROL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type	-	Float controlled		
1.5	Size (DN)	mm	200		
1.6	Pilot tube size (DN)	mm	-		
1.7	Body configuration	-	-		
1.8	Face to face dimension	mm	-		
1.9	Mass	kg	-		
1.10	Piping connection type	-	Flanged		
1.11	Flanges (BS, SABS, ANSI, etc.)	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Differential pressure rating	kPa	-		
2.2	Design pressure rating for body	kPa	-		
2.3	Max. required operating torque for rated pressure	Nm	-		
2.4	Max required operating torque for application	Nm	-		
2.5	Gearbox ratio	-	-		
2.6	Rated flow rate	L/s	19.4		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Valve body	-	Stainless steel		
3.2	Seals	-	-		
3.3	Diaphragm	-	-		
3.4	Grade of stainless steel for fastners	-	-		
3.4	Float and pilot	-	Stainless steel or brass		
4	**GENERAL DETAILS**				
4.1	Corrosion protection of valve body	-	-		
4.2	Design and details of seat	-	-		
4.3	Flange drilling	-	-		
4.4	Spare supplier & address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Swing Check Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-ZUT-DST-MM-0008-008	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Swing Check Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	Refer to P&ID	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHECK VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Type	-	Swing check valve		
1.5	Description of anti-slam features	-	-		
1.6	External indication of position	Yes/No	-		
1.7	Length of side lever	mm	-		
1.8	Mass of lever	kg	-		
1.9	Size (DN)	mm	200		
1.10	Face to face dimension	mm	-		
1.11	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	19.4		
2.2	Pressure operating range	kPa	-		
2.3	Pressure rating (nominal)	bar	10		
2.4	Body Test pressure	bar	1.5 x PN rating		
2.5	Seat Test pressure	bar	-		
2.6	Minimum flow rate required to open fully	m³/h	-		
2.7	Installation volumetric operating range	m³/h	-		
2.8	Installation pressure operating range	bar	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body	-	Stainless steel		
3.2	Blade (or equivalent)	-	-		
3.3	Spring	-	-		
3.4	Fasteners	-	316 stainless steel		
3.5	Other components	-	-		
4	**GENERAL DETAILS**				
4.1	Internal corrosion protection	-	-		
4.2	Spares supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Water Temperature Control Datasheet**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0009**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0009
Discipline	Mechanical (MM)
Process Area/Unit	0009

	EQUIPMENT	DATASHEET NR
1	Heat Exchangers	1001757-2000-DST-MM-0009-001
2	Chillers	1001757-2000-DST-MM-0009-002
3	Manual Ball Valves	1001757-2000-DST-MM-0009-003
4	Balancing Valves	1001757-2000-DST-MM-0009-004

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Heat Exchangers**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0009-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Heat Exchangers	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	98-HX-001	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**HEAT EXCHANGER DETAILS**				
1.1	Manifacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Type	-	Plate and Frame		
1.5	Plate type	-	-		
1.6	Mass	kg	-		
1.7	Frame length	mm	-		
1.8	Plate area	m^2	-		
1.9	Plate thickness	mm	-		
1.10	No. of plates	No.	-		
1.11	Installation orientation	-	-		
1.12	Connection type	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Flow direction	-	Counter-current		
2.2	Duty	kW	-		
2.3	Design pressure	kPa	-		
2.4	Process water flow rate	m^3/h	2.464		
2.5	Pressure drop	kPa	100		
2.6	Process water inlet temperature	°C	26		
2.7	Process water outlet temperature	°C	16		
2.8	Cooling water supply flow rate	m^3/h	4.928		
2.9	Cooling water supply inlet temperature	°C	11		
2.10	Cooling water supply outlet temperature	°C	16		
2.11	Design temperature	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Plate material		316 stainless steel		
3.2	Frame material		316 stainless steel		
3.3	Gasket		-		
3.4	Pipe network		316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Chillers**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0009-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Chillers	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): 98-CT-001	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**CHILLER DETAILS**				
1.1	Manifacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Type	-	Air cooled water chiller		
1.5	Refrigerant type	-	-		
1.6	Number of Compressors	-	-		
1.7	Number of passes (Evaporator)	-	-		
1.8	Mass	kg	-		
1.11	Installation orientation	-	-		
1.12	Connection type	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	29		
2.2	Cooling efficiency	kW/kW	-		
2.3	Total absorbed power	kW	-		
2.4	Entering air temperature	°C	-		
2.5	Cooling water supply flow rate	m^3/h	4.928		
2.6	Process water inlet temperature	°C	16		
2.7	Process water outlet temperature	°C	11		
2.8	Design temperature	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Casing		ALU-ZINC		
3.4	Pipe network		316 Stainless Steel		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Manual Ball Valves**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0009-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Manual Ball Valves	D.M	S.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**BALL VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	-		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	L/s	0.70 - 1.4		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure (nominal)	bar	10		
2.4	Body test pressure	bar	1.5 x PN rating		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient $K = (hm)/(v^2/(2g))$	K	-		
2.7	Actuation torque	Nm	No actuation		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Stainless steel or similar		
3.2	Lever	-	Stainless steel		
3.3	Ball	-	Stainless steel or similar		
3.4	Seats	-	PTFE or similar		
3.5	Stem	-	Stainless steel or similar		
3.6	Type of interior lining (2-pack epoxy, FBE, etc.)	-	-		
3.7	Type of exterior coating (2-pack epoxy, FBE, etc.)	-	-		
3.8	Fasteners	-	316 stainless steel		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Balancing Valves**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0009-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Balancing Valves	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**BALANCING VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model/ Series classification	-	-		
1.4	Nominal size DN	mm	-		
1.5	Connection type	-	-		
1.6	Seat (soft/metal seated)	-	-		
1.7	Flanges (BS, SABS, ANSI, etc)	-	-		
1.8	Raised faced flanges	Yes/No	-		
1.9	Face to face distance	mm	-		
1.10	Hand wheel/lever operated	Yes/No	Yes		
1.11	Gearbox	Yes/No	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Rated flow rate	ℓ/s	0.34		
2.2	Reduces/fill bore	-	-		
2.3	Rated pressure	bar	10		
2.4	Body test pressure	bar	-		
2.5	Seat test pressure	bar	-		
2.6	Loss coefficient K = (hm)/(v^2/(2g))	K	-		
2.7	Actuation torque	Nm	No actuation		
2.8	Measuring accuracy	%	±5		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Body (Brass, SS, nickel-plated etc.)	-	Brass or similar		
3.2	Body sealing	-	EPDM or similar		
3.3	Plug	-	Brass or similar		
3.4	Seat seal	-	EPDM or similar		
3.5	Spindle	-	Brass or similar		
3.6	Spindle seal	-	EPDM or similar		
3.7	Spring	-	Stainless steel		
3.8	Hand wheel	-	Polyamide or similar		
3.9	Measuring points	-	Brass or similar		
4	**GENERAL DETAILS**				
4.1	Total weight of valve	kg	-		
4.2	Main dimensions of valve (L x W x H)	mm	-		
4.3	Spares supplier and address	-	-		
4.4	Corrosion protection of valve body	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure	
TITLE **Summary Sheet:** **Lifting Equipment Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0010**	REV. T0

Title:	Muldersvlei 300 ML and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0010
Zone	Mechanical (MM)
Process Area/Unit	0010

	EQUIPMENT	DATASHEET NR
1	Overhead Travelling Crane	1001757-2000-DST-MM-0010-001
2	Digital Hanging Scale	1001757-2000-DST-MM-0010-002
3	Service Water Pumps Fixed Gantry	1001757-2000-DST-MM-0010-003
4	Diesel Fire Water Pumps Fixed Gantry	1001757-2000-DST-MM-0010-004
5	Electric Fire Water Pumps Fixed Gantry	1001757-2000-DST-MM-0010-005
6	Pallet Jack	1001757-2000-DST-MM-0010-006

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure **1001757**
TITLE **Overhead Travelling Crane**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0010-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Overhead Travelling Crane	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 45-CR-001	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CRANE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Duty Service (HMI Classification)	-	H4		
1.4	Type of Crane (Single, Double Girder Overhead/Gantry Crane, etc.)	-	Single Girder Overhead		
1.5	Crane Configuration (Under/Top Running)	-	T/R		
1.6	Maximum Safe Working Load (SWL) - Main Hoist	ton	2		
1.7	Maximum Safe Working Load (SWL) - Auxiliary Hoist	ton	N/A		
1.8	Maximum Hook Traveling Path (main hoist)	m	~4.8		
1.9	Minimum Hook Traveling Path (main hoist)	m	N/A		
1.10	Maximum Hook Traveling Path (auxiliary hoist)	m	N/A		
1.11	Minimum Hook Traveling Path (auxiliary hoist)	m	N/A		
1.12	Control (pendant, radio control, cabin, etc.)	-	Pendant		
1.13	Crane fitted with load cell	Yes/No	Yes		
1.14	Percentage Load Cell Rating of Crane Capacity	%	125		
1.15	Long Travel Distance	m	~15		
1.16	Cross Travel Distance	m	~11.5		
1.17	Long/Cross Travel Limit Switches	Yes/No	Yes		
1.18	Driving and Braking Forces	kN	-		
1.19	Crane Traveling Inertial Forces (Min. and Max.)	kN	-		
1.20	Skewing Forces (factor of 1.1 incl.) Max. and Min.	kN	-		
1.21	Buffer Forces (Max.)	kN	-		
1.22	Holding Brake System in case of Power Failure	Yes/No	Yes		
2	**OPERATING SPEEDS**				
2.1	Dual speed motor	Yes/No	Yes		
2.2	Long Travel - Fast Speed	m/min	-		
2.3	Long Travel - Slow Speed	m/min	-		
2.4	Cross Travel - Fast Speed	m/min	-		
2.5	Cross Travel - Slow Speed	m/min	-		
2.6	Hoist - Slow	m/min	-		
2.7	Hoist - Fast	m/min	-		
2.8	Hoisting Motions Electronically "ramped"	Yes/No	Yes		

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		Muldersvlei 300 ML and Associated Infrastructure 1001757	
TITLE **Overhead Travelling Crane**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0010-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Overhead Travelling Crane	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): 45-CR-001	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
3	**CRANE POWER SUPPLY**				
3.1	Operating Voltage	V	400		
3.2	Control Voltage	V	230		
3.3	Frequency	Hz	50		
3.4	Max Power Rating of Motor	kW	1.8		
3.5	IP Rating of Motor	IP	65		
3.6	Runway Power Transfer System (DSL)	-	Conductor Bar DSL		
3.7	Number of Conductor Bars	No.	4 (L1, L2, L3 & Earth)		
3.8	Trolley/Crab Power Transfer System	-	Festoon Flat Cable		
4	**GENERAL DETAILS**				
4.1	Total weight of Crane	kg	-		
4.2	Trolley/Crab weight	kg	-		
4.3	Crane girders weight	kg	-		
4.4	End Trucks weight	kg	-		
4.5	Overall Dimensions of Crane (L x W x H)	m	-		
4.6	Atmospheric Operating Conditions (Min. Max. Temp's)	°C	-		
4.7	Test load of crane	%	125		
4.7	All Crane motions tested at rated capacity	Yes/No	Yes		
4.8	Access Platforms on Crane Bridge	Yes/No	Yes		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure 1001757	
TITLE **Digital Hanging Scale**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0010-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Digital Hanging Scale	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**SCALE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Model	-	-		
1.4	Width	mm	-		
1.5	Depth	mm	-		
1.6	Height	mm	-		
1.7	Net weight	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Capacity	kg	2000		
2.2	Readability	kg	0.5		
2.3	Ultimate overload limit	kg	30000		
2.4	Stablisation time	s	2		
2.5	Operating temperature range	°C	0 - 40		
2.6	Power supply	Hz	50		
2.7	Relative humidity	%	95		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Housing	-	Cast aluminium		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure 1001757	
TITLE **Service Water Pumps Fixed Gantry**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0010-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Service Water Pumps Fixed Gantry	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 74-CR-002	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CRANE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Duty Service (HMI Classification)	-	H1		
1.4	Type of Crane (Single, Double Girder Overhead/Gantry Crane, etc.)	-	Single girder fixed gantry crane		
1.5	Crane Configuration (Under/Top Running)	-	T/R		
1.6	Safe Working Load (SWL)	ton	1.0		
1.8	Maximum Hook Traveling Path	m	~4.5		
1.9	Gantry beam length	m	~10.7		
1.12	Control (pendant, radio control, cabin, etc.)	-	Pendant		
1.13	Crane fitted with load cell	Yes/No	Yes		
1.14	Percentage Load Cell Rating of Crane Capacity	%	125		
1.18	Driving and Braking Forces	kN	-		
1.19	Crane Traveling Inertial Forces (Min. and Max.)	kN	-		
1.20	Skewing Forces (factor of 1.1 incl.) Max. and Min.	kN	-		
1.21	Buffer Forces (Max.)	kN	-		
1.22	Holding Brake System in case of Power Failure	Yes/No	Yes		
2	**OPERATING SPEEDS**				
2.1	Dual speed motor	Yes/No	Yes		
2.2	Long Travel - Fast Speed	m/min	-		
2.3	Long Travel - Slow Speed	m/min	-		
2.4	Hoist - Slow	m/min	-		
2.5	Hoist - Fast	m/min	-		
2.6	Hoisting Motions Electronically "ramped"	Yes/No	Yes		

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		Muldersvlei 300 ML and Associated Infrastructure **1001757**
TITLE **Service Water Pumps Fixed Gantry**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0010-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Service Water Pumps Fixed Gantry	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 74-CR-002	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
3	**CRANE POWER SUPPLY**				
3.1	Operating Voltage	V	415		
3.2	Control Voltage	V	24		
3.3	Frequency	Hz	50		
3.4	Max Power Rating of Motor	kW	1.8		
3.5	IP Rating of Motor	IP	65		
3.6	Trolley/Crab Power Transfer System	-	Festoon Flat Cable		
4	**GENERAL DETAILS**				
4.1	Total weight of Crane	kg	-		
4.2	Trolley/Crab weight	kg	-		
4.3	Crane girders weight	kg	-		
4.4	End Trucks weight	kg	-		
4.5	Overall Dimensions of Crane (L x W x H)	m	-		
4.6	Atmospheric Operating Conditions (Min. Max. Temp's)	°C	-		
4.7	All Crane motions tested at rated capacity	%	125		
4.8	Access Platforms on Crane Bridge	Yes/No	No		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure **1001757**
TITLE **Diesel Fire Water Pumps Fixed Gantry**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0010-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Diesel Fire Water Pumps Fixed Gantry	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 74-CR-002	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CRANE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Duty Service (HMI Classification)	-	H1		
1.4	Type of Crane (Single, Double Girder Overhead/Gantry Crane, etc.)	-	Single girder fixed gantry crane		
1.5	Crane Configuration (Under/Top Running)	-	T/R		
1.6	Safe Working Load (SWL)	ton	2.0		
1.8	Maximum Hook Traveling Path	m	~4.5		
1.9	Gantry beam length	m	~10.7		
1.12	Control (pendant, radio control, cabin, etc.)	-	Pendant		
1.13	Crane fitted with load cell	Yes/No	Yes		
1.14	Percentage Load Cell Rating of Crane Capacity	%	125		
1.18	Driving and Braking Forces	kN	-		
1.19	Crane Traveling Inertial Forces (Min. and Max.)	kN	-		
1.20	Skewing Forces (factor of 1.1 incl.) Max. and Min.	kN	-		
1.21	Buffer Forces (Max.)	kN	-		
1.22	Holding Brake System in case of Power Failure	Yes/No	Yes		
2	**OPERATING SPEEDS**				
2.1	Long Travel - Fast Speed	m/min	-		
2.2	Long Travel - Slow Speed	m/min	-		
2.5	Hoist - Slow	m/min	-		
2.6	Hoist - Fast	m/min	-		
2.7	Hoisting Motions Electronically "ramped"	Yes/No	Yes		
3	**CRANE POWER SUPPLY**				
3.1	Operating Voltage	V	415		
3.2	Control Voltage	V	24		
3.3	Frequency	Hz	50		
3.4	Max Power Rating of Motor	kW	1.8		
3.5	IP Rating of Motor	IP	65		
3.6	Trolley/Crab Power Transfer System	-	Festoon Flat Cable		
4	**GENERAL DETAILS**				
4.1	Total weight of Crane	kg	-		
4.2	Trolley/Crab weight	kg	-		
4.3	Crane girders weight	kg	-		
4.4	End Trucks weight	kg	-		
4.5	Overall Dimensions of Crane (L x W x H)	m	-		
4.6	Atmospheric Operating Conditions (Min. Max. Temp's)	°C	-		
4.7	All Crane motions tested at rated capacity	%	125		
4.8	Access Platforms on Crane Bridge	Yes/No	No		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure **1001757**
TITLE **Electric Fire Water Pumps Fixed Gantry**	CLIENT Nº. 194C-BW-WP037	PAGE
	ZUTARI Nº. 1001757-2000-DST-MM-0010-005	REV. T0

TI; TYPE OF ISSUE: A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Electric Fire Water Pumps Fixed Gantry	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): 74-CR-003	**Quantity:** Refer to specification

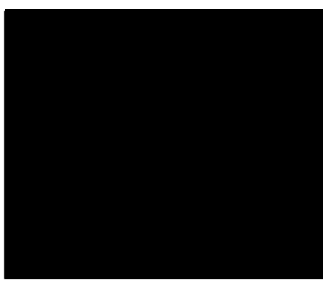
Item	Description	Unit	Specified	Proposed	
1	**CRANE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Duty Service (HMI Classification)	-	H1		
1.4	Type of Crane (Single, Double Girder Overhead/Gantry Crane, etc.)	-	Single girder fixed gantry crane		
1.5	Crane Configuration (Under/Top Running)	-	T/R		
1.6	Safe Working Load (SWL)	ton	2.0		
1.8	Maximum Hook Traveling Path	m	~4.5		
1.9	Gantry beam length	m	~10.7		
1.12	Control (pendant, radio control, cabin, etc.)	-	Pendant		
1.13	Crane fitted with load cell	Yes/No	Yes		
1.14	Percentage Load Cell Rating of Crane Capacity	%	125		
1.18	Driving and Braking Forces	kN	-		
1.19	Crane Traveling Inertial Forces (Min. and Max.)	kN	-		
1.20	Skewing Forces (factor of 1.1 incl.) Max. and Min.	kN	-		
1.21	Buffer Forces (Max.)	kN	-		
1.22	Holding Brake System in case of Power Failure	Yes/No	Yes		
2	**OPERATING SPEEDS**				
2.1	Long Travel - Fast Speed	m/min	-		
2.2	Long Travel - Slow Speed	m/min	-		
2.5	Hoist - Slow	m/min	-		
2.6	Hoist - Fast	m/min	-		
2.7	Hoisting Motions Electronically "ramped"	Yes/No	Yes		
3	**CRANE POWER SUPPLY**				
3.1	Operating Voltage	V	415		
3.2	Control Voltage	V	24		
3.3	Frequency	Hz	50		
3.4	Max Power Rating of Motor	kW	1.8		
3.5	IP Rating of Motor	IP	65		
3.6	Trolley/Crab Power Transfer System	-	Festoon Flat Cable		
4	**GENERAL DETAILS**				
4.1	Total weight of Crane	kg	-		
4.2	Trolley/Crab weight	kg	-		
4.3	Crane girders weight	kg	-		
4.4	End Trucks weight	kg	-		
4.5	Overall Dimensions of Crane (L x W x H)	m	-		
4.6	Atmospheric Operating Conditions (Min. Max. Temp's)	°C	-		
4.7	All Crane motions tested at rated capacity	%	125		
4.8	Access Platforms on Crane Bridge	Yes/No	No		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML and Associated Infrastructure **1001757**
TITLE **Pallet Jack**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0010-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Pallet Jack	D.M	B.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG): N/A	**Quantity:** Refer to specification

Item	Description	Unit	Specified		Proposed
1	**SCALE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of Origin	-	-		
1.3	Model	-	-		
1.4	Width	mm	-		
1.5	Height	mm	-		
1.6	Net weight	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Load capacity	kg	3000		
2.2	Lowered height	mm	-		
2.3	Raised fork height	mm	-		
2.4	Individual fork width	mm	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Pallet	-	-		
4	**GENERAL DETAILS**				
4.1	Spares supplier and address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Miscellaneous Equipment Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0011**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0011
Discipline	Mechanical (MM)
Process Area/Unit	0011

	EQUIPMENT	DATASHEET NR
1	Submersible Sump Pumps	1001757-2000-DST-MM-0011-001
2	Leakage Water Return Pumps	1001757-2000-DST-MM-0011-002

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Submersible Sump Pumps**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0011-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Submersible Sump Pumps	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	84-PMP-001/84-PMP-002	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**SUMP PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type (centrifugal, rotary, etc.)	-	Centrifugal		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Impeller diameter	mm	-		
1.1.8	Bearings used	-	-		
1.1.9	Method of lubrication for the bearings	-	-		
1.1.10	Mass	kg	-		
1.1.10	Float-switch included	Yes/No	Yes		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Flow rate at duty point	m^3/h	10		
1.2.2	Delivery head at duty point	kPa	50		
1.2.3	Shut-off head	kPa	-		
1.2.4	Efficiency at duty point	%	-		
1.2.5	Power required at duty point	kW	0.2		
1.2.6	Best efficiency point	%	-		
1.2.7	Flow rate at best efficiency point	m^3/h	-		
1.2.8	Delivery head at best efficiency point	kPa	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Impeller	-	-		
1.3.2	Casing	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Protective coating	-	-		
1.4.2	Spares address	-	-		

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Submersible Sump Pumps**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0011-001**	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Submersible Sump Pumps	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	84-PMP-001/84-PMP-002	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Type of frame	-	-		
2.1.5	Type of bearings	-	-		
2.1.6	Installed power	kW	0.37		
2.1.7	Class of insulation	-	-		
2.1.8	Enclosure IP rating	-	IP68		
2.1.9	Power supply	pH/V/Hz	-		
2.1.10	Mass	kg	-		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Splash protection	-	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Leakage Water Return Pumps**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0011-002**	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Leakage Water Return Pumps	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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Supplier:		Proposal:	
Identification (TAG):	84-PMP-003/84-PMP-004	Quantity:	Refer to specification

Item	Description	Unit	Specified	Proposed	
1.1	**SUMP PUMP DETAILS**				
1.1.1	Manufacturer	-	-		
1.1.2	Country of manufacture	-	-		
1.1.3	Model	-	-		
1.1.4	Pump type (centrifugal, rotary, etc.)	-	Centrifugal		
1.1.5	Inlet diameter (DN)	mm	-		
1.1.6	Outlet diameter (DN)	mm	-		
1.1.7	Impeller diameter	mm	-		
1.1.8	Bearings used	-	-		
1.1.9	Method of lubrication for the bearings	-	-		
1.1.10	Mass	kg	-		
1.1.10	Float-switch included	Yes/No	Yes		
1.2	**PUMP CHARACTERISTICS AND PERFORMANCE**				
1.2.1	Flow rate at duty point	m^3/h	15		
1.2.2	Delivery head at duty point	kPa	300		
1.2.3	Shut-off head	kPa	-		
1.2.4	Efficiency at duty point	%	-		
1.2.5	Power required at duty point	kW	2.2		
1.2.6	Best efficiency point	%	-		
1.2.7	Flow rate at best efficiency point	m^3/h	-		
1.2.8	Delivery head at best efficiency point	kPa	-		
1.3	**MATERIAL OF CONSTRUCTION**				
1.3.1	Impeller	-	-		
1.3.2	Casing	-	-		
1.4	**GENERAL DETAILS**				
1.4.1	Protective coating	-	-		
1.4.2	Spares address	-	-		

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Leakage Water Return Pumps**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0011-002	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Leakage Water Return Pumps	B.M	D.M	T.R	L.K	28/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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Supplier:		**Proposal:**	
Identification (TAG):	84-PMP-003/84-PMP-004	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
2.1	**MOTOR DETAILS**				
2.1.1	Manufacturer	-	-		
2.1.2	Country of manufacture	-	-		
2.1.3	Type of motor	-	-		
2.1.4	Type of frame	-	-		
2.1.5	Type of bearings	-	-		
2.1.6	Installed power	kW	3		
2.1.7	Class of insulation	-	-		
2.1.8	Enclosure IP rating	-	IP68		
2.1.9	Power supply	pH/V/Hz	-		
2.1.10	Mass	kg	-		
2.2	**MOTOR CHARACTERISTICS AND PERFORMANCE**				
2.2.1	Speed of rotation	rpm	-		
2.2.2	Splash protection	-	-		
2.3	**GENERAL DETAILS**				
2.3.1	Spares address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Sodium Hypo Generation Building HVAC Datasheet**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0012**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0012
Discipline	Mechanical (MM)
Process Area/Unit	0012

	EQUIPMENT	DATASHEET NR
1	Fresh Air Fan (FAF01)	1001757-2000-DST-MM-0012-001
2	Fresh Air Fan (FAF02)	1001757-2000-DST-MM-0012-002
3	Fresh Air Fan (FAF03)	1001757-2000-DST-MM-0012-003
4	Midwall Split Air Conditioning Unit	1001757-2000-DST-MM-0012-004
5	Hideaway Split Air Conditioning Unit	1001757-2000-DST-MM-0012-005
6	Air Extraction Fan (EAF01)	1001757-2000-DST-MM-0012-006
7	Air Extraction Fan (EAF02 to EAF04)	1001757-2000-DST-MM-0012-007
8	Air Extraction Fan (EAF05)	1001757-2000-DST-MM-0012-008
9	Louvres	1001757-2000-DST-MM-0012-009
10	Supply Grille	1001757-2000-DST-MM-0012-0010
11	Supply Grille (Corrosion Free)	1001757-2000-DST-MM-0012-0011
12	Extract Grille	1001757-2000-DST-MM-0012-0012
13	Extract Grille (Corrosion Free)	1001757-2000-DST-MM-0012-0013
14	Disc Valve	1001757-2000-DST-MM-0012-0014

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Fresh Air Fan (FAF01)**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0012-001**	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Fresh Air Fan (FAF01)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	FAF01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	160		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Silent Inline		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	50		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1440		
2.6	Nominal volatge	V	230		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Fresh Air Fan (FAF02)**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0012-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Fresh Air Fan (FAF02)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		Proposal:	
Identification (TAG):	FAF02	Quantity:	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	315		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Axial		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	645		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1500		
2.6	Nominal volatge	V	400		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Fresh Air Fan (FAF03)**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0012-002	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Fresh Air Fan (FAF03)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	FAF03	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	560		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Axial		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	3200		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating (Corrosion Resistant)	-	55		
2.5	Maximum nominal speed	rpm	1500		
2.6	Nominal volatge	V	400		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Midwall Split Air Conditioning Unit**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0012-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Midwall Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	AC04 and OAC04	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Split unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of split unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	3.5		
2.2	Heating capacity	kW	-		
2.3	Power input	A	7		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
2.7	Split unit phases	-	1		
2.8	Condenser phases	-	1		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Hideaway Split Air Conditioning Unit**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0012-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Hideaway Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	AC01 to AC03 and OAC01 to OAC03	**Quantity:**	3

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Split unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of split unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	22		
2.2	Heating capacity	kW	-		
2.3	Power input	A	15		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
2.7	Split unit phases	-	3		
2.8	Condenser phases	-	3		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Air Extraction Fan (EAF01)**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0012-006	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Air Extraction Fan (EAF01)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	EAF01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	160		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Silent In-line		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	50		
2.3	Estimated system pressure	Pa	150		
2.4	IP Rating	-	55		
2.5	Maximum nolmal speed	rpm	1440		
2.6	Nominal volatge	V	230		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4..2	Description of pulsation reduction	-	-		
4.2	Details of anti-vibration feet	-	-		
4.3	Spares supplier & address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Air Extraction Fan (EAF02 to EAF04)**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0012-007**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Air Extraction Fan (EAF02 to EAF04)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	EAF02 to EAF04	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	400		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	500		
2.3	Estimated system pressure	Pa	50		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1440		
2.6	Nominal volatge	V	230		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4..2	Description of pulsation reduction	-	-		
4.2	Details of anti-vibration feet	-	-		
4.3	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Air Extraction Fan (EAF05)**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0012-008	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Air Extraction Fan (EAF05)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	EAF05	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	355		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Inline KD - Corrosion Free		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	423		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1440		
2.6	Nominal volatge	V	230		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4..2	Description of pulsation reduction	-	-		
4.2	Details of anti-vibration feet	-	-		
4.3	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Louvres**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0012-009**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Louvres	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	WL	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Weather louvres		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	L/h/m^2	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	Stainless steel		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Supply Grille**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0012-0010**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Supply Grille	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	SAG01 & SAG02	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Supply Grille		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	L/h/m^2	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	Aluminium		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Supply Grille (Corrosion Free)**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0012-0011**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Supply Grille (Corrosion Free)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	SAG03	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Supply Grille (Corrosion Free)		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	L/h/m^2	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	Stainless steel		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Extract Grille**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0012-0012**	REV. **T0**

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Extract Grille	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Extract Grille		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	$L/h/m^2$	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

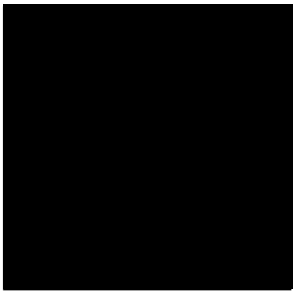
Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Extract Grille (Corrosion Free)**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0012-0013	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Extract Grille (Corrosion Free)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	EAG01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Extract Grille (Corrosion Free)		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	L/h/m^2	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	Stainless steel		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Disc Valve**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0012-0014	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Disc Valve	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	DV01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LOUVRE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Type	-	Disc Valve		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Face velocity	m/s	-		
2.2	Volume flow rate requirement	L/s	-		
2.3	Maximum allowable water penetration	$L/h/m^2$	-		
2.4	Total penetration area	m^2	-		
2.5	Water effectiveness class	-	-		
2.6	Discharge/entry loss coefficient	-	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Louvres	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Admin Building HVAC Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0013**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0013
Discipline	Mechanical (MM)
Process Area/Unit	0013

	EQUIPMENT	DATASHEET NR
1	Fresh Air Fan (Mixed Flow)	1001757-2000-DST-MM-0013-001
2	1.5kW Hideaway Split Air Conditioning Unit	1001757-2000-DST-MM-0013-002
3	3.6kW Hideaway Split Air Conditioning Unit	1001757-2000-DST-MM-0013-003
4	4.5kW Hideaway Split Air Conditioning Unit	1001757-2000-DST-MM-0013-004
5	9.0kW Hideaway Split Air Conditioning Unit	1001757-2000-DST-MM-0013-005
6	2.2kW Midwall Split Air Conditioning Unit	1001757-2000-DST-MM-0013-006
7	2.8kW Midwall Split Air Conditioning Unit	1001757-2000-DST-MM-0013-007
8	Extract Air Fan (Mixed Flow)	1001757-2000-DST-MM-0013-008
9	Ø200 Disc Valves	1001757-2000-DST-MM-0013-009
10	400x300 Door Grilles	1001757-2000-DST-MM-0013-0010

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Fresh Air Fan (Mixed Flow)**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0013-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Fresh Air Fan (Mixed Flow)	O.G.	D.B.	D.B.	D.B.	25/10/2024

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Supplier:		**Proposal:**	
Identification (TAG):	FAF01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	500		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	320		
2.3	Estimated system pressure	Pa	400		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm			
2.6	Nominal volatge	V	400		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	Bluechem Anti-Corrosion		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **1.5kW Hideaway Split Air Conditioning Unit**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0013-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	1.5kW Hideaway Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	AC08 and OAC08	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Split unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of split unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	1.5		
2.2	Heating capacity	kW			
2.3	Power input	A	5		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C			
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **3.6kW Hideaway Split Air Conditioning Unit**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0013-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	3.6kW Hideaway Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG): AC02 to AC05 and OAC02 to OAC05	**Quantity:** 4

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Spilt unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of spilt unit	kg	-		
1.9	Mass of condenser	kg	-		
2 2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	3.6		
2.2	Heatling capacity	kW	-		
2.3	Power input	A	7		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **4.5kW Hideaway Split Air Conditioning Unit**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0013-004**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	4.5kW Hideaway Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	AC01 and OAC01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Spilt unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of spilt unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	4.5		
2.2	Heatling capacity	kW	-		
2.3	Power input	A	8		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **9.0kW Hideaway Split Air Conditioning Unit**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0013-005**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	9.0kW Hideaway Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

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Supplier:		**Proposal:**	
Identification (TAG):	AC09 and OAC09	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Split unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of split unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	9.0		
2.2	Heating capacity	kW	-		
2.3	Power input	A	16		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Split unit	-	-		
3.2	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **2.2kW Midwall Split Air Conditioning Unit**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0013-006**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	2.2kW Midwall Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

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Supplier:		**Proposal:**	
Identification (TAG):	AC07 and OAC07	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Spilt unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of spilt unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	2.2		
2.2	Heating capacity	kW	-		
2.3	Power input	A	4		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Drip tray	-	Stainless Steel		
3.2	Split unit	-	-		
3.3	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **2.8kW Midwall Split Air Conditioning Unit**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0013-007	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	2.8kW Midwall Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

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Supplier:		**Proposal:**	
Identification (TAG):	AC06 and OAC06	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Spilt unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of spilt unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	2.2		
2.2	Heating capacity	kW	-		
2.3	Power input	A	4		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Drip tray	-	Stainless Steel		
3.2	Split unit	-	-		
3.3	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti-Corrosion		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Extract Air Fan (Mixed Flow)**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0013-008	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Extract Air Fan (Mixed Flow)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:		**Proposal:**	
Identification (TAG):	EAF01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Nominal diameter	mm	500		
1.6	Inlet diameter	mm	-		
1.7	Outlet diameter	mm	-		
1.8	Enclosure size (L x W x H)	mm	-		
1.9	Insulation thickness	mm	-		
1.10	Type of flow	-	Mixed		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	840		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating	-	55		
2.5	Maximum nolmal speed	rpm	1500		
2.6	Nominal volatge	V	400		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	Bluechem Anti-Corrosion		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Ø200 Disc Valves**		CLIENT N°. **194C-BW-WP037**	PAGE
		ZUTARI N°. **1001757-2000-DST-MM-0013-009**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Ø200 Disc Valves	O.G.	D.B.	D.B.	D.B.	25/10/2024

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	EDV200	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**DISC VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Type	-	-		
1.5	Size (DN)	mm	-		
1.6	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Flowrate of air	L/s	60		
2.2	Pressure drop	Pa	-		
2.3	Throw distance	mm	-		
2.4	Colour	-	RAL9016/RAL9010		
2.5	Sound level	dB (A)	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Mounting ring	-			
3.2	Central disc	-			
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **400x300 Door Grilles**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0013-0010**	REV. T0

TI: TYPE OF ISSUE A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	400x300 Door Grilles	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):	DG01	**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**DISC VALVE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Type	-	-		
1.5	Size (WxH)	mm x mm	400 x 300		
1.6	Mass	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Flowrate of air	L/s	Varies		
2.2	Pressure drop	Pa	-		
2.3	Throw distance	mm	-		
2.4	Colour	-	RAL9016/RAL9010		
2.5	Sound level	dB (A)	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Mounting ring	-			
3.2	Central disc	-			
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Guardhouse HVAC Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0014**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0014
Discipline	Mechanical (MM)
Process Area/Unit	0014

	EQUIPMENT	DATASHEET NR
1	Midwall Split Air Conditioning Unit	1001757-2000-DST-MM-0014-001
2	Wall Mounted Extract Air Fan (EAF01)	1001757-2000-DST-MM-0014-002
3	Wall Mounted Extract Air Fan (EAF02)	1001757-2000-DST-MM-0014-003
4	Fresh Air Fan (Silent In-line Type)	1001757-2000-DST-MM-0014-004

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Midwall Split Air Conditioning Unit**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0014-001**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Midwall Split Air Conditioning Unit	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**AIR CONDITIONING UNIT DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Piping length	m	-		
1.5	Piping height	m	-		
1.6	Split unit dimensions (WxHxD)	mm	-		
1.7	Condenser dimensions (WxHxD)	mm	-		
1.8	Mass of split unit	kg	-		
1.9	Mass of condenser	kg	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Cooling capacity	kW	3.5		
2.2	Heating capacity	kW	4.0		
2.3	Power input	A	6.0		
2.4	Refrigerant type	-	R401A		
2.5	Heating temperature range	°C	-		
2.6	Cooling temperature range	°C	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Drip tray	-	-		
3.2	Split unit	-	-		
3.3	Condenser	-	-		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Bluechem Anti Corrosion		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Wall Mounted Extract Air Fan (EAF01)**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0014-002	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Wall Mounted Extract Air Fan (EAF01)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Inlet diameter	mm	-		
1.6	Outlet diameter	mm	-		
1.7	Enclosure size (L x W x H)	mm	-		
1.8	Insulation thickness	mm	-		
1.9	Nominal diameter	mm	150		
1.10	Type of flow	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	40		
2.3	Estimated system pressure	Pa	50		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1500		
2.6	Nominal volatge	V	240		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	Bluechem Anti Corrosion		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Wall Mounted Extract Air Fan (EAF02)**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0014-003**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Wall Mounted Extract Air Fan (EAF02)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Inlet diameter	mm	-		
1.6	Outlet diameter	mm	-		
1.7	Enclosure size (L x W x H)	mm	-		
1.8	Insulation thickness	mm	-		
1.9	Nominal diameter	mm	150		
1.10	Type of flow	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	55		
2.3	Estimated system pressure	Pa	50		
2.4	IP Rating	-	55		
2.5	Maximum nolmal speed	rpm	1500		
2.6	Nominal volatge	V	240		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	Bluechem Anti Corrosion		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Fresh Air Fan (Silent In-line Type)**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0014-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Fresh Air Fan (Silent In-line Type)	O.G.	D.B.	D.B.	D.B.	25/10/2024

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	Proposal:
Identification (TAG):	Quantity: Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**FAN DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Inlet diameter	mm	-		
1.6	Outlet diameter	mm	-		
1.7	Enclosure size (L x W x H)	mm	-		
1.8	Insulation thickness	mm	-		
1.9	Nominal diameter	mm	250		
1.10	Type of flow	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design air flowrate	L/s	-		
2.2	Flow rate at duty point	L/s	130		
2.3	Estimated system pressure	Pa	250		
2.4	IP Rating	-	55		
2.5	Maximum noimal speed	rpm	1500		
2.6	Nominal volatge	V	240		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Fan	-	-		
3.2	Casing	-	-		
3.3	Rotors	-	-		
3.4	Bearings	-	-		
3.5	Insulation material	-	-		
4	**GENERAL DETAILS**				
4.1	Description of corrosion protection	-	-		
4.2	Description of pulsation reduction	-	-		
4.3	Details of anti-vibration feet	-	-		
4.4	Spares supplier & address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure	
TITLE **Summary Sheet:** **Sundries Datasheet**		CLIENT Nº. **194C-BW-WP037**	PAGE
		ZUTARI Nº. **1001757-2000-DST-MM-0015**	REV. T0

Title:	Muldersvlei 300 ML Reservoir and Associated Infrastructure
Client:	City of Cape Town
Project No:	1001757
Client ref. No.:	194C-BW-WP037
Zutari ref. No.:	1001757-2000-DST-MM-0015

Discipline	Mechanical (MM)
Process Area/Unit	0015

	EQUIPMENT	DATASHEET NR
1	Stepladder	1001757-2000-DST-MM-0015-001
2	Laboratory Hot Plate	1001757-2000-DST-MM-0015-002
3	Handheld Residual Chlorine Analyser	1001757-2000-DST-MM-0015-003
4	Handheld pH Analyser	1001757-2000-DST-MM-0015-004
5	Conductivity Analyser	1001757-2000-DST-MM-0015-005
6	Safety Shower and Eye Bath	1001757-2000-DST-MM-0015-006

Explanatory Notes

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Stepladder**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0015-001	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Stepladder	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**LADDER DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Mass	kg	-		
1.5	Type	-	-		
1.6	Reach height	m	4		
1.7	Static loading	kg	150		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Design temperature	°C	-		
2.2	Design pressure	kPa	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Ladder frame	-	-		
3.2	Ladder feet	-	PVC		
4	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Laboratory Hot Plate**	CLIENT N°. **194C-BW-WP037**	PAGE
	ZUTARI N°. **1001757-2000-DST-MM-0015-002**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Laboratory Hot Plate	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**HOT PLATE DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Heating temperature range	°C	-		
2.2	Temperature display accuracy	°C	±1		
2.3	Safety temperature	°C	-		
2.4	Permissible ambient relative humidity	%	-		
2.5	Maximum rotation speed of magnetic stirrer	rpm	-		
3	**MATERIAL OF CONSTRUCTION**				
3.1	Top plate	-	Ceramic		
4	**GENERAL DETAILS**				
4.2	Spares supplier and address	-	-		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Handheld Residual Chlorine Analyser**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0015-003	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Handheld Residual Chlorine Analyser	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CHLORINE ANALYSER DETAILS**				
1.1	Manufacturer	-	HACH or approved equivalent		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Measuring range	mg/L of Cl_2	0 to 3.5		
2.2	Accuracy	mg/L of Cl_2	0.03		
2.3	Light source	-	LED @ 525 nm		
2.4	Light detector	-	Silicon photocell		
3	**GENERAL DETAILS**				
3.1	Spares supplier & address	Yes/No	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filling the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Handheld pH Analyser**		CLIENT Nº. 194C-BW-WP037	PAGE
		ZUTARI Nº. 1001757-2000-DST-MM-0015-004	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Handheld pH Analyser	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

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III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:		**Proposal:**	
Identification (TAG):		**Quantity:**	Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**pH ANALYSER DETAILS**				
1.1	Manufacturer	-	HACH or approved equivalent		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Measuring range	pH	-2 to 14		
2.2	Repeatability	%	0.1		
2.3	Response time (t90%) for step changes 1-40 ppb	s	0.5		
2.4	Temperature sensor type	PT100/PT 1000	-20 to 200		
2.5	Temperature range	°C	-20 to 200		
2.6	Number of analog outputs (4-20 mA)	No.	1		

Explanatory Notes

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02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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[redacted]

		Muldersvlei 300 ML Reservoir and Associated Infrastructure 1001757	
TITLE **Conductivity Analyser**		CLIENT N°. 194C-BW-WP037	PAGE
		ZUTARI N°. 1001757-2000-DST-MM-0015-005	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Conductivity Analyser	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**CONDUCTIVITY ANALYSER DETAILS**				
1.1	Manufacturer	-	HACH or approved equivalent		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
2	**CHARACTERISTICS AND PERFORMANCE**				
2.1	Conductivity measuring range	µS/cm	0.5-10000		
2.1	Resistivity measuring range	Ω.cm	0-50		
2.2	Repeatability	µS/cm or %	±1% or 0,002µS/cm		
2.3	Response time (t90%) for step changes 1-40 ppb	s	0.5		
2.5	Temperature range	°C	-20 to 200		
2.6	Number of analog outputs (4-20 mA)	No.	1		
3	**GENERAL DETAILS**				
3.1	Spares supplier & address	Yes/No	-		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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		Muldersvlei 300 ML Reservoir and Associated Infrastructure **1001757**
TITLE **Safety Shower and Eye Bath**	CLIENT Nº. **194C-BW-WP037**	PAGE
	ZUTARI Nº. **1001757-2000-DST-MM-0015-006**	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	Safety Shower and Eye Bath	B.M	D.M	T.R	L.K	29/11/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the left column of the "Proposed" field with one of the following options: "MR" (Meets Requirements) or "D" (Deviation).

II - Suppliers must list any items marked "D" and any other clarifications in the "Deviations List", of the Technical Requisition. To include information in addition to the contents of this datasheet, suppliers should proceed in the same manner.

III - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier:	**Proposal:**
Identification (TAG):	**Quantity:** Refer to specification

Item	Description	Unit	Specified	Proposed	
1	**SAEFTY SHOWER AND EYE BATH DETAILS**				
1.1	Manufacturer	-	-		
1.2	Country of manufacture	-	-		
1.3	Model	-	-		
1.4	Total height	-	-		
1.5	Total width	-	-		
1.6	Shower operation	-	Platform operated		
1.7	Eye bath operation	-	Lever operated		
1.8	Type	-	Double column		
2	**MATERIAL OF CONSTRUCTION**				
2.1	Safety shower units	-	Stainless steel 316		
3	**GENERAL DETAILS**				
4.1	Spare supplier and address	-	-		
4.2	Corrosion protection	-	Pickled & passivated		

Explanatory Notes

01 - Supplier shall refer to reference documents listed on the requisition to complete equipment specification.

02 - Supplier shall confirm and/or provide all equipment data while filing the proposed column.

REFERENCE DOCUMENTS

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3.7.8 ELECTRICAL SPECIFICATION

The electrical specifications consist of the following sections:

3.7.8.1 DETAILED ELECTRICAL SPECIFICATION
3.7.8.2 ELECTRICAL DESIGN SCEDULES
3.7.8.3 ELECTRICAL DATA SHEETS

3.7.8.1 DETAILED ELECTRICAL SPECIFICATIONS

The Detailed Electrical and Electronic Specification is included immediately hereafter, comprising 42 pages.

These specifications shall be read in conjunction with the relevant Particular Specifications and form an integral part of this contract.

In the event of any discrepancy between these specifications and a part of the Particular Specifications, the schedule of quantities, or the drawings, these specifications shall take precedence.

In certain clauses the Particular Specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the specifications. It also contains additional specifications required for this particular Contract.

Replace the term "Engineer" wherever it may occur in any of the specifications with "Employer's Agent".

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1. GENERAL

The electrical portion of the Works shall comply with the Standard Specifications in C3.7.5 but as varied by this Detailed Electrical Specification, the Data Sheets and Drawings.

References in the Standard Specifications to "Project Specification" shall be read as referring to this Detailed Electrical Specification.

The Works shall consist of the design, supply, and installation of all required electrical equipment at the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure.

For all major equipment provided, Cape Town based maintenance with basic spare holding shall be available.

1.1 NORMATIVE REFERENCES

The overarching normative references to which the Contractor shall comply are:

- All equipment supplied and installed shall comply with the requirements of the Occupational health and Safety Act, Act 85 of 1993, and the regulations promulgated thereunder.
- All electrical and electronic installations shall comply with the requirements as set out in SANS 10142, and the normative references listed therein.

Normative references which deal with specific sections and/or items within this Detailed Electrical Specification are included in the relevant subsections.

1.2 DESIGN SCHEDULES

The following schedules are included as C3.7.8.2 in this document and form part of this the Detailed Electrical Specification:

- Motor and Equipment Schedules
- Motor and Equipment Cable Schedules
- MCC and Field Control Table

These schedules may be affected by the actual mechanical equipment chosen by the Contractor. Tenderers shall price for any changes to the electrical design that are caused by their selection of mechanical equipment. Where anticipated cable lengths are given, these are done so in good faith to assist in cable sizing and cost estimation. Quantities in the BOQ are based on the tender design; final quantities shall be as measured on site after installation, based on the Contractor's design.

The schedules shall be finalised by the Contractor during the contract and shall be submitted for approval by the Engineer before procurement and manufacture.

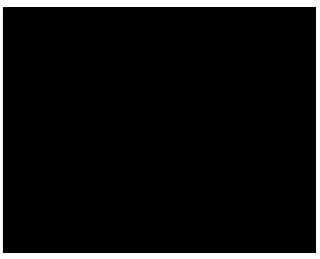
1.3 PLANT NUMBERING SYSTEM

The equipment tags used throughout the Tender documentation are indicative. The onus shall be on the Contractor to source the latest revision of the City of Cape Town Plant Numbering System Standard and generate equipment tags based thereon, for the approval of the Engineer, after the Contract is awarded.

1.4 DATA SHEETS

Data sheets for the electrical equipment included under this contract are included in C3.7.8.3, that shall be completed after the Contract is awarded. The data sheets form part

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of the Detailed Electrical and Electronic Specification and shall be read in conjunction with the specification.

1.5 DESIGN COORDINATION AND APPROVAL

The Contractor shall employ a certified Designer for all sections of this scope to review with the Engineer, the Employers, and on-site personnel to finalise all design requirements and ensure all industry regulations are adhered to.

The Contractor shall attend at least five (5) iterations of design coordination meetings with the Engineer, the Employers, and on-site personnel to finalise all design requirements and ensure all industry regulations are adhered to.

The Contractor shall also be responsible to liaise between the electronic and electrical subcontractors to ensure conduits and outlets are installed to all electronic equipment and socket outlets are installed for all electronic equipment requiring power.

All equipment lists and data sheets shall be neatly presented to the Engineer in an electronic format for approval. Samples of all equipment shall also be presented to the Engineer for approval before any equipment is ordered.

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2. ELECTRICAL SCOPE OF WORK

The electrical portion of this contract shall include the following:

a) Liaison with the supply authority (Eskom) and Employer's LV department to coordinate the installation of the LV supplies and on-site LV distribution network.
b) Design, supply, delivery, and installation of back-up generator.
c) Design, supply, delivery, and installation the following Motor Control Centres (MCCs):
    i. Disinfection MCC (MCC-DIS-01)
    ii. Fire pump panel (MCC-DIS-02)
d) Design, supply, delivery, and installation of LV Distribution Boards (DBs).
e) Design, supply, delivery, and installation of LV outdoor power kiosks.
f) Design, supply, delivery, and installation of actuated valves DB panels.
g) LV electrical motors.
h) Variable frequency converters (VFCs).
i) Design, supply, delivery, and installation of LV cables and cable support systems.
j) LV earthing.
k) Lightning protection for structures.
l) Building electrical installations for all buildings and structures, including area lighting.
m) Earthing and bonding of equipment.
n) Excavations and backfilling of trenches.
o) Factory testing, site testing and commissioning of the electrical installation.
p) Certificates(s) of compliance.
q) As-built drawings.
r) Operation and maintenance manuals.
s) Training.
t) Spares.

2.1 BATTERY LIMITS

2.1.1 ELECTRICAL SUPPLY BATTERY LIMIT

The Works will have three power supply points that will be done by the supply authority, as discussed in Section 3.1 of this specification. The battery limit of this contract with respect to the electricity supplies shall be the termination of the relevant LV supply cable at the LV side of each of these supply points.

2.1.2 INTERFACES WITH CIVIL WORKS

It shall be the Contractor's responsibility to liaise internally in the contracting party to ensure all civil requirements (including but not limited to plinths, box-outs, core drills, ducts, chasing, road crossings) resulting from electrical equipment installation requirements, are communicated in time to the Engineer for approval of the route and structural impact and handed in time to the civil contractor responsible.

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3. ELECTRICITY SUPPLY

3.1 SUPPLY ARRANGEMENT: RESERVOIR SITE

The supply authority (Eskom) will supply an on-site 500 kVA connection point from the nearby 11 kV overhead line. This connection will supply the transformer on which the Contractor shall terminate the supply cable to the Disinfection MCC, as per the power distribution block diagram.

The Point of Common Coupling (PCC) shall be taken as the termination of the supply authority's cable on the Eskom-supplied LV metering point.

The relevant preliminary electrical parameters at the PCC are as follows:

a) PCC design capacity: 500 kVA

b) The supply electrical characteristics are as follows:

- Nominal voltage: 400 V
- Frequency: 50 Hz
- Phase rotation: RWB
- Maximum three-phase fault level at 400 V busbars: 15 kA.
- Supply neutral earthing: TN-S

3.2 SUPPLY ARRANGEMENT: OUTLET VALVE CHAMBER

The supply authority (Eskom) will supply an on-site 25 kVA connection point from the nearby 11 kV overhead line. This connection will supply the transformer on which the Contractor shall terminate the supply cable to the outlet valve chamber DB, as per the power distribution block diagram.

The Point of Common Coupling (PCC) shall be taken as the termination of the supply authority's cable on the transformer.

The relevant preliminary electrical parameters at the PCC are as follows:

a) PCC design capacity: 25 kVA

b) The supply electrical characteristics are as follows:

- Nominal voltage: 400 V
- Frequency: 50 Hz
- Phase rotation: RWB
- Maximum three-phase fault level at 400 V busbars: 2.5 kA.
- Supply neutral earthing: TN-S

3.3 SUPPLY ARRANGEMENT: ACCESS ROAD GATE

The supply authority (Eskom) will supply an on-site 16 kVA connection point from the nearby 11 kV overhead line. This connection will supply the transformer on which the Contractor shall terminate the supply cable to the access road gate DB, as per the power distribution block diagram.

The Point of Common Coupling (PCC) shall be taken as the termination of the supply authority's cable on the transformer.

The relevant preliminary electrical parameters at the PCC are as follows:

a) PCC design capacity: 16 kVA

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b) The supply electrical characteristics are as follows:

- Nominal voltage: 230 V
- Frequency: 50 Hz
- Maximum three-phase fault level at 400 V busbars: 2.5 kA.
- Supply neutral earthing: TN-S

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4. DIESEL GENERATORS

4.1 NORMATIVE REFERENCES

The work under this clause shall comply with:

- City of Cape Town Standard Specifications for Electrical Works, clause 30
- City of Cape Town Standard Specification for Design: Build of Mechanical Equipment, clause D42
- Data Sheet DS-EE-0050: Diesel Powered Generator Sets

All installations shall comply with the latest edition of SANS 8528 and NRS-098.

4.2 GENERAL REQUIREMENTS

The Contractor shall be responsible for the design, supply, and install of the following diesel-powered generators.

Table 1: Generators

GENERATOR TAG	GENERATOR NAME	LOCATION	BACKUP SUPPLY FOR
GEN-DIS	Disinfection Backup Generator	Outside On-site Electro Chlorination building	Full operation of site when mains power is unavailable

The diesel-powered generator set (genset) shall operate automatically during a mains power failure.

Engine-driven electricity generating set (genset) installations shall include an engine-driven alternator, shaft coupling, engine and alternator cooling system, starting system, double baseplate and anti-vibration mounting system exhaust system, fuel tank, electrical control panel, dummy load where required and ISO container.

The power rating shall be determined by the Contractor, and Tenderers are responsible for offering a generator which is adequately rated to provide the required performance. The generator shall be designed and sized sufficiently to allow all the required loads to start up and run continuously. The net power output rating of the engine at 1500 rpm with all driven accessories as installed and for continuous operation shall be at least 15 % greater than the full generator input power required. Detailed calculations of the power rating shall be submitted for the Engineer's approval prior to procurement.

General arrangement drawings of the design and which indicate cable entry and exit routes shall be provided by the Contractor.

Two circuit breakers in the Incoming/Genset Changeover section of the Generator changeover panel in the container shall provide automatic changeover of power during a power outage should the generator be used for backup power after the supply authority has amended site supply. Mains supply circuit breakers shall remain in the closed position until the generator has reached full speed. At full speed the mains supply circuit breakers shall open, and the generator supply circuit breaker shall close. The genset shall include for a generator rundown period.

The Contractor shall make allowance for completion of the Employer's application for the connection of a standby supply, required for all new generator installations.

The Contractor shall make all arrangements for the Engineer to inspect the unit in the workshop and the Contractor shall also ensure that the control functions and load testing shall be conducted during this inspection.

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The engine cooling and ventilation system shall cater for all air needs such as combustion air, ventilation air and the cooling air requirements for the engine cooling system. Air for combustion, engine cooling and ambient cooling shall be drawn from an area free of the heated discharge(s) and the combustion emission.

If the engine is of the water-cooled type, the engine coolant shall be treated with the engine manufacturer's recommended anti-corrosive, water soluble coolant.

A two-stage cyclonic dry type air cleaner shall be fitted and shall have water and dust evacuators. The air cleaner shall be amply rated for the application. There shall be no flow restrictions and the complete air induction system shall have the approval of the engine manufacturer.

The Contractor shall make arrangements for the Engineer to inspect the equipment, after installation, for compliance prior to payment being made.

4.3 EXHAUST

All piping for the exhaust system shall be of grade 304 stainless steel. The silencers and all pipe support brackets shall also be of stainless steel.

A flexible connection of the stainless steel bellows type shall be installed as close to each manifold as possible to limit vibration transfer and to allow expansion under heating.

The exhaust system inside the container, including the silencers, shall be thermally insulated with a preformed mineral wool inner layer which is clad with stainless steel or aluminium sheeting.

The generator's outlet exhaust shall be extended to the outside of the container and be weather protected by means of a 45-degree sloped and downwards facing end. The outlet shall terminate at least three meters above the ground.

The engine shall be provided with a reactive silencer and with an absorptive silencer. Engines smaller than 100 kW may be provided with a combined reactive/absorptive silencer.

4.4 DUCTING

The Contractor shall provide stainless steel ducting for the radiator. The ducting shall exit the container and shall be weather-proof to prevent rain from entering the radiator.

4.5 LOUVRES

The Contractor shall provide the air supply and discharge openings with double acoustic louvres or acoustic attenuators (herein after referred to as louvres).

The Contractor shall provide documentary proof to the Engineer to demonstrate that the louvres have been correctly sized before they are installed.

The louvres shall be of hot dip galvanized steel and painted to suit the container colour scheme. The outlet louvre shall have normally closed weather flaps to prevent airflow into the room when the genset is not in operation. The louvres for the generator inlet air shall include filters to prevent dust and sand particulates from entering the container.

The louvres shall be protected by hot dip galvanized burglar proofing which is formed from square bar no smaller than 12mm x 12mm and which is attached by stainless steel through bolts secured on the inside wall of the container.

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4.6 DIESEL TANK

The fuel tank shall comply generally with City of Cape Town's General Electrical Specification, Section 30.11.

The fuel tank shall be provided in accordance with SANS 10131 (2004): Above-ground Storage Tanks for Petroleum Products.

The complete installation shall comply with all safety and fire regulations.

The Contractor shall provide a new fuel tank with a capacity to run the engine for at least 24 hours at continuous full power. The fuel tank shall be installed inside the container.

The Contractor shall provide new lockable-type refuelling caps for the tank. The Contractor shall provide an RFID tag reader for CCT eFuel system. A data sheet for the tag reader shall be submitted to the Engineer for approval prior to procurement.

The Contractor shall provide the tank with a 4 micron rated (insect screen) breather with a flow rate equal to the refuelling pump. The breather pipe shall comply further with SANS 10131(2004).

The tanks shall be fitted with an Ex-rated analogue fuel level transmitter linked with the respective controllers for real time fuel level indication. Adequate earthing of the tanks shall be provided. The Contractor shall loop the 4 – 20mA signal into the generator controller and into PLC or RTU via Ethernet.

The Contractor shall provide a hand pump with suction and discharge hoses to facilitate the transfer of diesel from drums and other portable storage devices. The hoses shall be provided with a wall docking facility as well as end closure in order to prevent damage and entry of dirt.

The Contractor shall specifically note that the aspects reflecting to design and manufacture, which are dealt with in detail in SANS 10131:2004, shall be strictly enforced.

A primary and secondary fuel filter of the replacement element type shall be provided. In addition, a water trap ("Otomatik" type or equivalent) shall be provided. All three shall be installed between the fuel tank and the injector pump.

Piping between the fuel tank and the engine shall be of stainless steel and a flexible section for absorbing vibration shall be fitted, at the engine, to meet the requirements and approval of the engine manufacturer.

The flow velocity in the suction piping shall not exceed 0.8 metres per second (based on 3 times the fuel consumption at the rated load). The tank suction connection shall be at least 50mm above the tank bottom.

A fuel return line from the engine shall be connected to the tank at the same level as the suction line and its diameter shall be the same as that of the suction line and they shall be separated by at least 300mm.

A fusible-link controlled, shut-off valve shall be mounted in the fuel supply line above the engine, and this shall close in the event of fire. A manual shut-off valve shall be installed upstream of this valve.

The Contractor shall note that the diesel tank shall be handed over full. An item has been included in the BOQ for the first fill of the tank after commissioning of the Works is complete.

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4.7 GENERATOR CONTROL PANEL

A generator control panel shall be provided in on the generator container for the control and monitoring of the generator.

The generator controller shall be of the type Deep Sea controller or approved equivalent and shall be configured to provide the following signals to the PLC or RTU via Ethernet (Modbus) connection:

a) real-time fuel reserve (in liters)
b) generator output voltage
c) generator current
d) generator loading (kVA)
e) generator frequency
f) generator load power factor
g) generator health status (oil, cooling water, etc.)
h) generator run hours.

All monitored items shall be displayed. Monitored and displayed items shall include the following:

i) generator output power (kW).
j) generator apparent power (kVA).
k) generator power factor.
l) generator voltage.
m) generator current.
n) engine coolant inlet temperature.
o) engine coolant outlet temperature.
p) engine oil pressure.
q) fuel tank level.

The following alarms shall cause a system trip:

r) high engine coolant temperature (if applicable).
s) engine coolant low flow (if applicable).
t) low engine oil pressure.
u) high ambient temperature in enclosure (if applicable).

The Contractor shall take note of the requirement for a dedicated cubicle for housing E-Fuel equipment to be provided with the generator control panel, as per the CCT Standard Specifications for Electrical Work clause 30.7.6.

4.8 ISO CONTAINER

The ISO container shall comply with the City of Cape Town's General Electrical Specification, Section 30.14: ISO Container Specification.

4.9 GENERATOR PLINTH

The Contractor shall be responsible to liaise within the contracting party to ensure that the generator plinth aligns with the offered generator set. The generator plinth design shall take the generator general arrangement drawings, inclusive of cable entry and exit routes, into consideration.

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The generator plinth design, including but not limited to, concrete, formwork, reinforcement etc., shall be in accordance with the requirements of SANS 1200 and its applicable amendments.

4.10 ACCEPTANCE TESTS

The tests which shall be carried out by the Contractor to certify that the equipment is operating in accordance with the performance requirements in this Specification shall include the following:

a) Fuel lines shall be tested for airtightness prior to filling.

b) A test shall be done to verify the guaranteed power output. The Contractor shall do preliminary tests and make adjustments as necessary. Once all adjustments have been carried out, the generating set shall operate for a period of not less than 15 minutes to permit conditions to settle down before proceeding with the acceptance test. The acceptance test shall be run for not less than 30 minutes at full specified continuous power output with electrical power output readings being taken every 5 minutes. The arithmetic average of these results will be taken as the official test result. All monitored parameters shall also be recorded.

c) Test that the genset is able to start the largest motor as specified.

d) Tests to show that each protection circuit is operational.

e) Pressure tests of all pipework.

f) Operation of all components of the system individually and as a system.

g) Where the genset is installed in an enclosure or room, the allowable temperature rise for plant room ambient temperature is 5 °C and this shall be confirmed during continuous operation for a period of at least two hours.

The Contractor shall make all arrangements and shall provide all equipment required to perform the above tests, including the provision of load resistor banks or equivalent.

4.11 TESTING REQUIREMENTS

Witnessed factory and site acceptance testing by 2 Engineers and 2 Employer's Personnel shall be carried out by the Contractor. Travel and accommodation costs for these persons shall be included in the tender pricing.

A factory acceptance test (FAT) document shall be provided to the Engineer prior to the witnessed FAT.

The factory acceptance test (FAT) and site acceptance test shall be done to prove performance as per the specifications. Load testing shall be done in increments of 25% up to 110% for a minimum of 30 minutes.

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5. LV SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

5.1 NORMATIVE REFERENCES

The LV assemblies (MCCs and PNL) shall comply with:

- City of Cape Town Standard Specifications for Electrical Works, clauses 7 to 12
- City of Cape Town Standard Specification for Design: Build of Mechanical Equipment, clause D45
- Datasheet DS-EE-0010a: LV Switchgear and Controlgear Assemblies - MCCs

5.2 MOTOR CONTROL CENTRES - SCOPE

The following motor control centres (MCCs) shall be provided under this contract. The panel and its location are shown in the table below, as well as the drawings relating to the MCC.

Table 04: MCCs

ASSEMBLY NAME	DESCRIPTION	LOCATION	GENERAL ARRANGEMENT AND SINGLE LINE DIAGRAM
MCC-DIS-01	Disinfection MCC	On-Site Electro-Chlorination Building MCC Room	1001757-2000-DRG-EE-2905 1001757-2000-DRG-EE-2906
MCC-DIS-02	Fire Pump Panel	Fire Pump Room	1001757-2000-DRG-EE-2906

5.3 MOTOR CONTROL CENTRES - GENERAL REQUIREMENTS

The MCCs shall power and control equipment associated with its designated process area, as shown on the drawings and in the appended design schedule.

The MCC shall consist of the following:

i. Metered main incomer section/(s).
ii. Functional units for the required incomer, pump motor starters, local control panels and other equipment feeders.
iii. Door mounted push buttons and indicators.
iv. Feeder(s) to building services distribution board (small power and lighting).
v. Feeder to control system power isolation transformer and UPS in PLC panel (instrument and PLC control power).
vi. Feeder to building ventilation equipment (where required).
vii. Terminal strip per functional unit for termination of all control wiring. All control inputs and outputs for motor controls shall be wired to the PLC. The power supply (main circuit breakers open/close, control voltage, etc.) shall also be wired to the PLC.
viii. Control and PLC section - This panel shall house the PLC, IO modules and UPS (discussed in section C3.7.9, Detail Electronic Specification).
ix. The MCC shall have an Ethernet device network to connect all intelligent motor starters and VFCs to the process control system as described in the Detailed Electronic Specification.

Further detail requirements for the MCCs are shown in the data sheets.

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DOL starters shall be equipped with intelligent motor management relays equal to the Schneider Electrical TesysT model, which includes the voltage unit to show kW consumption. All intelligent motor management relays shall interface with the Process Control System (PCS) through the Ethernet device network as described in the Detail Electronic specification.

The MCCs and Field Control Tables attached to this specification contain details of the starters, protection, push buttons, switches, indication etc. which shall be provided for each functional unit in the MCC.

Labels for the equipment on the MCCs shall have the following information:

a) Tag number
b) Description e.g. Compressor No.1
c) kW rating and
d) Full load current rating
e) Starter type

5.4 AIR-CONDITIONING OF MCC ROOMS

MCC room ventilation shall comply with Ventilation System and Corrosion Protection specifications listed in the Mechanical Detail Specification.

Inverter type air conditioning (AC) units shall be provided for the MCC room by means of wall- or under ceiling mounted split units. The Contractor shall ensure that his/her air conditioner selection takes into account all the heat loads in the MCC room including the heat losses of the electrical equipment.

Calculations shall be submitted to the Engineer as proof of the HVAC system's capability to compensate for the heat loads of the MCC and VFCs. Manufacturer's heat loss data of the chosen MCC equipment shall be used for sizing of the air conditioning units. The units shall not be rated less than 4kW. An allowance shall be made for the building structure heat load.

The nominal cooling capacity of the installed ventilation system shall be 150% of the anticipated cooling capacity required (i.e. 50% redundancy). A minimum of two AC units shall be used to achieve this cooling capacity.

The AC units shall maintain a room temperature of 24°C. The maximum ambient temperature shall be taken as 40°C.

5.5 LOCAL CONTROL PANELS

Each sodium hypochlorite generation (OSEC) skid shall come complete with a local control panel that shall contain all equipment required for motor starting and power distribution on the skid. These local control panels shall be fed from the main MCC and comply with all the requirements for LV switchgear as set out in this specification.

Refer to the Detailed Electronic Specification for control requirements related to the local control panels.

5.6 ACTUATOR DISTRIBUTION BOARDS (DBS)

400V LV actuator DBs shall be installed to feed power to the actuated valves as shown on the Reservoir P&IDs. Actuated valves in the same areas shall be grouped and supplied from the same DBs.

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Preliminary valve DBs are shown on the electrical drawings and design schedules. The Contractor shall refine this during detail design. All designs shall be submitted to the Engineer and approved before any manufacturing or procurement commences.

5.7 FIELD CONTROL STATIONS

Pedestal mounted Start/E-Stop field control stations shall be installed within arm's length of the installed motor/pump as far as possible.

Where pumps are installed inside a sump, the pedestal mounted field control station shall be installed next to the sump.

The Contractor shall ensure that the field control stations positions allow for easy access and do not hinder equipment maintenance.

The field control stations shall be equipped as indicated on the attached MCC and field control tables.

Field control stations shall not be required for chemical dosing pumps installed next to their respective chemical local control panels.

5.8 INSTALLATION

The MCC shall be installed in a dedicated MCC room, floor standing and over a trench. The indicative position of the MCC is shown on the cable route layout drawing.

The actuated valve DB panels shall be wall mounted as far as possible, or otherwise installed on pedestals.

Each MCC, local control panel and actuated panel shall be earthed to the relevant building earth bar, also located in the cable trench of the relevant MCC room.

5.9 TESTING REQUIREMENTS

Witnessed factory and site acceptance testing by 2 Engineers and 2 Employer's Personnel shall be carried out by the Contractor on all panels. Travel and accommodation costs for these persons shall be included in the tender pricing.

MCCs' factory acceptance test (FAT) documents shall be provided to the Engineer prior to the witnessed FAT at least two days prior to the FAT.

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6. LV CABLES AND CABLE SUPPORTS

6.1 NORMATIVE REFERENCES

The LV cables and supports shall comply with:

- City of Cape Town Standard Specifications for Electrical Works, clause 14, 17, 20.
- Datasheet DS-EE-0011: LV Cables
- Datasheet DS-EE-0012: Cable Supports

6.2 LV CABLES

Indicative cable routes are shown on the drawings. The Contractor shall design detailed cable routes in collaboration with the Engineer. Detailed cable routes shall be submitted for the Engineer's approval prior to installation.

The single line diagrams and motor and equipment cable schedules (C3.7.8.2) indicate LV cables based on the Engineer's design.

The actual cables shall be sized by the Contractor to power equipment offered by the Tenderer, with cable lengths measured following the Contractor's cable routes. The cables selected shall satisfy the constraints specified by the Engineer in the attached cable schedules and suite the method of installation.

LV multicore cables shall be copper conductor, PVC insulated cables with steel wire armouring.

All cables to be installed from VFCs to electrical motors shall be verified with the motor and VFC supplier. Special cables shall be used where required to compensate for the potential harmonics and impedance in the cable as directed by the VFC / motor supplier.

Where cables are installed in ground, concrete cable markers with engraved steel plating shall be used at every direction change or at every 30 meters. Danger tape shall be laid to cover all cables as per the cable trench detail drawing.

Cables installed on cable ladders/trays shall be neatly installed and secured in parallel with minimum cross over.

Indicative cable routes are shown on the cable route layout drawings.

6.3 LV CABLE SUPPORT SYSTEMS

The Contractor's cable route drawings shall detail cable support and cableway layouts which shall include layouts of cable ladders, cable trays, conduits, and ducts. It shall be the Contractor's responsibility to liaise internally in the contracting party to ensure all civil requirements (including but not limited to box-outs, core drills, ducts, chasing, road crossings) resulting from electrical cable or equipment installation requirements, are communicated in time to the Engineer for approval of the route and structural impact and handed in time to the civil contractor responsible.

Inside the buildings, LV cables shall be installed on surface mounted cable ladders mounted in cable trenches or along walls, as required by the Contractor's cable route. LV cables between buildings shall be installed in dedicated PVC sleeves or direct in ground. Indicative cable support systems are shown on the cable route drawings.

Electrical cables shall be installed on heavy or medium duty stainless steel 316 cable ladders or medium duty stainless steel wire mesh.

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All surface-mounted conduits shall be stainless steel complete with stainless steel saddles and end caps. Conduits that are installed in concrete or brickwork shall be PVC.

All incoming sleeves and openings into or at concrete structures and into buildings shall be thoroughly fire-proofed with fire foam and waterproofed with grout after the cable installation is complete, to limit water ingress into sleeves, buildings and building trenches.

All cables installed in building trenches shall be secured on cable ladders.

6.4 INSTALLATION

The general routes for the building and structures shall be as per the proposed cable route and containment layout drawings. The final routes of all cable support systems must be approved by the Engineer on site before installation commences.

Control and instrument cables may be run on the same cable tray/ladder as power cables, except where electromagnetic interference may affect the instrumentation signals. Control and Instrumentation cables shall be installed at least 300 mm away from power cables.

Cables shall enter and exit the MCC panels, local control panels and actuated DBs from the bottom of the panels.

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7. LV EARTHING, BONDING, AND LIGHTNING PROTECTION

7.1 NORMATIVE REFERENCES

The earthing and bonding shall comply with:

- City of Cape Town Standard Specification for Electrical Works, clause 13.

7.2 GENERAL REQUIREMENTS

All electrical equipment shall be earthed.

The MV / LV earthing diagram on the reservoir earthing drawing shows the earthing schemes.

The Disinfection Building shall be equipped with a main copper earthing bar located in the cable trench in the MCC room. Each assembly's earthing bar shall be connected to the building's main earthing bar.

All exposed conductive parts and accessible extraneous conductive parts shall be bonded in accordance with SANS 10142-1.

7.3 EARTH ELECTRODES

The Disinfection Building shall have a foundation earth electrode (70mm² Bare Copper Earth Conductor) installed. The earth electrode shall be brought out to a copper building electrode earth bar, which shall be installed in the cable trench in the MCC room. A 1500mm earth rod (16mm Diameter, copper plated, with 2000mm tail) shall be installed at each corner of the MCC room as deemed necessary by the lighting risk assessment results.

Each building earth electrode shall be complete with an earth testing pit for earth resistivity testing. The installed earth resistance shall be smaller than 1 Ohm.

All joints shall be CAD welded and witnessed by the Engineer. No earth electrodes shall be closed up in sand / backfill until the Engineer has witnessed the earthing installation.

The generator shall be provided with its own earth electrode.

7.4 EARTHING CONTINUITY CONDUCTORS

Earthing conductors shall be PVC-insulated copper conductors or bare earth copper conductor as indicated and sized in accordance with the single line diagram drawings.

7.5 EARTH CONTINUITY CONDUCTORS

Earth continuity conductors shall be provided with all LV power cables to electrical equipment and as shown on the single-line diagrams drawings.

Where no separate earth continuity conductor is shown on the single-line diagrams, the intention is that a spare core in the power cable shall serve this function.

Building services LV distribution boards shall be supplied from the nearest MCC or field DB.

7.6 LIGHTNING PROTECTION

The reservoir and disinfection facility are in an area with low lightning incidence. The preliminary lightning risk assessment showed no need for a dedicated lightning protection system, other than the earthing and surge protection specified elsewhere.

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The Contractor shall appoint a qualified entity to conduct a lightning risk assessment based on their detailed design and design a lightning protection system if so required. A provisional sum has been allowed for the lightning protection system.

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8. LV VARIABLE FREQUENCY CONVERTERS (VFC)

8.1 NORMATIVE REFERENCES

The LV variable frequency converters (VFCs) shall comply with:

- City of Cape Town Standard Specifications for Electrical Works, clause 9.3.
- Datasheet DS-EE-0023a: Variable Frequency Converters < 90 kW

8.2 GENERAL REQUIREMENTS

Variable Frequency Converters (VFCs) shall be provided as indicated on the single line diagrams and equipment list.

All VFCs shall be mounted in the MCC panels as per general arrangement drawings.

Note that the terms Variable Frequency Converter (VFC) and Variable Speed Drive (VSD) are used interchangeably in the Contract documentation.

8.3 PROCESS CONTROL INTERFACE

A password protected control panel shall be provided on the front of each VFC tier for setting up, monitoring and troubleshooting VFC operations. An alphanumeric LCD display shall provide plain text messages in English. A membrane keypad shall be provided for menu navigation, item selection and data entry. The VFC shall be supplied with an interface cable for programming.

The LCD display shall provide the following fault indication for the VFC as a minimum:

a) Overcurrent
b) Over-temperature
c) Loss of cooling air (where applicable)
d) Motor overload
e) Supply over/under voltage
f) Supply phase loss
g) Auxiliary power supply fault
h) Internal control system fault
i) Power circuit fault

In addition to the control panel, the following discrete controls and indicators shall be provided:

a) Pushbuttons for start, stop and reset operations
b) Selector switch for manual/auto operation
c) Potentiometer for speed adjustment
d) Indicator lights for running, stopped, VFC fault, E/Stop Activated, Over Temperature, Moisture Ingress, No Flow, and local operation indication
e) Display instruments for voltage, current, speed and run hours

Isolated digital inputs and outputs shall be provided for:

a) Monitoring and control of VFC starters
b) Protection signals from the converter transformer
c) Shutdown of the VFC by field-mounted emergency stop pushbuttons
d) Starting/stopping of the VFC via the local control pushbuttons

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Isolated analog (4-20 mA) inputs shall be provided for the following:

a) Local speed adjustment via the local speed reference potentiometer
b) Monitoring of the winding temperatures of the drive motor
c) Monitoring of the vibration of the drive motor

8.4 COOLING

Tenderers shall state the maximum heat losses and the cooling air requirements for the VFC when operating at the duty point. The MCC shall be equipped with fans for drawing air in through filtered louvers and discharging the air out the top of the panel.

8.5 CONTROL

The VFC shall provide control capability and monitoring feedback to a remote SCADA via the PLC and optical fibre network (or telemetry) and shall also be operable (controlled) locally at the pump station.

In addition, local control at the VFC shall be possible via a panel mounted keypad, conforming to the following requirements:

a) The keypad shall be detachable with at least a backlit 4-line, 20-character alphanumeric operating display for programming and control. The displayed messages shall be in user-friendly, descriptive text. Coded messages are not acceptable.
b) Parameter setting shall be possible using the keypad with user-friendly text messages. Password protection shall be provided to prevent unauthorized tampering with the set parameters.
c) It shall be possible to set the keypad to display (simultaneously or by continuous scrolling) any three of the following parameters or actual values, as selected by an engineer on site:
    i. Input Voltage
    ii. Input Frequency
    iii. Output Voltage
    iv. Output Frequency
    v. DC Bus Voltage
    vi. Output power
    vii. Output Torque
    viii. Output Current
    ix. Motor Speed
    x. Speed reference
    xi. Run / Stop / Fault
    xii. Remote / Local Control
d) At least the following drive functions shall be available from the keypad:
    i. Run
    ii. Stop
    iii. Accelerate
    iv. Decelerate
    v. Set Parameters
    vi. Scroll through and view actual values

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vii. Fault Analysis

e) An E-stop on the field control station shall be connected to the VFC to isolate power to the pump motor in case of emergency.

8.6 INSTALLATION, TESTING AND COMMISSIONING

The VFC shall be installed in the MCC inside the electro-chlorination building as shown on the drawings.

All the VFCs shall be subject to routine tests. In summary, each VFC shall be tested as follows:

a) Visual Inspection
b) Check of auxiliary devices
c) Insulation test
d) Check of protective devices
e) Light load and functional test
f) Measurement of output voltage
g) Measurement of input harmonic currents
h) Confirmation of output voltage adjustable range

The results of these tests shall be shown on certified test certificates for the VFC supplied.

In addition, type test certificates shall be supplied with the results of the following tests:

a) Rated output test
b) Overcurrent test
c) Temperature rise test
d) Power loss determination
e) Measurement of output voltage
f) Confirmation of output voltage adjustable range
g) Confirmation of output frequency adjustable range
h) Check of automatic control

The Contractor shall commission the VFC on site. The commissioning process shall include:

a) Verification of hardware installation and connection
b) Motor ID and protection settings
c) Programming of parameters to interface with PLC/RTU and remote SCADA

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9. LV ELECTRIC MOTORS

9.1 NORMATIVE REFERENCES

The LV motors shall comply with the following:

- City of Cape Town Standard Specification for Mechanical Works, clause D21
- Data Sheet DS-EE-0025a: LV Electrical Motors - Motors < 50kW

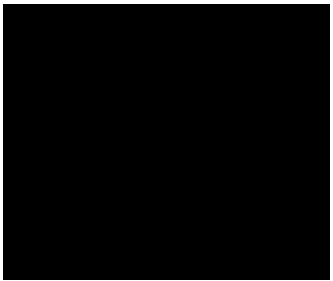
9.2 GENERAL REQUIREMENTS

The single line diagrams and the motor equipment schedules attached to the specifications indicate the Engineer's estimated ratings of motors and equipment. The actual rated power shall be selected by the Tenderer to suit the offered driven equipment.

9.3 PUMP / MOTOR PROTECTION

Each pump / motor set shall be supplied with the protection as shown on the process and instrumentation diagrams (P&IDs) and single line diagrams.

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10. LV ELECTRICAL ACTUATORS

10.1 NORMATIVE REFERENCES

The LV electrical actors shall comply with:

- City of Cape Town Standard Specification for Mechanical Works, clause D16
- Data Sheet DS-EE-0026: Electrical Actuators

10.2 GENERAL REQUIREMENTS

The single line diagrams, motor equipment schedules and P&IDs attached to the specifications indicate the electrical actuated valves that shall be fed from the MCCs, dosing local control panels, and actuated valves distribution boards.

All actuated valves shall be provided with built-in starter and control circuitry.

Field control shall be done at the actuators by means of on-board push buttons at the actuator control panel. The control unit shall be able to split off from the actuator section; the control unit shall be installed above water flood line where relevant in an easily accessible location to operators and maintenance personnel.

For the actuated valves associated with the reservoir, the control and feedback communication between the PLC and the actuator shall be by means of hardwired digital signals to the PLC.

For the actuated valves associated with the disinfection facility, the control and feedback communication between the PLC and the actuator shall be by means of IO-Link and Ethernet IP protocol to the PLC.

Only actuator manufacturers with a minimum of seven-year proven track record in the South African water and wastewater industry shall be accepted.

The offered actuator supplier shall have local support and maintenance team available within 1 hour's drive of the project site.

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11. ROOFTOP PHOTOVOLTAIC (PV) SYSTEM

11.1 NORMATIVE REFERENCES

The design and installation of the photovoltaic system shall comply with the latest edition of the following:

- SANS 10142:1 The wiring of premises Part 1: Low-voltage installations
- SANS (IEC) 60364-7-712 LV electrical installations: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems
- IEC 60364-6 LV Electrical installations: Ongoing verification
- IEC 62446 Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance

11.2 GENERAL REQUIREMENTS

The overall design requirement is to have on site renewable energy to cater for all electrical energy required by the building electrical load for the Administration Building on an annual basis. The intent is to offset all power requirements by building electrical load (i.e. the PV system + BESS shall not power the in the case of power utility failure).

The source of power will come from:

1. PV system + BESS (main source of power supply)
2. Eskom (backup in times where PV + BESS cannot meet the load demands) and
3. Generator (backup if Eskom fails)

The contractor shall appoint a specialist rooftop PV sub-contractor who is familiar with working in the CoCT as well as registered and accredited. The sub-contractor shall be responsible for the detailed design of the rooftop PV system based on these functional requirements and equipment offered.

The modelled design and all drawings shall be submitted to the Engineer for approval. These results shall specifically demonstrate how much of the building electrical load (excluding industrial / process loads) are anticipated to be offset by onsite renewable energy of the plant as a whole.

The single line diagram (as per drawing 1001757-2000-DRG-EE-2852) indicate where the PV generated power is to be tied in.

The Contractor shall be responsible for registering this PV generation plant with:

a) NERSA as a generator
b) Documentary proof of this shall be included in the O&M manuals.
c) Electrical design of the system must be completed and signed off by an accredited solar PV designer accredited with SAPVIA.

The design and equipment offered shall be compatible and integrate seamlessly with the rest of the plant electrical and electronic scope. All designs, product data sheets and drawings shall be submitted to the Engineer for approval prior to any work being undertaken.

The design and equipment shall be industry proven, robust and reliable incorporating protection systems as required, to ensure all equipment are considered safe and enable long-term operability for the given environment in which it is located.

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The Contractor, as part of the design, shall detail and outline site specific safety issues and additional safety hardware to be installed to ensure safe installation and ongoing maintenance.

11.3 DESIGN REQUIREMENTS

11.3.1 PV SYSTEM

The roof mounted PV system on the administration building shall effectively tie in and offset power locally at the building's DB panel (LV level). The generated power shall be consumed by the building electrical loads at LV. As the building electrical power consumption will be less than the peak power generated from the rooftop PV system, the rooftop PV and BESS system shall closely match the load profile demand, of the building being powered, to ensure all power generated will be utilised effectively.

In all cases, the PV system shall be connected to the relevant Main DB of the building where power is generated from.

The use of BESS has been included, to enable use of building services through load shedding or during night-time. The BESS system shall be designed for up to 10 hours coverage. Thus, it should be able to cover the buildings peak electrical load for up to 10 hours.

For each rooftop PV generated connection, this is effectively considered a grid-tied system. It will not however back feed at LV level, the power generated by the PV system for the admin building will be used by that building.

PV modules shall be installed on the dedicated roof areas as indicated on the rooftop PV layout drawing (as per drawing 1001757-2000-DRG-EE-2851).

11.3.2 PV MODULE LAYOUT

The Engineer's conservative estimated power to be generated is given in the table below (based on following assumptions):

- average energy yield of 1825 kWh / kWp annually for the Admin Building;
- roof space utilisation of 65% for the Admin Building
- Admin building module angle set at 20°;
- degradation of 0.5%/year;
- inverter efficiency of 97%.

Table 2: Estimated rooftop power per building

BUILDING	ESTIMATED ROOF SPACE	ROOF DETAIL	ESTIMATED POWER (AT AC)	ESTIMATED ANNUAL ENERGY YIELD (AT AC)
Administration building	300 m^2 (available space, not including HVAC units)	flat concrete roof, with upstand beams and crushed stone over	40 kVA	75941 kWh
		TOTAL	40 kVA	

The estimated kWp and annual kWh values in the table above shall be the minimum values allowed in the Contractor's design to ensure sufficient power is generated.

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The actual PV system design and equipment selection shall be selected by the Tenderer to offset all power requirements, taken into consideration the available roof space.

A solar resource study shall be conducted and used as inputs to the detail PV design. A report with results from this study shall be presented to the Engineer.

The PV module layout design shall meet the load requirements, while simultaneously ensuring ease of access for cleaning and maintenance of the PV installation. The following PV module layout design requirements shall be met:

- Available roof space shall not be utilised more than 80%
- Walkways for cleaning, maintenance, module removal, and wiring of minimum 800mm wide shall be allowed between blocks and around the edges of the roof space.
- Modules shall be grouped in blocks where with rows of 2 modules, or where rows have 3 modules, the block shall not be larger than 3 x 4 modules, to always allow easy maintenance / cleaning access to the centre modules.
- A 100mm wide expansion gap shall be allowed for every 10 modules.
- PV modules will be fixed. No tracking is required.

For the Admin building roof, the installation orientation and angle shall be selected to result in best solar yield, but the mounting structure shall be parallel to the main building lines.

The Contractor shall conduct the detail design of the PV system based on the specifications for the roof areas mentioned above.

11.3.3 PV MODULES

Only PV modules that have a Certificate of Compliance with SANS 61215 and SANS 61646 and the City of Cape Town shall be allowed. PV modules shall be certified to IEC 61701 and IEC 62716.

Only Tier 1 modules as per Bloomberg ranking with low losses associated with temperature coefficient should be used. Within Tier 1 modules, preference to be given to those modules that have a Positive Quality Rating. Equipment class should be class II or better.

Module mismatch shall not be allowed. All modules used on the project shall be the same size, rating and have the same cable lead size.

PV modules shall have an efficiency greater than 20 %.

The module frame material shall be anodised aluminium alloy with cable junction boxes rated to provide IP 67 protection. Modules shall be encapsulated in toughened glass. The glass material shall be low-iron, alkali free and lead-free glass, with an anti-reflective coating that does not generate titanium oxide or zinc oxide.

A minimum of three bypass diodes, integrated into the module junction box, shall be provided per module.

Modules shall have a minimum IP rating of IP65. Framing should be designed such that it does not hold water when mounted in any orientation or tilt angle.

PV modules shall be factory fitted with UV protected 4mm² module cables ('leads'), long enough to allow the modules to be interconnected electrically in series to form strings equipped with cables (minimum 1-meter length), as well as with minimum IP 65 pin type Multi-Contact ('MC') connectors (with a clear indication of polarity for the connections) suitable for module interconnection.

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PV modules shall be rated at minimum 1000 VDC system voltage and the operating temperature range shall be at least -20°C to 80°C. All components shall be UV resistant.

The maximum cell temperature co-efficient shall be -0.45%/°C.

Preference shall be given to modules with less degradation (light induced and annual degradation). The PV modules shall have a performance warranty of at least 90% output power at 10 years and at least 80% output power at 25 years. Any insurance guarantee underwriting the long-term performance warranty should be specified, such as third-party insurance arrangements.

The PV modules shall have a manufacturing warranty of 10 years from date of installation. Any insurance guarantee underwriting the long-term manufacturing warranty should be specified, such as third-party insurance arrangements.

11.3.4 DC SYSTEM

The use of collector / combiner boxes is required. Their material of construction shall be either Aluzinc or 3CR12 material, IP67 with only bottom entry.

The DC system shall be able to safely and locally isolate, de-energise, lockout and earth individual combiner boxes under load without de-energising other combiner boxes.

Each string shall have a plug and socket, and shall be protected by a suitable rated fuse on the DC positive circuit. Fuse ratings shall be between (ISC MOD STRING x 1.5) and (IMAX OCPR STRING = 15A). Fuses shall be type gPV to IEC 60269-6 and holders shall be finger safe. Separate in-line fuses shall be installed on negative DC phases.

All circuit breakers and switch disconnectors on the DC circuits shall be rated for DC duty, 'on-load' and be polarity insensitive.

A minimum of two (2) independent Maximum Power Point (MPP) inputs per inverter shall be provided. The maximum number of strings per MPP input shall be three (3).

DC string cables shall be insulated, sheathed, UV-stabilized, single-core multi-stranded flexible copper cables. Strings shall make use of specialist PV Cu TWIN cable, nominal voltage 0.6/1 kV, flame retardant, weather/UV and abrasive resistant, rated up to 90°C and compliant to EN 50618, (similar or equal to H1Z2Z2-K) wiring of minimum 4mm². String wiring diameter shall be selected to have a maximum voltage drop of 2% on the DC system.

DC cables and DC equipment shall be terminated with suitable rated and approved DC connecters. DC cable joints and terminations shall be fit for outdoor installation. All DC connectors shall be the same make and model as the connectors on the PV module leads.

All PV power plant cables shall be fully compliant with SANS 1507-3 and have excellent resistance to heat, cold, water, ozone, abrasion, corrosion and UV radiation.

Cabling shall be labelled in accordance with the site wide cable labelling standard and to match the as-built drawings.

All PV power plant DC cables shall be protected and managed by hot dipped galvanised cable racks, securely mounted to roof structures and walls. Enclosed cable trays/trunking shall be used on the roof.

All PV modules, cable / wire ways and mounting structures shall be properly earthed and bonded in accordance with SANS 10142-1. The Contractor shall present an integrated earthing system that ensures the PV system earthing tie into the building and plant earthing systems.

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The PV power plant shall be protected against earth faults, overload conditions, DC reverse polarity connection, and AC and DC over- and under-voltages.

11.3.5 SURGE PROTECTION

A Class 2 surge protection device shall be included on each DB bus. Where inverters have integral surge protection systems, these shall not replace the required external device on the DB bus.

11.3.6 BATTERY

All battery rooms shall be cooled via Air Conditioned (AC) units. The heat load of the battery bank shall be considered as part of the AC unit sizing by the Contractor.

Batteries can be either wall mounted or grounded in the Battery room, depending on the type of battery. The position and weight of the batteries shall also be shown in the roof and Battery room layout design submitted to the Engineer for approval.

The use of BESS has been included, to offset building power requirements during night-time. The BESS system shall be designed for up to 10 hours coverage, or 10-hour backup for capacity of inverter considered.

Batteries shall be Lithium Ion. All batteries shall be able to be integrated with the necessary Battery Management System (BMS) and control circuitry for protection and integration with any inverter. The BMS will communicate with the inverter and overall control system, linking back to the SCADA.

The battery shall have a minimum warranty of 10 years.

The weight of the batteries shall be such that it can be carried by 2 people.

11.3.7 INVERTER

The Contractor shall design a DC and inverter configuration, based on string inverters, to optimise the roof space layout and limit future maintenance costs. Not more than 6 strings shall be combined to each inverter.

Inverters shall conform to SANS 62109-1 and 62109-2 and shall be type tested. Only inverters approved by the City of Cape Town, as per the approved inverter list published at www.capetown.gov.za/SolarPV, and that are certified according to NRS 097-2-1 (with test certificates) shall be allowed. Only tier 1 inverters shall be accepted.

PV inverters outputs shall be connected to a dedicated PV distribution board. Inverter output shall be balanced, 3-phase, 400VAC, 50Hz. The maximum inverter input voltage rating shall be at least 1000VDC. Electronic / power equipment shall be rated for the highest expected fault current.

The minimum nominal output rating per converter shall be at least 25kW. Not more than two different size inverters shall be used on the project. Inverter output power control (throttling) shall be provided.

Module STC / max DC power shall not be oversized (DC) more than 110%.

A switch disconnector may be provided at DC side between the DC bus and the inverters if required.

A Maximum Power Point Tracking (MPPT) shall be provided at each inverter, or power optimiser units (if required) shall be installed on modules to ensure a fixed DC voltage is shown on the inverter input side, despite module mismatch due to shading / cloud cover, thermal mismatch, soiling, damage, etc. If optimisers are selected, these shall utilise

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communication system between the optimisers through the DC network and not require additional communication cabling.

Inverters shall provide the following internal protection:

- DC side disconnection
- Earth fault monitoring
- Grid monitoring
- Type II DC surge arrestors
- DC reverse polarity protection
- AC short-circuit protection
- RCD protection
- Anti-islanding protection

Inverter efficiency shall be greater than 97%, and be able to operate at ambient temperatures of between -10°C and +40°C. Inverter noise emissions shall be lower than 55dB(A).

Inverter enclosures shall provide IP65 protection. Inverter cooling shall be assisted by an internal fan.

All Inverter rooms shall be cooled via Air Conditioned (AC) units. The heat load of the inverters shall be considered as part of the AC unit sizing by the Contractor.

Inverters shall be wall mounted in the Inverter room. The position and weight of the inverters shall also be shown in the roof and Inverter room layout design submitted to the Engineer for approval.

Inverter outputs to be compatible with aluminium or copper AC cables.

Inverters with reactive power support at night function are preferred.

The weight of the inverters shall be such that it can be carried by 2 people.

The inverter communication network interface shall be by Ethernet to the local network switch. The site wide fibre optic cable ring network shall be utilised to communicate all data back to the historian and SCADA for display on the various workstations. A separate layer (set of fibre cores) shall be utilised for communication of renewable energy. Refer to the list of parameters in Section 6 of the Detailed Electronic Specification that should be available on the SCADA operating interface.

Inverters shall carry a minimum 10-year warranty from the date of installation. Warrantees shall not be voided if the inverter were to be overloaded. Any insurance guarantee underwriting the warranty should be specified, such as third-party insurance arrangements.

11.3.8 TIE IN AND DISTRIBUTION BOARD

11.3.8.1 General

The point of connection for the rooftop PV shall be at the relevant DB for that applicable building. Connection shall be made at 400VAC, 3-phase, from the electrical supply feeding the building as per drawing 1001757-2000-DRG-EE-2852.

Where there is more than one inverter per building, the LV AC outputs of all PV inverters (in a building) shall be connected to a single dedicated LV panel (titled the 'PV DB') via appropriate input protection devices, before tying into the relevant DB.

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Excess power not utilised by the LV system where it is tied in, shall not be exported. Reverse power blocking shall be installed.

Connection to the main LV DB will be by a single 3-pole motorised input breaker.

The harmonic contribution from the PV system shall be considered as part of the site wide power quality / harmonic study and harmonic filter design.

11.3.8.2 PV distribution board (DB)

Each PV DB shall comply with the LV switchgear requirements as specified elsewhere. For all circuits in the PV DB, the top of the breaker connection shall be to the grid-side, while the bottom of the breaker connection shall be to the inverter.

A wall mounted 4-pole rotary switch disconnector shall be provided at the output of each inverter, before connection to the PV DB.

A 4-pole input circuit breaker shall be installed for each inverter connection to the PV DB.

An earth leakage protection device shall be provided on the AC side (at each connection to the PV DB) in accordance with NRS 097-2-1 clause 4.2.5.2. The earth leakage unit itself shall comply with IEC 60947-2. The device shall be rated IEC 60755 Type 'A' as per NRS 097-2-1 clause 4.2.5.3. A minimum of 100 mA residual current rating shall be used to prevent unintentional triggering (or 'nuisance tripping').

The 4-pole circuit breaker and earth leakage protection device may be combined into a single residual current device with LV circuit breaker.

An advanced digital power meter (allowing also for harmonic content) shall be provided inside the DB where the PV system is connected.

Physical spare space shall be allowed in the DB for future expansion to allow at least one more inverter connected.

11.3.8.3 Utility power failures

PV inverter operation shall be inhibited during utility power failures (anti-islanding) and during standby generator operation. A zero-export and control module shall be provided and installed to prevent the export of excess PV energy into the LV grid.

Careful consideration shall be given to the integration of the diesel generator use which powers all the site during each power outage. The generator controller, generator main changeover system shall be integrated via PLC controller and hard wired interlocked inside the MCC.

11.3.9 METERING AND MONITORING

The metering and monitoring of the PV system are included in the Detailed Electronic Specification, Section C3.7.9.

11.3.10 ROOFTOP COMPONENTS

11.3.10.1 General

The Contractor shall be responsible for the design and installation of all the PV panel support frame, the complete mounting structure for all rooftop components of the PV system (which includes ancillaries such as connectors, fasteners, etc.), and the installation of all rooftop components of the PV system, including but not limited to the PV panels and layout thereof, cabling and cable routes, access on the roof (including a fall protection system), etc. The rooftop components of the PV system shall be selected and erected to withstand the expected external influences such as wind, temperature, UV and corrosion.

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The designed clearance between the PV panels and the roof structure should accommodate:

- sufficient access for cleaning, maintenance and inspections
- free air flow, to ensure cooling of the panels and quick drying of the roof sheeting beneath the PV panels
- adequate space for self-cleaning, ensuring no build-up of debris, entrapped moisture or other contaminants.

Unless otherwise indicated, the PV panel support frame and mounting structure (excluding fasteners which are specified elsewhere) shall be of aluminium and/or structural steel and shall adhere to all SANS 1200 H requirements, as well as SANS 1200 HC for corrosion protection.

The PV panel support frame and mounting structure shall have a design life of at least 30 years with a product warranty of minimum 10 years, and shall be designed to ensure that all rooftop components of the PV system are safe and adequately supported and fixed to the building/roof structure. The design shall include for high wind loads, determined according to SANS 10160-3:2019, for Terrain Category A and a mean return period of 50 years.

Before construction of a building that will be equipped with a PV system commences, the Contractor shall confirm to the Engineer, in writing (as part of the design submission), that the permanent access to the roof of that building as shown on the civil/structural drawings is sufficient for installation and long-term cleaning / maintenance of the rooftop components of the PV system.

PV components shall be positioned in such a way as to ensure ease of access for maintenance and repair of the PV module installation. All modules and wire ways must be safely accessible, with any one PV module accessed by the removal of only one other PV module.

No fittings, connections or parts of the PV panel support frame or mounting structure shall protrude over the side of the building for aesthetic reasons.

The Contractor shall include in his design a roof fall protection system (unless handrailing has already been included for on the civil/structural drawings) to ensure safe working at heights for cleaning and maintenance. The design life and minimum product warranty of the fall protection system shall match that of the PV panel mounting structure specified elsewhere. The system shall be compatible with the roof sheeting (where not a concrete roof) and shall be approved by the Engineer and the roof sheeting supplier and installer (for steel/aluminium roofs) or the torch-on supplier and installer (for concrete roofs). The Contractor shall have the fall protection system designed, installed, and certified by a specialist in the field.

LV/PV metal cable trays with adequate cable protection shall be used for cabling. The trays shall be fixed to the mounting structure and include additional supports where required. Unless otherwise indicated, cabling entering buildings shall be through the brickwork cladding rather than the concrete roof. In circumstances where roof entry/penetration is approved by the Engineer, it shall be through a special water- and fire-proof hatch designed for the roof structure and shall be located above the respective Electrical room to reduce length of wiring in the building. For roof entry, concrete upstands will be required around the penetration, and the engineer shall be given sufficient time to adjust the design. Cable fire stops shall be provided between floors in accordance with SANS 10400-T if/where applicable.

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The PV system shall not affect the durability or performance of the roof or waterproofing systems and shall ensure that the roof and waterproofing warrantees are unaffected by the installation thereof.

All designs (including wind load calculations), layouts and shop drawings of the rooftop components of the PV system shall be submitted to the Engineer for approval prior to commencing with procurement, manufacture, or installation. All materials, coatings, framework details, fittings, connections, fasteners, the fall protection system components, etc. to be utilised shall be clearly indicated in the submission. The Contractor shall also submit structural certification (completed SANS 10400-A Form 3 and Form 4) for the Competent Person appointed to design the PV panel support frame and mounting structure.

11.3.10.2 PV components on roof slabs

The Admin Building roof comprise of flat concrete roof slabs with perimeter upstand beams and internal concrete stub columns. The roof is overlaid with a screed-to-fall and torch-on waterproofing membrane and covered with a layer of crushed stone. Large HVAC units will be located in certain areas on the roof (see final HVAC sub-contractor's designs and layouts).

The Contractor shall design the structural steel and/or aluminium PV panel support frame and mounting structure, taking into consideration the high wind loads. The mounting structure shall be fixed to the top of concrete stub columns and upstand beams only, and shall by no means damage, pierce or compromise the waterproofing membrane. Fixing to the sides of the stub columns and upstand beams, or to the top of the concrete roof shall not be permitted. The contractor may include in the mounting structure design the use of ballast to provide additional support against wind uplift. The design submission shall include a ballast layout designed for the varying wind pressures across the roof area and careful consideration shall be given to the allowable additional dead loads (ADL) provided on the respective Civil/Structural drawings for each building. Note that the ADL provided on the drawings is the overall allowable ADL per square metre of roof area, including the self-weight of the stone layer, plinths, waterproofing membranes, etc.

All fasteners for fixing to a concrete substrate shall be SS316 chemical anchors (Sika Anchorfix-2+ or similar approved), with a minimum embedment depth of 150mm and minimum concrete edge distance of 140mm.

11.4 INSTALLATION

PV installers shall meet following minimum requirements:

- registered with SAPVIA and accredited with a PV Green Card
- a minimum 3-year track record with verifiable experience on <1MWp installations
- P4 performer on PQRS platform

Unless otherwise approved, all equipment shall be mounted square to building line walls; shall be levelled, plumbed and in alignment with similar equipment. The installation shall have a neat and orderly appearance on completion, to the satisfaction of the Engineer.

Any damage to the building and ancillaries caused by the Contractor shall be made good at the expense of the Contractor. If it is found necessary to alter the finished work through fault of the Contractor, then such work will be performed at the expense of the Contractor.

No cutting, chasing, drilling or excavation shall be performed by the Contractor without prior notice or approval by the Engineer regarding the type, location, method or timing of such works. Any cable cuttings or loose screws shall be removed from the roof spaces.

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Cabling should not lie in the pans or be situated as to create a barrier for washing off water, debris or contaminants.

No high / live VDC shall be on the system during installation. Power optimisers and DC cables shall be switched off when the inverter is off or not yet connected.

Warning signage shall be provided at the feed in switch panel to warn the user that there are multiple power sources.

The Contractor shall arrange for the Engineer's representative to witness the installation of the first block of PV modules and to inspect the PV panel support frame and mounting structure before installation continues further.

Throughout the installation, the Contractor shall arrange for the Engineer to inspect the depth and preparation of all anchor holes in concrete, prior to applying the chemical anchor product and installing the fastener.

All parts of the installation shall comply to the latest version of the South African OHS Act.

11.5 TESTING REQUIREMENTS

11.5.1 FACTORY

Factory site acceptance testing of main components (including panels and inverters), which shall be witnessed by the Employer (2 persons) and the Engineer (2 persons), shall be carried out by the Contractor. The Contractor's representative and OEM Commissioning Engineer shall also attend these tests. Travel and accommodation costs for all persons shall be included in the tender pricing.

Test results shall be documented and presented to the Engineer before the factory tests are witnessed. These results shall also be included in the final O&M manual.

11.5.2 SITE

A site testing and commissioning plan shall be submitted to the Engineer for approval before testing commences on site. This shall include at least the following:

- All FAT test results and proof of necessary authority registration/application for generation plants
- Sequence of events and programme (all tied into the large project timeframes)
- An emergency start and shut down procedure of the PV plant.
- A complete quality assurance document pack, including a PV Green Card.
- Method statement of how the plant will be tied into the grid

All site testing shall be carried out by the Contractor and shall be witnessed by the Employer and Engineer before energising. The OEM's Commissioning Engineer shall attend and certify site testing.

The Certificate of Compliance (CoC) for the relevant DBs / MCCs where the PV tie in, shall include certification of the PV installation.

Inspections for roof leaks shall be ongoing duration of the Defects Notification Period. Any leaks identified shall be attended to as soon as possible by the party responsible and at their own cost. If the Engineer requires that the cause of the leak to be searched for or additional testing be done for whatsoever reason, the cost thereof shall be for the responsible party's account.

The following shall be proven in conjunction with the SCADA tie in:

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- Confirmation of the software representation of system and system variables. This shall include comment and one round of iteration of the screen layouts, graphic layouts, reports and trends to ensure Employer satisfaction is achieved on visualisation.
- Confirmation that the tags, labelling and naming of each device corresponds to the tags, labels and names used on all software screens, manuals, record drawings, documentation, devices, etc. (software representation vs real-world presentation)
- Confirm proper and error free communication with devices
- Demonstrate and confirm the addresses and tags for all the data or control points on devices. Procedures shall be established to confirm beyond any doubt that the correct data point is read or controlled. This shall be done by creating or simulating a change in device data or fault condition and witnessing that same change is displayed and recorded on the SCADA.

11.6 TOOLS AND SPARES

A toolbox shall be provided and delivered to the Employer as directed by the Engineer. It shall contain all tools required to service and maintain the equipment. The following spare parts and safety equipment shall be supplied in the appropriate quantity:

- Inverters (1 off, for each size used)
- PV Modules (4 off)
- S-5 clamps (5 off)
- Power optimiser units (4 off)
- MPPT (2 off)
- DC wiring strings (5 off, of the longest length used on site)
- DC panel / wire connectors (5 off)
- Fuses (5 off, each size used)
- Surge protection device (2 off)
- Tool needed for installation of S-5 clamps
- Harness for roof access, fall arrest system (PPE) (3 off)

11.7 TRAINING

Employer to be fully trained by Contractor in operation and external maintenance of PV system, including but not limited to:

- Provide training manuals,
- Provide training on site,
- Provide training register, to be signed
- Operation and adjustment of system
- Cleaning and maintenance
- Fault identification and actions

Training to be complete before the Contractor leaves site on day of energization, unless otherwise agreed by Engineer.

11.8 O&M MANUALS

O&M manual shall contain:

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- Final versions of design documentation including material brochures, manuals, guides, etc.
- Final versions of testing and commissioning documentation including test plans, factory test data, etc.
- Signoffs by NSP, Engineer etc and training registers
- Snag lists and close-out reports
- Any other documentation generated in accordance with this specification and its references including traceability documentation.

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12. BUILDING ELECTRICAL SERVICES

The building electrical and electronic services portion of this contract shall include the design, supply, installation, testing and commissioning of the following:

a) 400V AC Distribution Boards (DBs).
b) Building lighting (interior and exterior).
c) Building power outlets and power skirting.
d) Switch disconnectors and power supply to building ventilation equipment.
e) Low Voltage (LV) cables, wiring and conduits.
f) 400V AC Street and area lighting kiosks.
g) Street and area lighting.
h) Cable support systems.
i) Earthing and bonding of equipment.
j) Excavations and backfilling of trenches.
k) Sleeves into building and underneath roads or pavements.
l) Labelling of all equipment.
m) Factory testing, site testing and commissioning of the electrical installation.
n) Certificates of Compliance.
o) As-built drawings.
p) Operation and maintenance manuals.
q) Training manuals and training.
r) Spares.

12.1 BATTERY LIMITS

12.1.1 INTERFACES WITH CIVIL WORKS

It shall be the Contractor's responsibility to liaise internally in the contracting party to ensure all civil requirements (including but not limited to plinths, box-outs, core drills, ducts, chasing, road crossings) resulting from electrical equipment installation requirements, are communicated in time to the Engineer for approval of the route and structural impact and handed in time to the Civil Contractor responsible.

12.2 DISTRIBUTION BOARDS AND KIOSKS

12.2.1 NORMATIVE REFERENCES

The small power and lighting distribution boards and street and area lighting kiosks shall comply with:

- City of Cape Town Standard Specification for Electrical Works
- Datasheet DS-EE-0010S: Distribution Boards and Kiosks

12.2.2 DISTRIBUTION BOARDS

Each building built under this contract shall have a dedicated low voltage flush mounted small power and lighting DB.

The small power and lighting DB for each building shall be supplied from the Disinfection MCC.

The following distribution boards (DBs) shall be provided. The DBs and their location are shown in the table below, as well as the drawings relating to each DB.

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humid environment inside the reservoir and have a minimum ingress protection rating of IP67.

The internal reservoir lighting shall be controlled by means of a switch located at the relevant outdoor kiosk. Cables shall be rated for submersion and installed in PVC conduit inside the reservoir. All glands shall be waterproof (IP68).

Luminaires (lights) shall be mounted on custom GRP poles, as shown on the drawings. Light poles shall be supplied complete with baseplate and anchors, gland plate, miniature circuit breakers, access door, stainless steel single side entry spigot and all other ancillaries required to complete installation.

The Contractor shall liaise within the contracting party to install sleeves as needed for entry into the reservoir.

Details of the luminaires to be installed are supplied in the technical datasheets.

Indicative lighting designs are shown on the drawings.

12.4 POWER OUTLETS AND SWITCH DISCONNECTORS

12.4.1 NORMATIVE REFERENCES

The power outlets and switch disconnectors shall comply with:

- City of Cape Town Standard Electrical Specification, clauses 15
- Datasheet DS-EE-0013: Small Power and Lighting

12.4.2 GENERAL REQUIREMENTS

All single phase switched socket outlets shall be installed flush mounted in walls or in double compartment power skirting in upper compartment and as indicated on drawings.

All telephone and data outlets shall be installed in double compartment power skirting in bottom compartment and as indicated on drawings.

All outdoor single phase switched socket outlets shall be installed in a weatherproof box with a sliding door cover to shut close.

Industrial three phase socket outlets shall be 32A 5-pin and surface mounted unless otherwise specified on drawings.

Swich disconnectors shall be flush mounted and installed within arm's reach of the equipment it isolates. Where this is not possible, lockable type switch disconnectors shall be installed and a sign shall be provided to inform which equipment the switch disconnector isolates.

All switch disconnectors and power outlets installed outdoors shall be IP65 rated.

IP65 corrosive resistant switch disconnectors and power outlets shall be installed in all corrosive areas or as indicated on the drawings.

12.5 CABLES AND WIRING FOR THE BUILDING SERVICES

12.5.1 NORMATIVE REFERENCES

The cables and wiring shall comply with:

- City of Cape Town Standard Electrical Specification, clause 7, 10, 15
- Datasheet DS-EE-0013: Small Power and Lighting

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12.5.2 GENERAL REQUIREMENTS

Conduits in brick walls or concrete shall be PVC.

Where the Contractor is required to carry out trenching, core drilling, chasing sleeves or conduits, the Contractor shall co-ordinate such activities with the relevant sub-contractors.

Power to the distribution boards and kiosks shall be by means of PVC insulated SWA Cu cables installed in suitably sized PVC sleeves in wall. The supply power to the DBs shall be bottom entry.

All wiring to the light fittings, light switches and single-phase power outlets shall be done with PVC insulated house wire through PVC conduits. No surface mounted conduits shall be allowed on walls.

Wiring sizes shall be as indicated on the single line diagrams.

All incoming sleeves and openings into or at concrete structures and into buildings shall be thoroughly sealed as per the Engineers specification after the cable installation is complete to limit ingress into sleeves and building trenches.

All surface mounted conduits used for the installation of LV cables shall be stainless steel, except when installation in concrete then PVC conduits shall be used.

As far as possible, no surface mounting shall be used by the Contractor for electrical and building services. The Contractor shall request from the Engineer approval to install surface conduiting for electrical and building services where they deem impossible or not practical to flush in walls or concrete.

Any conduit work at soffit level which does not conform to the above requirements shall be surface mounted and stainless-steel type.

Double compartment power skirting with cover shall be installed in the Administration building. The bottom compartment shall be used for data and telephone communication wiring and the top compartment shall be used for power cabling and wiring.

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3.7.8.2 ELECTRICAL DESIGN SCHEDULES

The Electrical Design Schedules are included immediately hereafter, comprising 18 pages.

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Rev	Item No	Plant Reference Number	Service Description	V	Ph	Required Mechanical Load (Absorbed)	Unit	Installed Equipment Rating	Unit	Efficiency class	Motor PF at Installed Load	Motor Eff at Installed Load	Motor Feeder Load Current	Duty Factor	Back-up Supply	Motor Load Estimate kVA	Full Load Current (FLC)	Full Load PF	Full Load Eff	Starter	Start-up Current (Ist / In)	Remarks
			GEN-PNL: GENERATOR CHANGEOVER PANEL																			
T0	1	GEN-PNL-Q01	Incomer 1	400	3	630	A	800	A					1		436.5	800.0			Incomer	1	
T0	2	GEN-PNL-Q02	Incomer 2 (Generator)	400	3	630	A	800	A					1		436.5	800.0			Incomer	1	
T0	3	MCC-DIS-01-Q51	Disinfection MCC	400	3	712	A	800	A				712.0	1	Generator	493.3	800.0			FDR	1	
			MCC-DIS-01: DISINFECTION MCC																			
T0	1	MCC-DIS-01-Q01	Incomer	400	3	712	A	800	A					1		493.3	800.0			Incomer	1	
T0	2	MCC-DIS-01-Q02	Control incomer	230	1	10	A	16	A				10.0	1	Generator	2.3	16.0			Incomer	1	
T0	3	74-PMP-001	Site Service Water Pump #1	400	3	4.4	kW	7.5	kW	IE3	0.80	90.8%	8.7	1	Generator	6.1	13.9	0.86	90.6%	VFC	1.2	
T0	4	74-PMP-002	Site Service Water Pump #2	400	3	4.4	kW	7.5	kW	IE3	0.80	90.8%	8.7	1	Generator	6.1	13.9	0.86	90.6%	VFC	1.2	
T0	5	74-PMP-003	Site Service Water Pump #3	400	3	4.4	kW	7.5	kW	IE3	0.80	90.8%	8.7	1	Generator	6.1	13.9	0.86	90.6%	VFC	1.2	
T0	6	74-PMP-004	Site Service Water Pump #4	400	3	4.4	kW	7.5	kW	IE3	0.80	90.8%	8.7	0	Generator	0.0	13.9	0.86	90.6%	VFC	1.2	
T0	7	98-CT-001	Chiller	400	3	12.08	kW	15	kW	IE1	0.76	89.7%	25.6	1	Generator	17.7	29.2	0.83	89.3%	DOL	6.8	
T0	8	45-CR-001	Overhead Travelling Crane	400	3	1.5	kW	2.2	kW	IE1	0.74	80.0%	3.7	1	Generator	2.5	4.8	0.82	80.0%	DOL	5.6	
T0	9	45-CR-002	Overhead Travelling Crane	400	3	1.5	kW	2.2	kW	IE1	0.74	80.0%	3.7	1	Generator	2.5	4.8	0.82	80.0%	DOL	5.6	
T0	10	45-CR-003	Overhead Travelling Crane	400	3	1.5	kW	2.2	kW	IE1	0.74	80.0%	3.7	1	Generator	2.5	4.8	0.82	80.0%	DOL	5.6	
T0	11	45-EC-001	OSEC Unit #1	400	3	44	kW	55	kW	IE1	0.82	93.2%	83.1	1	Generator	57.6	100.3	0.85	93.1%	FDR	1	
T0	12	45-EC-002	OSEC Unit #2	400	3	44	kW	55	kW	IE1	0.82	93.2%	83.1	1	Generator	57.6	100.3	0.85	93.1%	FDR	1	
T0	13	45-EC-003	OSEC Unit #3	400	3	44	kW	55	kW	IE1	0.82	93.2%	83.1	0	Generator	0.0	100.3	0.85	93.1%	FDR	1	
T0	14	45-EC-004	OSEC Unit #4	400	3	44	kW	55	kW	IE1	0.82	93.2%	83.1	0	Generator	0.0	100.3	0.85	93.1%	FDR	1	
T0	15	46-BL-001	Storage Tank Blower #1	400	3	0.25	kW	0.37	kW	IE1	0.64	62.0%	0.9	1	Generator	0.6	1.1	0.73	66.0%	DOL	3.6	
T0	16	46-BL-002	Storage Tank Blower #2	400	3	0.25	kW	0.37	kW	IE1	0.64	62.0%	0.9	0	Generator	0.0	1.1	0.73	66.0%	DOL	3.6	
T0	17	46-BL-003	Storage Tank Blower #3	400	3	0.25	kW	0.37	kW	IE1	0.64	62.0%	0.9	1	Generator	0.6	1.1	0.73	66.0%	DOL	3.6	
T0	18	46-BL-004	Storage Tank Blower #4	400	3	0.25	kW	0.37	kW	IE1	0.64	62.0%	0.9	0	Generator	0.0	1.1	0.73	66.0%	DOL	3.6	
T0	19	46-PMP-001	Sodium Hypochlorite Dosing Pump #1	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	1	Generator	0.2	1.0	0.7	77.3%	VFC	1.2	
T0	20	46-PMP-002	Sodium Hypochlorite Dosing Pump #2	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	1	Generator	0.2	1.0	0.7	77.3%	VFC	1.2	
T0	21	46-PMP-003	Sodium Hypochlorite Dosing Pump #3	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	0	Generator	0.0	1.0	0.7	77.3%	VFC	1.2	
T0	22	46-PMP-004	Sodium Hypochlorite Dosing Pump #4	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	1	Generator	0.2	1.0	0.7	77.3%	VFC	1.2	
T0	23	46-PMP-005	Sodium Hypochlorite Dosing Pump #5	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	1	Generator	0.2	1.0	0.7	77.3%	VFC	1.2	
T0	24	46-PMP-006	Sodium Hypochlorite Dosing Pump #6	400	3	0.1	kW	0.37	kW	IE3	0.62	75.0%	0.3	0	Generator	0.0	1.0	0.7	77.3%	VFC	1.2	
T0	25	46-PMP-007	Chemical Pump	400	3	0.4	kW	0.55	kW	IE3	0.74	79.0%	1.0	0	Generator	0.0	1.2	0.8	80.8%	DOL	6.6	
T0	26	47-PMP-001	Calcium Hypochlorite Dosing Pump #1	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	1	Generator	5.3	10.4	0.85	89.7%	VFC	1.2	
T0	27	47-PMP-002	Calcium Hypochlorite Dosing Pump #2	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	1	Generator	5.3	10.4	0.85	89.7%	VFC	1.2	
T0	28	47-PMP-003	Calcium Hypochlorite Dosing Pump #3	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	0	Generator	0.0	10.4	0.85	89.7%	VFC	1.2	
T0	29	47-PMP-004	Calcium Hypochlorite Dosing Pump #4	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	1	Generator	5.3	10.4	0.85	89.7%	VFC	1.2	
T0	30	47-PMP-005	Calcium Hypochlorite Dosing Pump #5	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	1	Generator	5.3	10.4	0.85	89.7%	VFC	1.2	
T0	31	47-PMP-006	Calcium Hypochlorite Dosing Pump #6	400	3	3.8	kW	5.5	kW	IE3	0.80	89.6%	7.7	0	Generator	0.0	10.4	0.85	89.7%	VFC	1.2	
T0	32	84-PMP-001	Leakage Water Return Pump 1	400	3	0.9	kW	1.1	kW	IE3	0.72	84.5%	2.1	0	Generator	0.0	2.3	0.8	84.5%	DOL	7.6	
T0	33	84-PMP-002	Leakage Water Return Pump 2	400	3	0.9	kW	1.1	kW	IE3	0.72	84.5%	2.1	1	Generator	1.5	2.3	0.8	84.5%	DOL	7.6	
T0	34	84-PMP-003	Reservoir Sump Pump 1	400	3	0.3	kW	0.37	kW	IE3	0.62	75.0%	0.9	1	Generator	0.6	1.0	0.7	77.3%	DOL	4.8	
T0	35	84-PMP-004	Reservoir Sump Pump 2	400	3	0.3	kW	0.37	kW	IE3	0.62	75.0%	0.9	0	Generator	0.0	1.0	0.7	77.3%	DOL	4.8	
T0	36	DB-OSEC	SP&L DB Feeder - OSEC Building	400	3	218	A	250	A				218.0	1	Generator	151.0	250.0			FDR	1	
T0	37	DB-ADM	SP&L DB Feeder - Admin Building	400	3	40	A	63	A				40.0	1	Generator	27.7	63.0			FDR	1	
T0	38	DB-FLD-01	Field DB 01 Feeder	400	3	40	A	63	A				40.0	1	Generator	27.7	63.0			FDR	1	
T0	39	DB-FLD-04	Field DB 04 Feeder	400	3	32	A	40	A				32.0	1	Generator	22.2	40.0			FDR	1	
T0	40	DB-FLD-06	Field DB 06 Feeder	400	3	40	A	63	A				40.0	1	Generator	27.7	63.0			FDR	1	
T0	41	-	Salt Tanks Internal Light	400	3	0.125	kW	0.125	kW		1.00	100.0%	0.2	1	Generator	0.1	0.2	0.85	100.0%	FDR	1	
T0	42	-	Salt Tanks Internal Light	400	3	0.125	kW	0.125	kW		1.00	100.0%	0.2	1	Generator	0.1	0.2	0.85	100.0%	FDR	1	
T0	43	MCC-DIS-02	Fire Pump Panel	400	3	72	A	100	A				72.0	1	Generator	49.9	100.0			FDR	1	

Total MCC load 712 A
Total Installed Current 832.619 A

Total Generator Load (Running) 492.9 kVA
Total MCC Load (Absorbed) 492.9 kVA

Rev	Item No	Plant Reference Number	Service Description	V	Ph	Required Mechanical Load (Absorbed)	Unit	Installed Equipment Rating	Unit	Efficiency class	Motor PF at Installed Load	Motor Eff at Installed Load	Motor Feeder Load Current	Duty Factor	Back-up Supply	Motor Load Estimate kVA	Full Load Current (FLC)	Full Load PF	Full Load Eff	Starter	Start-up Current (Ist / In)	Remarks
			MCC-DIS-02: FIRE PUMP PANEL																			
T0	1	MCC-DIS-02-Q01	Incomer	400	3	72	A	100	A					1		49.9	100.0			Incomer	1	
T0	2	MCC-DIS-02-Q02	Control incomer	230	1	10	A	16	A				10.0	1	Generator	2.3	16.0			Incomer	1	
T0	3	74-PMP-005	Fire Water Pump #1	400	3	32.2	kW	45	kW	IE3	0.81	94.1%	61.0	1	Generator	42.2	80.9	0.85	94.4%	VFC	1.2	
T0	4	74-PMP-007	Fire Water Pump #3 (Jockey)	400	3	3.3	kW	4	kW	IE3	0.74	89.1%	7.2	1	Generator	5.0	8.0	0.81	88.8%	VFC	1.2	

Total MCC load 72 A
Total Installed Current 104.974 A

Total Generator Load (Running) 49.6 kVA
Total MCC Load (Absorbed) 49.6 kVA

[redacted]

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Rev	Item No	Plant Reference Number	Service Description	V	Ph	Required Mechanical Load (Absorbed)	Unit	Installed Equipment Rating	Unit	Efficiency class	Motor PF at Installed Load	Motor EFF at Installed Load	Motor/ Feeder Load Current	Duty Factor	Back-up Supply	Motor Load Estimate kVA	Full Load Current (FLC)	Full Load PF	Full Load Eff	Starter	Start-up Current (Ist / In)	Remarks
Instrumentation																						
Salt Dissolution Tanks																						
T0	1	45-XV-001	Salt Dissolution Tank 1 Inlet On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	45-XV-002	Salt Dissolution Tank 1 Outlet On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	45-XV-003	Salt Dissolution Tank 2 Inlet On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	45-XV-004	Salt Dissolution Tank 2 Outlet On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	45-LT-001	Salt Dissolution Tank 1 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	45-LT-002	Salt Dissolution Tank 2 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	45-LS-001	Salt Dissolution Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	45-LS-002	Salt Dissolution Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	45-LS-003	Salt Dissolution Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	45-LS-004	Salt Dissolution Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	45-LS-005	Salt Dissolution Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	11	45-LS-006	Salt Dissolution Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	12	45-LS-007	Salt Dissolution Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	45-LS-008	Salt Dissolution Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	14	98-FS-001	Plate Heat Exchanger Feed Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	15	98-TT-001	Plate Heat Exchanger Outlet Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	16	98-TT-002	Plate Heat Exchanger Feed Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
Sodium Hypo Generators																						
T0	1	45-FT-001	Water Softener 1 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	45-AT-001	Water Softener 1 Discharge Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	45-XV-005	Softened Water Feed to Electrolytic Reactor 1 On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	45-FT-002	Softened Water Feed to Electrolytic Reactor 1 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	45-TT-001	Softened Water Feed to Electrolytic Reactor 1 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	45-SIC-001	Brine pump for electrolytic reactor 1 Speed Indicator Controller	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	45-ZS-001	Softened Water Feed to Electrolytic Reactor 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	45-ZS-002	Softened Water Feed to Electrolytic Reactor 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	45-ZS-003	Saturated Brine Solution Feed to Electrolytic Reactor 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	45-TT-002	Electrolytic Reactor 1 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	11	45-LS-009	Electrolytic Reactor 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	12	45-XV-006	Softened Water Feed 1 to Salt Dissolution Tank On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	45-AT-002	On-site Sodium hypo Generator Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	14	45-AT-003	On-site Sodium hypo Generator Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	15	45-FT-003	Water Softener 2 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	16	45-AT-004	Water Softener 2 Discharge Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	17	45-XV-007	Softened Water Feed to Electrolytic Reactor 2 On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	18	45-FT-004	Softened Water Feed to Electrolytic Reactor 2 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	19	45-TT-003	Softened Water Feed to Electrolytic Reactor 2 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	20	45-SIC-002	Brine pump for electrolytic reactor 2 Speed Indicator Controller	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	21	45-ZS-004	Softened Water Feed to Electrolytic Reactor 2 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	22	45-ZS-005	Softened Water Feed to Electrolytic Reactor 2 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	23	45-ZS-006	Saturated Brine Solution Feed to Electrolytic Reactor 2 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	24	45-TT-004	Electrolytic Reactor 2 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	25	45-LS-010	Electrolytic Reactor 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	26	45-XV-008	Softened Water Feed 2 to Salt Dissolution Tank On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	27	45-FT-005	Water Softener 3 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	28	45-AT-005	Water Softener 3 Discharge Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	29	45-XV-009	Softened Water Feed to Electrolytic Reactor 3 On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	30	45-TT-005	Softened Water Feed to Electrolytic Reactor 3 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	31	45-SIC-003	Brine pump for electrolytic reactor 3 Speed Indicator Controller	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	32	45-ZS-007	Softened Water Feed to Electrolytic Reactor 3 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	33	45-ZS-008	Softened Water Feed to Electrolytic Reactor 3 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	34	45-ZS-009	Saturated Brine Solution Feed to Electrolytic Reactor 3 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	35	45-TT-006	Electrolytic Reactor 3 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	36	45-LS-011	Electrolytic Reactor 3 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	37	45-XV-010	Softened Water Feed 3 to Salt Dissolution Tank On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	38	45-FT-007	Water Softener 4 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	39	45-AT-006	Water Softener 4 Discharge Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	40	45-XV-011	Softened Water Feed to Electrolytic Reactor 4 On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	41	45-FT-008	Softened Water Feed to Electrolytic Reactor 4 Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	42	45-TT-007	Softened Water Feed to Electrolytic Reactor 4 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	43	45-SIC-004	Brine pump for electrolytic reactor 4 Speed Indicator Controller	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	44	45-ZS-010	Softened Water Feed to Electrolytic Reactor 4 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	45	45-ZS-011	Softened Water Feed to Electrolytic Reactor 4 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	46	45-ZS-012	Saturated Brine Solution Feed to Electrolytic Reactor 4 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	47	45-TT-008	Electrolytic Reactor 4 Temperature Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	48	45-LS-012	Electrolytic Reactor 4 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	49	45-XV-012	Softened Water Feed 4 to Salt Dissolution Tank On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	

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Rev	Item No	Plant Reference Number	Service Description	V	Ph	Required Mechanical Load (Absorbed)	Unit	Installed Equipment Rating	Unit	Efficiency class	Motor PF at Installed Load	Motor Eff at Installed Load	Motor Feeder Load Current	Duty Factor	Back-up Supply	Motor Load Estimate kVA	Full Load Current (FLC)	Full Load PF	Full Load Eff	Starter	Start-up Current (Ist / In)	Remarks
			NaOCl Storage Tanks																			
T0	1	46-LS-001	Sodium Hypo Storage Tanks Basement Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	2	46-LS-002	NaOCl Storage Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	3	46-LS-003	NaOCl Storage Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	4	46-LS-004	NaOCl Storage Tank 1 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	5	46-LS-005	NaOCl Storage Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	6	46-ZS-001	Commercial NaOCl Feed to NaOCl Storage Tank 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	7	46-ZS-002	Commercial NaOCl Feed to Chemical Injector Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	8	46-ZS-003	NaOCl Feed to Storage Tank 2 In Series Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	9	46-ZS-004	Diluted Commercial NaOCl Feed to NaOCl Storage Tank 2 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	10	46-LT-001	NaOCl Storage Tank 1 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	11	46-YA-001	NaOCl Storage Tank 1 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	12	46-LT-002	NaOCl Storage Tank 2 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	13	46-YA-002	NaOCl Storage Tank 2 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	14	46-FS-001	NaOCl Storage Tank 1 Outlet Air Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	15	46-FN -001	Storage Tank Blower 1 Fan	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	16	46-FN -002	Storage Tank Blower 2 Fan	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	17	46-LS-006	NaOCl Storage Tank 3 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	18	46-LS-007	NaOCl Storage Tank 4 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	19	46-LS-008	NaOCl Storage Tank 3 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	20	46-LS-009	NaOCl Storage Tank 4 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	21	46-ZS-005	Commercial NaOCl Feed to NaOCl Storage Tank 3 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	22	46-ZS-006	Commercial NaOCl Feed to Chemical Injector Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	23	46-ZS-007	NaOCl Feed to Storage Tank 4 In Series Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	24	46-ZS-008	Diluted commercial NaOCl Feed to NaOCl Storage Tank 4 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	25	46-LT-003	NaOCl Storage Tank 3 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	26	46-YA-003	NaOCl Storage Tank 3 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	27	46-LT-004	NaOCl Storage Tank 4 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	28	46-YA-004	NaOCl Storage Tank 4 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	29	46-FS-002	NaOCl Storage Tank 3 Outlet Air Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	30	46-FN -003	Storage Tank Blower 1 Fan	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
T0	31	46-FN -004	Storage Tank Blower 2 Fan	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	Intrinsically safe instrument
			NaOCl Dosing System																			
T0	1	46-FS-003	NaOCl Reservoir Inlet Dosing Pump 1 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	46-FS-004	NaOCl Reservoir Inlet Dosing Pump 2 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	46-FS-005	NaOCl Reservoir Inlet Dosing Pump 3 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	46-FT-001	NaOCl Reservoir Inlet Dosing Pumps Combined Discharges Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	46-FS-006	NaOCl Reservoir Outlet Dosing Pump 1 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	46-FS-007	NaOCl Reservoir Outlet Dosing Pump 2 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	46-FS-008	NaOCl Reservoir Outlet Dosing Pump 3 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	46-FT-002	NaOCl Reservoir Outlet Dosing Pumps Combined Discharges Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Commercial NaOCl Dilution System																			
T0	1	46-XV-001	Commercial NaOCl Feed On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	46-ZS-009	Commercial NaOCl Manifold Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	46-ZS-010	Dilution Water Feed to Injector 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	46-ZS-011	Dilution Water Feed to Injector 1 Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	46-ZS-012	Injectors Combined Discharge Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	46-XV-002	Dilution Water Feed On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Calcium Hypo Make-up																			
T0	1	47-FT-001	Service Water Feed Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	47-FI-001	Service Water Feed Flow Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	47-XV-001	Service Water Feed On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	47-LS-001	Calcium Hypo Tanks Basement Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	47-LS-002	Calcium Hypo Storage Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	47-LS-003	Calcium Hypo Storage Tank 2 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	47-LT-001	Calcium Hypo Storage Tank 2 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	47-YA-001	Calcium Hypo Storage Tank 2 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	47-ZS-001	Calcium Hypo Storage Tank 2 Feed Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	47-LS-004	Calcium Hypo Storage Tank 3 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	11	47-LS-005	Calcium Hypo Storage Tank 3 Level Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	12	47-LT-002	Calcium Hypo Storage Tank 3 Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	47-YA-002	Calcium Hypo Storage Tank 3 Siren	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	14	47-ZS-002	Calcium Hypo Storage Tank 3 Feed Position Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	

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Rev	Item No	Plant Reference Number	Service Description	V	Ph	Required Mechanical Load (Absorbed)	Unit	Installed Equipment Rating	Unit	Efficiency class	Motor PF at Installed Load	Motor Eff at Installed Load	Motor Feeder Load Current	Duty Factor	Back-up Supply	Motor Load Estimate kVA	Full Load Current (FLC)	Full Load PF	Full Load Eff	Starter	Start-up Current (Ist / In)	Remarks
			Calcium Hypo Dosing System																			
T0	1	47-FS-001	Calcium Hypo Reservoir Inlet Dosing Pump 1 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	47-FS-002	Calcium Hypo Reservoir Inlet Dosing Pump 2 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	47-FS-003	Calcium Hypo Reservoir Inlet Dosing Pump 3 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	47-FT-002	Calcium Hypo Reservoir Inlet Dosing Pumps Combined Discharges Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	47-FS-004	Calcium Hypo Reservoir Outlet Dosing Pump 1 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	47-FS-005	Calcium Hypo Reservoir Outlet Dosing Pump 2 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	47-FS-006	Calcium Hypo Reservoir Outlet Dosing Pump 3 Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	47-FT-003	Calcium Hypo Reservoir Outlet Dosing Pumps Combined Discharges Flow Transmitte	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Service Water Wet Well																			
T0	1	74-LT-001	Service Water Sump Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	74-LT-002	Service Water Sump Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Service Water Reticulation																			
T0	1	74-PI-001	Site Service Water Pump 1 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	74-PI-002	Site Service Water Pump 1 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	74-FS-001	Site Service Water Pump 1 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	74-PI-003	Site Service Water Pump 2 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	74-PI-004	Site Service Water Pump 2 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	74-FS-002	Site Service Water Pump 2 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	74-PI-005	Site Service Water Pump 3 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	74-PI-006	Site Service Water Pump 3 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	74-FS-003	Site Service Water Pump 3 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	74-PI-007	Site Service Water Pump 4 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	11	74-PI-008	Site Service Water Pump 4 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	12	74-FS-004	Site Service Water Pump 4 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	74-FT-002	Site Service Water Pumps - Combined Discharge Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	14	74-PT-001	Site Service Water Pumps - Combined Discharge Pressure Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Fire Water																			
T0	1	74-PI-010	Fire Water Pump 1 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	74-PI-011	Fire Water Pump 1 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	74-FS-005	Fire Water Pump 1 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	74-PI-012	Fire Water Pump 2 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	74-PI-013	Fire Water Pump 2 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	74-FS-006	Fire Water Pump 2 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	74-PI-014	Fire Water Pump 3 - Suction Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	74-PI-015	Fire Water Pump 3 - Discharge Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	74-FS-007	Fire Water Pump 3 - Discharge Flow Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	74-PI-016	Fire Water Pumps Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	11	74-PI-017	Fire Water Pumps Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	12	74-PI-018	Fire Water Pumps Pressure Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	74-PS-001	Fire Water Pumps Pressure Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	14	74-PS-002	Fire Water Pumps Pressure Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	15	74-PS-003	Fire Water Pumps Pressure Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	16	74-PS-004	Fire Water Pumps Pressure Switch	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	17	74-PT-002	Fire Water Pumps Pressure Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
			Muldersvlei Reservoir																			
T0	1	84-FI-001	Leakage Water Return Pump 1 Discharge Flow Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	2	84-FI-002	Leakage Water Return Pump 2 Discharge Flow Indicator	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	3	84-LT-001	Leakage Water Return Pump 1 Inlet Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	4	84-LT-002	Leakage Water Return Pump 2 Inlet Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	5	84-LT-003	Muldersvlei Reservoir Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	6	84-LT-004	Muldersvlei Reservoir Level Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	7	84-XV-001	Water Feed Line from Wemmershoek WTW On/Off Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	8	84-FT-001	Water Feed Line from Wemmershoek WTW Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	9	84-AT-001	Water Feed Line from Wemmershoek WTW Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	10	84-FT-002	Water outlet to Glen Garry Reservoir Flow Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	11	84-FCV-001	Water outlet to Glen Garry Reservoir Flow Control Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	12	84-FCV-002	Water outlet to Glen Garry Reservoir Flow Control Valve	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	
T0	13	84-AT-002	Water outlet to Glen Garry Reservoir Analyser Transmitter	24 VDC	1	1	A	1.1	A				1.0	1		0.024	1.1			Other	1	

Rating of Required Transformer 500 kVA
Transformer Nominal Output Current Rating 721.688 A
Transformer Maximum Fault Current Rating @ Zmin 16.0375 kA

Total Generator Load (Running) 542.4 kVA
Total MCC Load (Absorbed) 492.5 kVA

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Rev	Item No	Service Description	Plant Reference Number	Starter	Options	Installed Equipment Rating	Unit	LCS Type	FLC	Is/In	Nom %Vd	St %Vd	Estimated CB size	Estimated CB isc trip current	Remarks
						GEN-PNL: GENERATOR CHANGEOVER PANEL									
T0	1	Incomer 1	GEN-PNL-Q01	Incomer	a	800	A		800.0	1	1%	5%	800	9600	
T0	2	Incomer 2 (Generator)	GEN-PNL-Q02	Incomer	a	800	A		800.0	1	1%	5%	800	9600	
T0	3	Disinfection MCC	MCC-DIS-01-Q51	FDR		800	A		800.0	1	1%	5%	800	9600	
						MCC-DIS-01: DISINFECTION MCC									
T0	1	Incomer	MCC-DIS-01-Q01	Incomer	a	800	A		800.0	1	1%	5%	800	9600	
T0	2	Control incomer	MCC-DIS-01-Q02	Incomer		16	A		16.0	1	1%	5%	16	192	
T0	3	Site Service Water Pump #1	74-PMP-001	VFC	i,m,t	7.5	kW		13.9	1.2	2%	5%	16	192	
T0	4	Site Service Water Pump #2	74-PMP-002	VFC	i,m,t	7.5	kW		13.9	1.2	2%	5%	16	192	
T0	5	Site Service Water Pump #3	74-PMP-003	VFC	i,m,t	7.5	kW		13.9	1.2	2%	5%	16	192	
T0	6	Site Service Water Pump #4	74-PMP-004	VFC	i,m,t	7.5	kW		13.9	1.2	2%	5%	16	192	
T0	7	Chiller	98-CT-001	DOL	i,m,t	15	kW		29.2	6.8	2%	5%	40	480	
T0	8	Overhead Travelling Crane	45-CR-001	DOL	i,m,t	2.2	kW		4.8	5.6	2%	5%	10	120	
T0	9	Overhead Travelling Crane	45-CR-002	DOL	i,m,t	2.2	kW		4.8	5.6	2%	5%	10	120	
T0	10	Overhead Travelling Crane	45-CR-003	DOL	i,m,t	2.2	kW		4.8	5.6	2%	5%	10	120	
T0	11	OSEC Unit #1	45-EC-001	FDR		55	kW		100.3	1	2%	5%	125	1500	
T0	12	OSEC Unit #2	45-EC-002	FDR		55	kW		100.3	1	2%	5%	125	1500	
T0	13	OSEC Unit #3	45-EC-003	FDR		55	kW		100.3	1	2%	5%	125	1500	
T0	14	OSEC Unit #4	45-EC-004	FDR		55	kW		100.3	1	2%	5%	125	1500	
T0	15	Storage Tank Blower #1	46-BL-001	DOL	i,m,t	0.37	kW		1.1	3.6	2%	5%	10	120	
T0	16	Storage Tank Blower #2	46-BL-002	DOL	i,m,t	0.37	kW		1.1	3.6	2%	5%	10	120	
T0	17	Storage Tank Blower #3	46-BL-003	DOL	i,m,t	0.37	kW		1.1	3.6	2%	5%	10	120	
T0	18	Storage Tank Blower #4	46-BL-004	DOL	i,m,t	0.37	kW		1.1	3.6	2%	5%	10	120	
T0	19	Sodium Hypochlorite Dosing Pump #1	46-PMP-001	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	20	Sodium Hypochlorite Dosing Pump #2	46-PMP-002	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	21	Sodium Hypochlorite Dosing Pump #3	46-PMP-003	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	22	Sodium Hypochlorite Dosing Pump #4	46-PMP-004	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	23	Sodium Hypochlorite Dosing Pump #5	46-PMP-005	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	24	Sodium Hypochlorite Dosing Pump #6	46-PMP-006	VFC	i,m,t	0.37	kW		1.0	1.2	2%	5%	10	120	
T0	25	Chemical Pump	46-PMP-007	DOL	i,m,t	0.55	kW		1.2	6.6	2%	5%	10	120	
T0	26	Calcium Hypochlorite Dosing Pump #1	47-PMP-001	VFC	i,m,t	5.5	kW		10.4	1.2	2%	5%	16	192	
T0	27	Calcium Hypochlorite Dosing Pump #2	47-PMP-002	VFC	i,m,t	5.5	kW		10.4	1.2	2%	5%	16	192	
T0	28	Calcium Hypochlorite Dosing Pump #3	47-PMP-003	VFC	i,m,t	5.5	kW		10.4	1.2	2%	5%	16	192	
T0	29	Calcium Hypochlorite Dosing Pump #4	47-PMP-004	VFC	i,m,t	5.5	kW		10.4	1.2	2%	5%	16	192	
T0	30	Calcium Hypochlorite Dosing Pump #5	47-PMP-005	VFC	i,m,t	5.5	kW		10.4	1.2	3%	5%	16	192	
T0	31	Calcium Hypochlorite Dosing Pump #6	47-PMP-006	VFC	i,m,t	5.5	kW		10.4	1.2	3%	5%	16	192	
T0	32	Leakage Water Return Pump 1	84-PMP-001	DOL	i,m,t	1.1	kW		2.3	7.6	2%	5%	10	120	
T0	33	Leakage Water Return Pump 2	84-PMP-002	DOL	i,m,t	1.1	kW		2.3	7.6	2%	5%	10	120	
T0	34	Reservoir Sump Pump 1	84-PMP-003	DOL	i,m,t	0.37	kW		1.0	4.8	3%	5%	10	120	
T0	35	Reservoir Sump Pump 2	84-PMP-004	DOL	i,m,t	0.37	kW		1.0	4.8	3%	5%	10	120	
T0	36	SP&L DB Feeder - OSEC Building	DB-OSEC	FDR	h	250	A		250.0	1	3%	5%	250	3000	
T0	37	SP&L DB Feeder - Admin Building	DB-ADM	FDR	h	63	A		63.0	1	3%	5%	63	756	
T0	38	Field DB 01 Feeder	DB-FLD-01	FDR	h	63	A		63.0	1	3%	5%	63	756	
T0	39	Field DB 04 Feeder	DB-FLD-04	FDR	h	40	A		40.0	1	3%	5%	40	480	
T0	40	Field DB 06 Feeder	DB-FLD-06	FDR	h	63	A		63.0	1	3%	5%	63	756	
T0	41	Salt Tanks Internal Light	-	FDR	h	0.125	kW		0.2	1	3%	5%	10	120	
T0	42	Salt Tanks Internal Light	-	FDR	h	0.125	kW		0.2	1	3%	5%	10	120	
	43	Fire Pump Panel	MCC-DIS-02	FDR		100	A		100.0	1	103%	5%	100	1200	

[redacted]

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Rev	Item No	Service Description	Plant Reference Number	Starter	Options	Installed Equipment Rating	Unit	LCS Type	FLC	Is/In	Nom %Vd	St %Vd	Estimated CB size	Estimated CB Isc trip current	Remarks
MCC-DIS-02: FIRE PUMP PANEL															
T0	43	Incomer	MCC-DIS-02-Q01	F1	a	100	A		100.0	1	2%	5%	100	1200	
T0	44	Control incomer	MCC-DIS-02-Q02	F1		16	A		16.0	1	2%	5%	16	192	
T0	45	Fire Water Pump #1	74-PMP-005	M3	i,m,t	45	kW		80.9	1.2	2%	15%	100	1200	
T0	46	Fire Water Pump #3 (Jockey)	74-PMP-007	M3	i,m,t	4	kW		8.0	1.2	2%	15%	16	192	

[redacted]

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Rev	Item No	Plant Reference Number	Service Description	Volt	Starter	Selector Switches		Push Buttons						Indicators														Metering				Protection			Field Control						Comments
						Forced Ventilation	Manual/ Off/ Auto	Start	Stop	Open	Close	Reset/Overload	Lamp Test	Other	Running	Stopped	Opened	Closed	Tripped/Fault	E-Stop	No Flow	Over Torque	Belt Failure	Overheat	Over vibration	Main Healthy	Other	kWh	Amp	Volt	Run Hours	Overload	Earth Leakage	Surge Protection	Start/Stop/E-Stop	E-Stop	Open/Stop/Close	Local/Off/Remote	Forward / Reverse	Other	*Note: Functionality to be provided either by intelligent motor starter interface,or conventional push buttons and indicators.
			GEN-PNL: GENERATOR CHANGEOVER PANEL																																						
T0	1	GEN-PNL-Q01	Incomer 1	400	Incomer								1													1	1	Power meter				1		1						Alarms for reverse phase, over/under voltage, phase unbalanced
T0	2	GEN-PNL-Q02	Incomer 2 (Generator)	400	Incomer								1													1	1	Power meter				1		1						Alarms for reverse phase, over/under voltage, phase unbalanced
T0	3	MCC-DIS-01-Q51	Disinfection MCC	400	FDR																					1	1	1	1	1	1									
			MCC-DIS-01: DISINFECTION MCC																																						
T0	1	MCC-DIS-01-Q01	Incomer	400	Incomer								1													1	1	Power meter				1		1						Alarms for reverse phase, over/under voltage, phase unbalanced
T0	2	MCC-DIS-01-Q02	Control incomer	230	Incomer																																			
T0	3	74-PMP-001	Site Service Water Pump #1	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	4	74-PMP-002	Site Service Water Pump #2	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	5	74-PMP-003	Site Service Water Pump #3	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	6	74-PMP-004	Site Service Water Pump #4	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	7	98-CT-001	Chiller	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	8	45-CR-001	Overhead Travelling Crane	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	9	45-CR-002	Overhead Travelling Crane	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	10	45-CR-003	Overhead Travelling Crane	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	11	45-EC-001	OSEC Unit #1	400	FDR																									1										
T0	12	45-EC-002	OSEC Unit #2	400	FDR																									1										
T0	13	45-EC-003	OSEC Unit #3	400	FDR																									1										
T0	14	45-EC-004	OSEC Unit #4	400	FDR																									1										
T0	15	46-BL-001	Storage Tank Blower #1	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	16	46-BL-002	Storage Tank Blower #2	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	17	46-BL-003	Storage Tank Blower #3	400	DOL		1	1	1			1	1		1	1			1	1									1		1	1			1						
T0	18	46-BL-004	Storage Tank Blower #4	400	DOL		1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	19	46-PMP-001	Sodium Hypochlorite Dosing Pump #1	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	20	46-PMP-002	Sodium Hypochlorite Dosing Pump #2	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	21	46-PMP-003	Sodium Hypochlorite Dosing Pump #3	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	22	46-PMP-004	Sodium Hypochlorite Dosing Pump #4	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	23	46-PMP-005	Sodium Hypochlorite Dosing Pump #5	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	24	46-PMP-006	Sodium Hypochlorite Dosing Pump #6	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	25	46-PMP-007	Chemical Pump	400	DOL	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	26	47-PMP-001	Calcium Hypochlorite Dosing Pump #1	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	27	47-PMP-002	Calcium Hypochlorite Dosing Pump #2	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	28	47-PMP-003	Calcium Hypochlorite Dosing Pump #3	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	29	47-PMP-004	Calcium Hypochlorite Dosing Pump #4	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	30	47-PMP-005	Calcium Hypochlorite Dosing Pump #5	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	31	47-PMP-006	Calcium Hypochlorite Dosing Pump #6	400	VFC	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	32	84-PMP-001	Leakage Water Return Pump 1	400	DOL	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	33	84-PMP-002	Leakage Water Return Pump 2	400	DOL	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	34	84-PMP-003	Reservoir Sump Pump 1	400	DOL	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	35	84-PMP-004	Reservoir Sump Pump 2	400	DOL	1	1	1	1			1	1		1	1			1	1	1							1	1	1	1	1			1						
T0	36	DB-OSEC	SP&L DB Feeder - OSEC Building	400	FDR																																			
T0	37	DB-ADM	SP&L DB Feeder - Admin Building	400	FDR																																			
T0	38	DB-FLD-01	Field DB 01 Feeder	400	FDR																																			
T0	39	DB-FLD-04	Field DB 04 Feeder	400	FDR																																			
T0	40	DB-FLD-06	Field DB 06 Feeder	400	FDR																																			
T0	41	-	Salt Tanks Internal Light	400	FDR																																			
T0	42	-	Salt Tanks Internal Light	400	FDR																																			
T0	43	MCC-DIS-02	Fire Pump Panel	400	FDR																					1	1	1	1	1	1									

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Rev	Item No	Plant Reference Number	Service Description	Volt	Starter	Forced Ventilation	Manual/ Off/ Auto	Start	Stop	Open	Close	Reset/Overload	Lamp Test	Other	Running	Stopped	Opened	Closed	Tripped/Fault	E-Stop	No Flow	Over Torque	Seal Failure	Overheat	Over vibration	Main Healthy	Other	kWh	Amp	Volt	Run Hours	Overload	Earth Leakage	Surge Protection	Start/Stop/E-Stop	E-Stop	Open/Stop/Close	Local/Off/Remote	Forward / Reverse	Other	*Note: Functionality to be provided either by intelligent motor starter interface,or conventional push buttons and indicators.
MCC-DIS-02: FIRE PUMP PANEL																																									
T0	1	MCC-DIS-02-Q01	Incomer	400	Incomer																							Power meter			1		1								Alarms for reverse phase, over/under voltage, phase unbalanced
T0	2	MCC-DIS-02-Q02	Control incomer	230	Incomer																																				
T0	3	74-PMP-005	Fire Water Pump #1	400	VFC	1		1	1	1			1	1		1	1			1	1	1						1	1	1	1	1			1						
T0	4	74-PMP-007	Fire Water Pump #3 (Jockey)	400	VFC	1		1	1	1			1	1		1	1			1	1	1						1	1	1	1	1			1						

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Rev	MCC Item No	Cable Reference Designation	Cable Source	Source Description	Cable Destination	Destination Description	Installation Method	Estimate Length	Current	Insulation	Conductor	Rating	Screen	Armour	Flexible Cable	Insl Cores	Used Cores	Area mm²	% Volt Drop Nominal	% Volt Drop Start-up	Gland Size	Bare Cu Earth	Remarks
						GEN-PNL: GENERATOR CHANGEOVER PANEL																	
T0	1	XB01-TA01-WD01//GEN-PNL-Q01	XB01-TA01	Transformer	GEN-PNL-Q01	Incomer 1	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	1	XB01-TA01-WD02//GEN-PNL-Q01	XB01-TA01	Transformer	GEN-PNL-Q01	Incomer 1	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	1	XB01-TA01-WD03//GEN-PNL-Q01	XB01-TA01	Transformer	GEN-PNL-Q01	Incomer 1	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	2	XB01-GEN01-WD01//GEN-PNL-Q02	XB01-GEN01	Generator	GEN-PNL-Q02	Incomer 2 (Generator)	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	2	XB01-GEN01-WD02//GEN-PNL-Q02	XB01-GEN01	Generator	GEN-PNL-Q02	Incomer 2 (Generator)	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	2	XB01-GEN01-WD03//GEN-PNL-Q02	XB01-GEN01	Generator	GEN-PNL-Q02	Incomer 2 (Generator)	Ground	60	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	1.1%	1.1%	6	95	
T0	3	GEN-PNL-Q01-WD01//MCC-DIS-01-Q51	GEN-PNL-Q01	Changeover panel	MCC-DIS-01-Q51	Disinfection MCC	Ground	See incomer details below															
						MCC-DIS-01: DISINFECTION MCC																	
T0	1	GEN-PNL-Q01-WD01//MCC-DIS-01-Q01	GEN-PNL-Q01	Changeover panel	MCC-DIS-01-Q01	Incomer	Ground	50	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	0.8%	0.9%	6	95	
T0	1	GEN-PNL-Q01-WD02//MCC-DIS-01-Q01	GEN-PNL-Q01	Changeover panel	MCC-DIS-01-Q01	Incomer	Ground	50	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	0.8%	0.9%	6	95	
T0	1	GEN-PNL-Q01-WD03//MCC-DIS-01-Q01	GEN-PNL-Q01	Changeover panel	MCC-DIS-01-Q01	Incomer	Ground	50	293.33	PVC	Copper	600/1 000 V	None	SWA		4		185	0.8%	0.9%	6	95	
T0	2	MCC-DIS-01-WD01//MCC-DIS-01-Q02	MCC-DIS-01	MCC	MCC-DIS-01-Q02	Control incomer	Air	10	16.00	PVC	Copper	600/1 000 V	None	SWA		4		4	0.6%	0.8%	1	4	
T0	3	MCC-DIS-01-WD01//XB01-RB02	MCC-DIS-01	MCC	XB01-RB02	Site Service Water Pump #1	Air	40	13.89	PVC	Copper	600/1 000 V	None	SWA		4		4	1.3%	1.6%	1	4	
T0	4	MCC-DIS-01-WD01//WC01-XD01	MCC-DIS-01	MCC	WC01-XD01	Site Service Water Pump #2	Air	40	13.89	PVC	Copper	600/1 000 V	None	SWA		4		4	1.3%	1.6%	1	4	
T0	5	MCC-DIS-01-WD01//WC01-XD02	MCC-DIS-01	MCC	WC01-XD02	Site Service Water Pump #3	Air	40	13.89	PVC	Copper	600/1 000 V	None	SWA		4		4	1.3%	1.6%	1	4	
T0	6	MCC-DIS-01-WD01//BU01-WC01	MCC-DIS-01	MCC	BU01-WC01	Site Service Water Pump #4	Air	40	13.89	PVC	Copper	600/1 000 V	None	SWA		4		4	1.3%	1.6%	1	4	
T0	6	MCC-DIS-01-WD01//98-CT-001	MCC-DIS-01	MCC	98-CT-001	Chiller	Air	50	29.21	PVC	Copper	600/1 000 V	None	SWA		4		25	0.8%	3.8%	3	16	
T0	7	MCC-DIS-01-WD01//45-CR-001	MCC-DIS-01	MCC	45-CR-001	Overhead Travelling Crane	Air	30	4.84	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.6%	3.1%	1	2.5	
T0	7	MCC-DIS-01-WD01//45-CR-002	MCC-DIS-01	MCC	45-CR-002	Overhead Travelling Crane	Air	30	4.84	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.6%	3.1%	1	2.5	
T0	8	MCC-DIS-01-WD01//45-CR-003	MCC-DIS-01	MCC	45-CR-003	Overhead Travelling Crane	Air	30	4.84	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.6%	3.1%	1	2.5	
T0	9	MCC-DIS-01-WD01//45-EC-001	MCC-DIS-01	MCC	45-EC-001	OSEC Unit #1	Air	25	100.32	PVC	Copper	600/1 000 V	None	SWA		4		25	1.0%	1.0%	3	16	
T0	10	MCC-DIS-01-WD01//45-EC-002	MCC-DIS-01	MCC	45-EC-002	OSEC Unit #2	Air	25	100.32	PVC	Copper	600/1 000 V	None	SWA		4		25	1.0%	1.0%	3	16	
T0	11	MCC-DIS-01-WD01//45-EC-003	MCC-DIS-01	MCC	45-EC-003	OSEC Unit #3	Air	25	100.32	PVC	Copper	600/1 000 V	None	SWA		4		25	1.0%	1.0%	3	16	
T0	12	MCC-DIS-01-WD01//45-EC-004	MCC-DIS-01	MCC	45-EC-004	OSEC Unit #4	Air	25	100.32	PVC	Copper	600/1 000 V	None	SWA		4		25	1.0%	1.0%	3	16	
T0	13	MCC-DIS-01-WD01//46-BL-001	MCC-DIS-01	MCC	46-BL-001	Storage Tank Blower #1	Air	40	1.11	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.6%	1	2.5	
T0	14	MCC-DIS-01-WD01//46-BL-002	MCC-DIS-01	MCC	46-BL-002	Storage Tank Blower #2	Air	40	1.11	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.6%	1	2.5	
T0	15	MCC-DIS-01-WD01//46-BL-003	MCC-DIS-01	MCC	46-BL-003	Storage Tank Blower #3	Air	40	1.11	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.6%	1	2.5	
T0	16	MCC-DIS-01-WD01//46-BL-004	MCC-DIS-01	MCC	46-BL-004	Storage Tank Blower #4	Air	40	1.11	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.6%	1	2.5	
T0	17	MCC-DIS-01-WD01//46-PMP-001	MCC-DIS-01	MCC	46-PMP-001	Sodium Hypochlorite Dosing Pump #1	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	18	MCC-DIS-01-WD01//46-PMP-002	MCC-DIS-01	MCC	46-PMP-002	Sodium Hypochlorite Dosing Pump #2	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	19	MCC-DIS-01-WD01//46-PMP-003	MCC-DIS-01	MCC	46-PMP-003	Sodium Hypochlorite Dosing Pump #3	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	20	MCC-DIS-01-WD01//46-PMP-004	MCC-DIS-01	MCC	46-PMP-004	Sodium Hypochlorite Dosing Pump #4	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	21	MCC-DIS-01-WD01//46-PMP-005	MCC-DIS-01	MCC	46-PMP-005	Sodium Hypochlorite Dosing Pump #5	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	22	MCC-DIS-01-WD01//46-PMP-006	MCC-DIS-01	MCC	46-PMP-006	Sodium Hypochlorite Dosing Pump #6	Air	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.2%	1	2.5	
T0	23	MCC-DIS-01-WD01//46-PMP-007	MCC-DIS-01	MCC	46-PMP-007	Chemical Pump	Air	40	1.23	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	1.2%	1	2.5	
T0	23	MCC-DIS-01-WD01//47-PMP-001	MCC-DIS-01	MCC	47-PMP-001	Calcium Hypochlorite Dosing Pump #1	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	24	MCC-DIS-01-WD01//47-PMP-002	MCC-DIS-01	MCC	47-PMP-002	Calcium Hypochlorite Dosing Pump #2	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	25	MCC-DIS-01-WD01//47-PMP-003	MCC-DIS-01	MCC	47-PMP-003	Calcium Hypochlorite Dosing Pump #3	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	26	MCC-DIS-01-WD01//47-PMP-004	MCC-DIS-01	MCC	47-PMP-004	Calcium Hypochlorite Dosing Pump #4	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	27	MCC-DIS-01-WD01//47-PMP-005	MCC-DIS-01	MCC	47-PMP-005	Calcium Hypochlorite Dosing Pump #5	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	28	MCC-DIS-01-WD01//47-PMP-006	MCC-DIS-01	MCC	47-PMP-006	Calcium Hypochlorite Dosing Pump #6	Air	40	10.41	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.6%	1.9%	1	2.5	
T0	29	MCC-DIS-01-WD01//84-PMP-001	MCC-DIS-01	MCC	84-PMP-001	Leakage Water Return Pump 1	Ducts	40	2.35	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.4%	2.7%	1	2.5	
T0	30	MCC-DIS-01-WD01//84-PMP-002	MCC-DIS-01	MCC	84-PMP-002	Leakage Water Return Pump 2	Ducts	40	2.35	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.4%	2.7%	1	2.5	
T0	31	MCC-DIS-01-WD01//84-PMP-003	MCC-DIS-01	MCC	84-PMP-003	Reservoir Sump Pump 1	Ducts	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.7%	1	2.5	
T0	32	MCC-DIS-01-WD01//84-PMP-004	MCC-DIS-01	MCC	84-PMP-004	Reservoir Sump Pump 2	Ducts	40	0.99	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.2%	0.7%	1	2.5	
T0	29	MCC-DIS-01-WD01//DB-OSEC	MCC-DIS-01	MCC	DB-OSEC	SP&L DB Feeder - OSEC Building	Air	20	200.00	PVC	Copper	600/1 000 V	None	SWA		4		95	0.5%	0.5%	5	50	
T0	30	MCC-DIS-01-WD01//DB-ADM	MCC-DIS-01	MCC	DB-ADM	SP&L DB Feeder - Admin Building	Air	75	63.00	PVC	Copper	600/1 000 V	None	SWA		4		16	2.8%	2.8%	3	16	
T0	31	MCC-DIS-01-WD01//DB-FLD-01	MCC-DIS-01	MCC	DB-FLD-01	Field DB 01 Feeder	Ducts	10	63.00	PVC	Copper	600/1 000 V	None	SWA		4		16	0.4%	0.4%	3	16	
T0	32	MCC-DIS-01-WD01//DB-FLD-04	MCC-DIS-01	MCC	DB-FLD-04	Field DB 04 Feeder	Ducts	80	40.00	PVC	Copper	600/1 000 V	None	SWA		4		16	1.9%	1.9%	3	16	
T0	33	MCC-DIS-01-WD01//DB-FLD-06	MCC-DIS-01	MCC	DB-FLD-06	Field DB 06 Feeder	Ground	150	63.00	PVC	Copper	600/1 000 V	None	SWA		4		35	2.6%	2.6%	4	16	
T0	34	MCC-DIS-01-WD01//-	MCC-DIS-01	MCC	-	Salt Tanks Internal Light	Ground	40	0.21	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.0%	0.0%	1	2.5	
T0	35	MCC-DIS-01-WD01//-	MCC-DIS-01	MCC	-	Salt Tanks Internal Light	Ground	40	0.21	PVC	Copper	600/1 000 V	None	SWA		4		2.5	0.0%	0.0%	1	2.5	
T0	4	GEN-PNL-Q01-WD01//MCC-DIS-02	GEN-PNL-Q01	MCC	MCC-DIS-02	Fire Pump Panel	Ground	See incomer details below															
						MCC-DIS-02: FIRE PUMP PANEL																	
T0	1	GEN-PNL-Q01-WD01//MCC-DIS-02-Q01	GEN-PNL-Q01	Changeover panel	MCC-DIS-02-Q01	Incomer	Ground	50	110.00	PVC	Copper	600/1 000 V	None	SWA		4		35	1.5%	1.5%	4	16	
T0	1	MCC-DIS-02-WD01//MCC-DIS-02-Q02	MCC-DIS-02	MCC	MCC-DIS-02-Q02	Control incomer	Air	10	17.60	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.4%	1.4%	1	2.5	
T0	1	MCC-DIS-02-WD01//74-PMP-005	MCC-DIS-02	MCC	74-PMP-005	Fire Water Pump #1	Air	50	110.00	PVC	Copper	600/1 000 V	None	SWA		4		35	1.5%	1.8%	4	16	
T0	2	MCC-DIS-02-WD01//74-PMP-007	MCC-DIS-02	MCC	74-PMP-007	Fire Water Pump #3 (Jockey)	Air	50	8.03	PVC	Copper	600/1 000 V	None	SWA		4		2.5	1.5%	1.8%	1	2.5	

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Rev	MCC Item No	Cable Reference Designation	Cable Source	Source Description	Cable Destination	Destination Description	Estimate Length	Insulation	Conductor	Rating	Sheath	Armour	Inst Cores	Area mm²	Communication Cabl = Protocol	Remarks
							MCC-DIS-01: DISINFECTION MCC									
T0	1	MCC-DIS-01-WG01//74-PMP-001	MCC-DIS-01	MCC	74-PMP-001	Site Service Water Pump #1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	2	MCC-DIS-01-WG01//74-PMP-002	MCC-DIS-01	MCC	74-PMP-002	Site Service Water Pump #2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	3	MCC-DIS-01-WG01//74-PMP-003	MCC-DIS-01	MCC	74-PMP-003	Site Service Water Pump #3	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	4	MCC-DIS-01-WG01//74-PMP-004	MCC-DIS-01	MCC	74-PMP-004	Site Service Water Pump #4	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	5	MCC-DIS-01-WG01//98-CT-001	MCC-DIS-01	MCC	98-CT-001	Chiller	50	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	6	MCC-DIS-01-WG01//45-CR-001	MCC-DIS-01	MCC	45-CR-001	Overhead Travelling Crane	30	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	7	MCC-DIS-01-WG01//45-CR-002	MCC-DIS-01	MCC	45-CR-002	Overhead Travelling Crane	30	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	8	MCC-DIS-01-WG01//45-CR-003	MCC-DIS-01	MCC	45-CR-003	Overhead Travelling Crane	30	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	9	MCC-DIS-01-WG01//45-EC-001	MCC-DIS-01	MCC	45-EC-001	OSEC Unit #1	40	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	
T0	10	MCC-DIS-01-WG01//45-EC-002	MCC-DIS-01	MCC	45-EC-002	OSEC Unit #2	40	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	
T0	11	MCC-DIS-01-WG01//45-EC-003	MCC-DIS-01	MCC	45-EC-003	OSEC Unit #3	40	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	
T0	12	MCC-DIS-01-WD01//45-EC-004	MCC-DIS-01	MCC	45-EC-004	OSEC Unit #4	40	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	
T0	13	MCC-DIS-01-WG01//46-BL-001	MCC-DIS-01	MCC	46-BL-001	Storage Tank Blower #1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	14	MCC-DIS-01-WG01//46-BL-002	MCC-DIS-01	MCC	46-BL-002	Storage Tank Blower #2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	15	MCC-DIS-01-WG01//46-BL-003	MCC-DIS-01	MCC	46-BL-003	Storage Tank Blower #3	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	16	MCC-DIS-01-WD01//46-BL-004	MCC-DIS-01	MCC	46-BL-004	Storage Tank Blower #4	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	13	MCC-DIS-01-WG01//46-PMP-001	MCC-DIS-01	MCC	46-PMP-001	Sodium Hypochlorite Dosing Pump #1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	14	MCC-DIS-01-WG01//46-PMP-002	MCC-DIS-01	MCC	46-PMP-002	Sodium Hypochlorite Dosing Pump #2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	15	MCC-DIS-01-WG01//46-PMP-003	MCC-DIS-01	MCC	46-PMP-003	Sodium Hypochlorite Dosing Pump #3	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	16	MCC-DIS-01-WG01//46-PMP-004	MCC-DIS-01	MCC	46-PMP-004	Sodium Hypochlorite Dosing Pump #4	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	17	MCC-DIS-01-WG01//46-PMP-005	MCC-DIS-01	MCC	46-PMP-005	Sodium Hypochlorite Dosing Pump #5	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	18	MCC-DIS-01-WG01//46-PMP-006	MCC-DIS-01	MCC	46-PMP-006	Sodium Hypochlorite Dosing Pump #6	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	19	MCC-DIS-01-WG01//46-PMP-007	MCC-DIS-01	MCC	46-PMP-007	Chemical Pump	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	19	MCC-DIS-01-WG01//47-PMP-001	MCC-DIS-01	MCC	47-PMP-001	Calcium Hypochlorite Dosing Pump #1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	20	MCC-DIS-01-WG01//47-PMP-002	MCC-DIS-01	MCC	47-PMP-002	Calcium Hypochlorite Dosing Pump #2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	21	MCC-DIS-01-WG01//47-PMP-003	MCC-DIS-01	MCC	47-PMP-003	Calcium Hypochlorite Dosing Pump #3	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	22	MCC-DIS-01-WG01//47-PMP-004	MCC-DIS-01	MCC	47-PMP-004	Calcium Hypochlorite Dosing Pump #4	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	23	MCC-DIS-01-WG01//47-PMP-005	MCC-DIS-01	MCC	47-PMP-005	Calcium Hypochlorite Dosing Pump #5	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	24	MCC-DIS-01-WG01//47-PMP-006	MCC-DIS-01	MCC	47-PMP-006	Calcium Hypochlorite Dosing Pump #6	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	25	MCC-DIS-01-WG01//84-PMP-001	MCC-DIS-01	MCC	84-PMP-001	Leakage Water Return Pump 1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	26	MCC-DIS-01-WG01//84-PMP-002	MCC-DIS-01	MCC	84-PMP-002	Leakage Water Return Pump 2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	27	MCC-DIS-01-WG01//84-PMP-003	MCC-DIS-01	MCC	84-PMP-003	Reservoir Sump Pump 1	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	28	MCC-DIS-01-WG01//84-PMP-004	MCC-DIS-01	MCC	84-PMP-004	Reservoir Sump Pump 2	40	PVC	Copper	600/1 000 V	None	SWA	7	1.5	N/A	
T0	25	45-JB-01-WG01//45-XV-001	45-JB-01	JB/IO-Link Master 01	45-XV-001	Salt Dissolution Tank 1 Inlet On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	26	45-JB-01-WG01//45-XV-002	45-JB-01	JB/IO-Link Master 01	45-XV-002	Salt Dissolution Tank 1 Outlet On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	27	45-JB-01-WG01//45-XV-003	45-JB-01	JB/IO-Link Master 01	45-XV-003	Salt Dissolution Tank 2 Inlet On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	28	45-JB-01-WG01//45-XV-004	45-JB-01	JB/IO-Link Master 01	45-XV-004	Salt Dissolution Tank 2 Outlet On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	29	45-JB-02-WG01//45-LT-001	45-JB-02	JB/IO-Link Master 02	45-LT-001	Salt Dissolution Tank 1 Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	30	45-JB-03-WG01//45-LT-002	45-JB-03	JB/IO-Link Master 03	45-LT-002	Salt Dissolution Tank 2 Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	31	45-JB-02-WG01//45-LS-001	45-JB-02	JB/IO-Link Master 02	45-LS-001	Salt Dissolution Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	32	45-JB-02-WG01//45-LS-002	45-JB-02	JB/IO-Link Master 02	45-LS-002	Salt Dissolution Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	33	45-JB-02-WG01//45-LS-003	45-JB-02	JB/IO-Link Master 02	45-LS-003	Salt Dissolution Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	34	45-JB-02-WG01//45-LS-004	45-JB-02	JB/IO-Link Master 02	45-LS-004	Salt Dissolution Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	35	45-JB-03-WG01//45-LS-005	45-JB-03	JB/IO-Link Master 03	45-LS-005	Salt Dissolution Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	36	45-JB-03-WG01//45-LS-006	45-JB-03	JB/IO-Link Master 03	45-LS-006	Salt Dissolution Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	37	45-JB-03-WG01//45-LS-007	45-JB-03	JB/IO-Link Master 03	45-LS-007	Salt Dissolution Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	38	45-JB-03-WG01//45-LS-008	45-JB-03	JB/IO-Link Master 03	45-LS-008	Salt Dissolution Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	39	45-JB-02-WG01//98-FS-001	45-JB-02	JB/IO-Link Master 02	98-FS-001	Plate Heat Exchanger Feed Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	40	45-JB-03-WG01//98-TT-001	45-JB-03	JB/IO-Link Master 03	98-TT-001	Plate Heat Exchanger Outlet Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	41	45-JB-03-WG01//98-TT-002	45-JB-03	JB/IO-Link Master 03	98-TT-002	Plate Heat Exchanger Feed Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	42	45-JB-04-WG01//45-FT-001	45-JB-04	JB/IO-Link Master 04	45-FT-001	Water Softener 1 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	43	45-JB-04-WG01//45-AT-001	45-JB-04	JB/IO-Link Master 04	45-AT-001	Water Softener 1 Discharge Analyser Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	44	45-JB-04-WG01//45-XV-005	45-JB-04	JB/IO-Link Master 04	45-XV-005	Softened Water Feed to Electrolytic Reactor 1 On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	45	45-JB-04-WG01//45-FT-002	45-JB-04	JB/IO-Link Master 04	45-FT-002	Softened Water Feed to Electrolytic Reactor 1 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	46	45-JB-04-WG01//45-TT-001	45-JB-04	JB/IO-Link Master 04	45-TT-001	Softened Water Feed to Electrolytic Reactor 1 Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	47	45-JB-04-WG01//45-SIC-001	45-JB-04	JB/IO-Link Master 04	45-SIC-001	Brine pump for electrolytic reactor 1 Speed Indicator Controller	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	48	45-JB-04-WG01//45-ZS-001	45-JB-04	JB/IO-Link Master 04	45-ZS-001	Softened Water Feed to Electrolytic Reactor 1 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	49	45-JB-04-WG01//45-ZS-002	45-JB-04	JB/IO-Link Master 04	45-ZS-002	Softened Water Feed to Electrolytic Reactor 1 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	50	45-JB-05-WG01//45-ZS-003	45-JB-05	JB/IO-Link Master 05	45-ZS-003	Saturated Brine Solution Feed to Electrolytic Reactor 1 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	51	45-JB-05-WG01//45-TT-002	45-JB-05	JB/IO-Link Master 05	45-TT-002	Electrolytic Reactor 1 Temperature Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	52	45-JB-05-WG01//45-LS-009	45-JB-05	JB/IO-Link Master 05	45-LS-009	Electrolytic Reactor 1 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	53	45-JB-05-WG01//45-XV-006	45-JB-05	JB/IO-Link Master 05	45-XV-006	Softened Water Feed 1 to Salt Dissolution Tank On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		RIO-DIS-01-WG01//45-AT-002	RIO-DIS-01	JB/Remote IO 01	45-AT-002	On-site Sodium hypo Generator Analyser Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	
		RIO-DIS-01-WG01//45-AT-003	RIO-DIS-01	JB/Remote IO 01	45-AT-003	On-site Sodium hypo Generator Analyser Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	
		45-JB-06-WG01//45-FT-003	45-JB-06	JB/IO-Link Master 06	45-FT-003	Water Softener 2 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		45-JB-06-WG01//45-AT-004	45-JB-06	JB/IO-Link Master 06	45-AT-004	Water Softener 2 Discharge Analyser Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		45-JB-06-WG01//45-XV-007	45-JB-06	JB/IO-Link Master 06	45-XV-007	Softened Water Feed to Electrolytic Reactor 2 On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		45-JB-06-WG01//45-FT-004	45-JB-06	JB/IO-Link Master 06	45-FT-004	Softened Water Feed to Electrolytic Reactor 2 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	

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T0	60	45-JB-06-WG01/45-TT-003	45-JB-06	JB/IO-Link Master 06	45-TT-003	Softened Water Feed to Electrolytic Reactor 2 Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	61	45-JB-06-WG01/45-SIC-002	45-JB-06	JB/IO-Link Master 06	45-SIC-002	Brine pump for electrolytic reactor 2 Speed Indicator Controller	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	62	45-JB-06-WG01/45-ZS-004	45-JB-06	JB/IO-Link Master 06	45-ZS-004	Softened Water Feed to Electrolytic Reactor 2 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	63	45-JB-06-WG01/45-ZS-005	45-JB-06	JB/IO-Link Master 06	45-ZS-005	Softened Water Feed to Electrolytic Reactor 3 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	64	45-JB-07-WG01/45-ZS-006	45-JB-07	JB/IO-Link Master 07	45-ZS-006	Saturated Brine Solution Feed to Electrolytic Reactor 2 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	65	45-JB-07-WG01/45-TT-004	45-JB-07	JB/IO-Link Master 07	45-TT-004	Electrolytic Reactor 2 Temperature Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	66	45-JB-07-WG01/45-LS-010	45-JB-07	JB/IO-Link Master 07	45-LS-010	Electrolytic Reactor 2 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	67	45-JB-07-WG01/45-XV-008	45-JB-07	JB/IO-Link Master 07	45-XV-008	Softened Water Feed 2 to Salt Dissolution Tank On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	68	45-JB-07-WG01/45-FT-005	45-JB-07	JB/IO-Link Master 07	45-FT-005	Water Softener 3 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	69	45-JB-07-WG01/45-AT-005	45-JB-07	JB/IO-Link Master 07	45-AT-005	Water Softener 3 Discharge Analyser Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	70	45-JB-08-WG01/45-XV-009	45-JB-08	JB/IO-Link Master 08	45-XV-009	Softened Water Feed to Electrolytic Reactor 3 On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	71	45-JB-07-WG01/45-TT-005	45-JB-07	JB/IO-Link Master 07	45-TT-005	Softened Water Feed to Electrolytic Reactor 3 Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	72	45-JB-07-WG01/45-SIC-003	45-JB-07	JB/IO-Link Master 07	45-SIC-003	Brine pump for electrolytic reactor 3 Speed Indicator Controller	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	73	45-JB-08-WG01/45-ZS-007	45-JB-08	JB/IO-Link Master 08	45-ZS-007	Softened Water Feed to Electrolytic Reactor 3 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	74	45-JB-08-WG01/45-ZS-008	45-JB-08	JB/IO-Link Master 08	45-ZS-008	Softened Water Feed to Electrolytic Reactor 3 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	75	45-JB-08-WG01/45-ZS-009	45-JB-08	JB/IO-Link Master 08	45-ZS-009	Saturated Brine Solution Feed to Electrolytic Reactor 3 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	76	45-JB-08-WG01/45-TT-006	45-JB-08	JB/IO-Link Master 08	45-TT-006	Electrolytic Reactor 3 Temperature Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	77	45-JB-08-WG01/45-LS-011	45-JB-08	JB/IO-Link Master 08	45-LS-011	Electrolytic Reactor 3 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	78	45-JB-08-WG01/45-XV-010	45-JB-08	JB/IO-Link Master 08	45-XV-010	Softened Water Feed 3 to Salt Dissolution Tank On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	79	45-JB-09-WG01/45-FT-007	45-JB-09	JB/IO-Link Master 09	45-FT-007	Water Softener 4 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	80	45-JB-09-WG01/45-AT-006	45-JB-09	JB/IO-Link Master 09	45-AT-006	Water Softener 4 Discharge Analyser Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	81	45-JB-09-WG01/45-XV-011	45-JB-09	JB/IO-Link Master 09	45-XV-011	Softened Water Feed to Electrolytic Reactor 4 On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	82	45-JB-09-WG01/45-FT-008	45-JB-09	JB/IO-Link Master 09	45-FT-008	Softened Water Feed to Electrolytic Reactor 4 Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	83	45-JB-09-WG01/45-TT-007	45-JB-09	JB/IO-Link Master 09	45-TT-007	Softened Water Feed to Electrolytic Reactor 4 Temperature Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	84	45-JB-09-WG01/45-SIC-004	45-JB-09	JB/IO-Link Master 09	45-SIC-004	Brine pump for electrolytic reactor 4 Speed Indicator Controller	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	85	45-JB-10-WG01/45-ZS-010	45-JB-10	JB/IO-Link Master 10	45-ZS-010	Softened Water Feed to Electrolytic Reactor 4 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	86	45-JB-10-WG01/45-ZS-011	45-JB-10	JB/IO-Link Master 10	45-ZS-011	Softened Water Feed to Electrolytic Reactor 4 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	87	45-JB-10-WG01/45-ZS-012	45-JB-10	JB/IO-Link Master 10	45-ZS-012	Saturated Brine Solution Feed to Electrolytic Reactor 4 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	88	45-JB-10-WG01/45-TT-008	45-JB-10	JB/IO-Link Master 10	45-TT-008	Electrolytic Reactor 4 Temperature Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	89	45-JB-10-WG01/45-LS-012	45-JB-10	JB/IO-Link Master 10	45-LS-012	Electrolytic Reactor 4 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	90	45-JB-10-WG01/45-XV-012	45-JB-10	JB/IO-Link Master 10	45-XV-012	Softened Water Feed 4 to Salt Dissolution Tank On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	91	RIO-DIS-01-WG01/46-LS-001	RIO-DIS-01	JB/Remote IO 01	46-LS-001	Sodium Hypo Storage Tanks Basement Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	92	RIO-DIS-01-WG01/46-LS-002	RIO-DIS-01	JB/Remote IO 01	46-LS-002	NaOCl Storage Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	93	RIO-DIS-01-WG01/46-LS-003	RIO-DIS-01	JB/Remote IO 01	46-LS-003	NaOCl Storage Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	94	RIO-DIS-01-WG01/46-LS-004	RIO-DIS-01	JB/Remote IO 01	46-LS-004	NaOCl Storage Tank 1 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	95	RIO-DIS-01-WG01/46-LS-005	RIO-DIS-01	JB/Remote IO 01	46-LS-005	NaOCl Storage Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	96	RIO-DIS-01-WG01/46-ZS-001	RIO-DIS-01	JB/Remote IO 01	46-ZS-001	Commercial NaOCl Feed to NaOCl Storage Tank 1 Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	97	RIO-DIS-01-WG01/46-ZS-002	RIO-DIS-01	JB/Remote IO 01	46-ZS-002	Commercial NaOCl Feed to Chemical Injector Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	98	RIO-DIS-01-WG01/46-ZS-003	RIO-DIS-01	JB/Remote IO 01	46-ZS-003	NaOCl Feed to Storage Tank 2 in Series Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	99	RIO-DIS-01-WG01/46-ZS-004	RIO-DIS-01	JB/Remote IO 01	46-ZS-004	Diluted Commercial NaOCl Feed to NaOCl Storage Tank 2 Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	100	RIO-DIS-01-WG01/46-LT-001	RIO-DIS-01	JB/Remote IO 01	46-LT-001	NaOCl Storage Tank 1 Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	101	RIO-DIS-01-WG01/46-YA-001	RIO-DIS-01	JB/Remote IO 01	46-YA-001	NaOCl Storage Tank 1 Siren	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	102	RIO-DIS-01-WG01/46-LT-002	RIO-DIS-01	JB/Remote IO 01	46-LT-002	NaOCl Storage Tank 2 Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	103	RIO-DIS-01-WG01/46-YA-002	RIO-DIS-01	JB/Remote IO 01	46-YA-002	NaOCl Storage Tank 2 Siren	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	104	RIO-DIS-01-WG01/46-FS-001	RIO-DIS-01	JB/Remote IO 01	46-FS-001	NaOCl Storage Tank 1 Outlet Air Flow Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	105	RIO-DIS-01-WG01/46-FN -001	RIO-DIS-01	JB/Remote IO 01	46-FN -001	Storage Tank Blower 1 Fan	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	106	RIO-DIS-01-WG01/46-FN -002	RIO-DIS-01	JB/Remote IO 01	46-FN -002	Storage Tank Blower 2 Fan	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	107	RIO-DIS-01-WG01/46-LS-006	RIO-DIS-01	JB/Remote IO 01	46-LS-006	NaOCl Storage Tank 3 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	108	RIO-DIS-01-WG01/46-LS-007	RIO-DIS-01	JB/Remote IO 01	46-LS-007	NaOCl Storage Tank 4 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	109	RIO-DIS-01-WG01/46-LS-008	RIO-DIS-01	JB/Remote IO 01	46-LS-008	NaOCl Storage Tank 3 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	110	RIO-DIS-01-WG01/46-LS-009	RIO-DIS-01	JB/Remote IO 01	46-LS-009	NaOCl Storage Tank 4 Level Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	111	RIO-DIS-01-WG01/46-ZS-005	RIO-DIS-01	JB/Remote IO 01	46-ZS-005	Commercial NaOCl Feed to NaOCl Storage Tank 3 Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	112	RIO-DIS-01-WG01/46-ZS-006	RIO-DIS-01	JB/Remote IO 01	46-ZS-006	Commercial NaOCl Feed to Chemical Injector Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	113	RIO-DIS-01-WG01/46-ZS-007	RIO-DIS-01	JB/Remote IO 01	46-ZS-007	NaOCl Feed to Storage Tank 4 in Series Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	114	RIO-DIS-01-WG01/46-ZS-008	RIO-DIS-01	JB/Remote IO 01	46-ZS-008	Diluted commercial NaOCl Feed to NaOCl Storage Tank 4 Position Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	115	RIO-DIS-01-WG01/46-LT-003	RIO-DIS-01	JB/Remote IO 01	46-LT-003	NaOCl Storage Tank 3 Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	116	RIO-DIS-01-WG01/46-YA-003	RIO-DIS-01	JB/Remote IO 01	46-YA-003	NaOCl Storage Tank 3 Siren	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	117	RIO-DIS-01-WG01/46-LT-004	RIO-DIS-01	JB/Remote IO 01	46-LT-004	NaOCl Storage Tank 4 Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	118	RIO-DIS-01-WG01/46-YA-004	RIO-DIS-01	JB/Remote IO 01	46-YA-004	NaOCl Storage Tank 4 Siren	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	119	RIO-DIS-01-WG01/46-FS-002	RIO-DIS-01	JB/Remote IO 01	46-FS-002	NaOCl Storage Tank 3 Outlet Air Flow Switch	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	120	RIO-DIS-01-WG01/46-FN -003	RIO-DIS-01	JB/Remote IO 01	46-FN -003	Storage Tank Blower 1 Fan	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument
T0	121	RIO-DIS-01-WG01/46-FN -004	RIO-DIS-01	JB/Remote IO 01	46-FN -004	Storage Tank Blower 2 Fan	15	PVC	Copper	600/1 000 V	IOS	None	1pair	1.5	N/A	Intrinsically safe instrument

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Rev	MCC Item No	Cable Reference Designation	Cable Source	Source Description	Cable Destination	Destination Description	Estimated Length	Insulation	Conductor	Rating	Screen	Armour	No. of Cores	Area mm²	Communication Cable Protocol	Remarks
T0	122	45-JB-11-WG01//46-FS-003	45-JB-11	JB/IO-Link Master 11	46-FS-003	NaOCl Reservoir Inlet Dosing Pump 1 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	123	45-JB-11-WG01//46-FS-004	45-JB-11	JB/IO-Link Master 11	46-FS-004	NaOCl Reservoir Inlet Dosing Pump 2 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	124	45-JB-11-WG01//46-FS-005	45-JB-11	JB/IO-Link Master 11	46-FS-005	NaOCl Reservoir Inlet Dosing Pump 3 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	125	45-JB-11-WG01//46-FT-001	45-JB-11	JB/IO-Link Master 11	46-FT-001	NaOCl Reservoir Inlet Dosing Pumps Combined Discharges Flow Transmi	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	126	45-JB-11-WG01//46-FS-006	45-JB-11	JB/IO-Link Master 11	46-FS-006	NaOCl Reservoir Outlet Dosing Pump 1 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	127	45-JB-11-WG01//46-FS-007	45-JB-11	JB/IO-Link Master 11	46-FS-007	NaOCl Reservoir Outlet Dosing Pump 2 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	128	45-JB-11-WG01//46-FS-008	45-JB-11	JB/IO-Link Master 11	46-FS-008	NaOCl Reservoir Outlet Dosing Pump 3 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	129	45-JB-11-WG01//46-FT-002	45-JB-11	JB/IO-Link Master 11	46-FT-002	NaOCl Reservoir Outlet Dosing Pumps Combined Discharges Flow Trans	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	130	45-JB-12-WG01//46-XV-001	45-JB-12	JB/IO-Link Master 12	46-XV-001	Commercial NaOCl Feed On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	131	45-JB-12-WG01//46-ZS-009	45-JB-12	JB/IO-Link Master 12	46-ZS-009	Commercial NaOCl Manifold Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	132	45-JB-12-WG01//46-ZS-010	45-JB-12	JB/IO-Link Master 12	46-ZS-010	Dilution Water Feed to Injector 1 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	133	45-JB-12-WG01//46-ZS-011	45-JB-12	JB/IO-Link Master 12	46-ZS-011	Dilution Water Feed to Injector 1 Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	134	45-JB-12-WG01//46-ZS-012	45-JB-12	JB/IO-Link Master 12	46-ZS-012	Injectors Combined Discharge Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	135	45-JB-12-WG01//46-XV-002	45-JB-12	JB/IO-Link Master 12	46-XV-002	Dilution Water Feed On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	136	45-JB-13-WG01//47-FT-001	45-JB-13	JB/IO-Link Master 13	47-FT-001	Service Water Feed Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	137	45-JB-13-WG01//47-FI-001	45-JB-13	JB/IO-Link Master 13	47-FI-001	Service Water Feed Flow Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	138	45-JB-13-WG01//47-XV-001	45-JB-13	JB/IO-Link Master 13	47-XV-001	Service Water Feed On/Off Valve	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	139	45-JB-13-WG01//47-LS-001	45-JB-13	JB/IO-Link Master 13	47-LS-001	Calcium Hypo Tanks Basement Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	140	45-JB-13-WG01//47-LS-002	45-JB-13	JB/IO-Link Master 13	47-LS-002	Calcium Hypo Storage Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	141	45-JB-13-WG01//47-LS-003	45-JB-13	JB/IO-Link Master 13	47-LS-003	Calcium Hypo Storage Tank 2 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	142	45-JB-13-WG01//47-LT-001	45-JB-13	JB/IO-Link Master 13	47-LT-001	Calcium Hypo Storage Tank 2 Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	143	45-JB-14-WG01//47-YA-001	45-JB-14	JB/IO-Link Master 14	47-YA-001	Calcium Hypo Storage Tank 2 Siren	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	144	45-JB-14-WG01//47-ZS-001	45-JB-14	JB/IO-Link Master 14	47-ZS-001	Calcium Hypo Storage Tank 2 Feed Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	145	45-JB-14-WG01//47-LS-004	45-JB-14	JB/IO-Link Master 14	47-LS-004	Calcium Hypo Storage Tank 3 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	146	45-JB-14-WG01//47-LS-005	45-JB-14	JB/IO-Link Master 14	47-LS-005	Calcium Hypo Storage Tank 3 Level Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	147	45-JB-14-WG01//47-LT-002	45-JB-14	JB/IO-Link Master 14	47-LT-002	Calcium Hypo Storage Tank 3 Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	148	45-JB-14-WG01//47-YA-002	45-JB-14	JB/IO-Link Master 14	47-YA-002	Calcium Hypo Storage Tank 3 Siren	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	149	45-JB-14-WG01//47-ZS-002	45-JB-14	JB/IO-Link Master 14	47-ZS-002	Calcium Hypo Storage Tank 3 Feed Position Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	150	45-JB-15-WG01//47-FS-001	45-JB-15	JB/IO-Link Master 15	47-FS-001	Calcium HypoReservoir Inlet Dosing Pump 1 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	151	45-JB-15-WG01//47-FS-002	45-JB-15	JB/IO-Link Master 15	47-FS-002	Calcium Hypo Reservoir Inlet Dosing Pump 2 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	152	45-JB-15-WG01//47-FS-003	45-JB-15	JB/IO-Link Master 15	47-FS-003	Calcium Hypo Reservoir Inlet Dosing Pump 3 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	153	45-JB-15-WG01//47-FT-002	45-JB-15	JB/IO-Link Master 15	47-FT-002	Calcium Hypo Reservoir Inlet Dosing Pumps Combined Discharges Flow T	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	154	45-JB-15-WG01//47-FS-004	45-JB-15	JB/IO-Link Master 15	47-FS-004	Calcium Hypo Reservoir Outlet Dosing Pump 1 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	155	45-JB-15-WG01//47-FS-005	45-JB-15	JB/IO-Link Master 15	47-FS-005	Calcium Hypo Reservoir Outlet Dosing Pump 2 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	156	45-JB-15-WG01//47-FS-006	45-JB-15	JB/IO-Link Master 15	47-FS-006	Calcium Hypo Reservoir Outlet Dosing Pump 3 Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	157	45-JB-15-WG01//47-FT-003	45-JB-15	JB/IO-Link Master 15	47-FT-003	Calcium Hypo Reservoir Outlet Dosing Pumps Combined Discharges Flow	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	158	45-JB-16-WG01//74-LT-001	45-JB-16	JB/IO-Link Master 16	74-LT-001	Service Water Sump Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	159	45-JB-16-WG01//74-LT-002	45-JB-16	JB/IO-Link Master 16	74-LT-002	Service Water Sump Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	160	45-JB-16-WG01//74-PI-001	45-JB-16	JB/IO-Link Master 16	74-PI-001	Site Service Water Pump 1 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	161	45-JB-16-WG01//74-PI-002	45-JB-16	JB/IO-Link Master 16	74-PI-002	Site Service Water Pump 1 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	162	45-JB-16-WG01//74-FS-001	45-JB-16	JB/IO-Link Master 16	74-FS-001	Site Service Water Pump 1 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		45-JB-16-WG01//74-PI-003	45-JB-16	JB/IO-Link Master 16	74-PI-003	Site Service Water Pump 2 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	164	45-JB-16-WG01//74-PI-004	45-JB-16	JB/IO-Link Master 16	74-PI-004	Site Service Water Pump 2 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	165	45-JB-16-WG01//74-FS-002	45-JB-16	JB/IO-Link Master 16	74-FS-002	Site Service Water Pump 2 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	166	45-JB-17-WG01//74-PI-005	45-JB-17	JB/IO-Link Master 17	74-PI-005	Site Service Water Pump 3 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	167	45-JB-17-WG01//74-PI-006	45-JB-17	JB/IO-Link Master 17	74-PI-006	Site Service Water Pump 3 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	168	45-JB-17-WG01//74-FS-003	45-JB-17	JB/IO-Link Master 17	74-FS-003	Site Service Water Pump 3 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	169	45-JB-17-WG01//74-PI-007	45-JB-17	JB/IO-Link Master 17	74-PI-007	Site Service Water Pump 4 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	170	45-JB-17-WG01//74-PI-008	45-JB-17	JB/IO-Link Master 17	74-PI-008	Site Service Water Pump 4 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	171	45-JB-17-WG01//74-FS-004	45-JB-17	JB/IO-Link Master 17	74-FS-004	Site Service Water Pump 4 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	172	45-JB-17-WG01//74-FT-002	45-JB-17	JB/IO-Link Master 17	74-FT-002	Site Service Water Pumps - Combined Discharge Flow Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	173	45-JB-17-WG01//74-PT-001	45-JB-17	JB/IO-Link Master 17	74-PT-001	Site Service Water Pumps - Combined Discharge Pressure Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	174	45-JB-18-WG01//74-PI-010	45-JB-18	JB/IO-Link Master 18	74-PI-010	Fire Water Pump 1 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	175	45-JB-18-WG01//74-PI-011	45-JB-18	JB/IO-Link Master 18	74-PI-011	Fire Water Pump 1 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-FS-005	45-JB-18	JB/IO-Link Master 18	74-FS-005	Fire Water Pump 1 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-PI-012	45-JB-18	JB/IO-Link Master 18	74-PI-012	Fire Water Pump 2 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-PI-013	45-JB-18	JB/IO-Link Master 18	74-PI-013	Fire Water Pump 2 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-FS-006	45-JB-18	JB/IO-Link Master 18	74-FS-006	Fire Water Pump 2 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-PI-014	45-JB-19	JB/IO-Link Master 19	74-PI-014	Fire Water Pump 3 - Suction Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
		[redacted]-WG01//74-PI-015	45-JB-19	JB/IO-Link Master 19	74-PI-015	Fire Water Pump 3 - Discharge Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	

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Rev	MCC Item No	Cable Reference Designation	Cable Source	Source Description	Cable Destination	Destination Description	Estimated Length	Insulation	Conductor	Rating	Screen	Armour	Ins'd Cores	Area mm²	Communication Cable Protocol	Remarks
T0	182	45-JB-19-WG01/74-FS-007	45-JB-19	JB/IO-Link Master 19	74-FS-007	Fire Water Pump 3 - Discharge Flow Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	183	45-JB-19-WG01/74-PI-016	45-JB-19	JB/IO-Link Master 19	74-PI-016	Fire Water Pumps Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	184	45-JB-19-WG01/74-PI-017	45-JB-19	JB/IO-Link Master 19	74-PI-017	Fire Water Pumps Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	185	45-JB-19-WG01/74-PI-018	45-JB-19	JB/IO-Link Master 19	74-PI-018	Fire Water Pumps Pressure Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	186	45-JB-20-WG01/74-PS-001	45-JB-20	JB/IO-Link Master 20	74-PS-001	Fire Water Pumps Pressure Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	187	45-JB-20-WG01/74-PS-002	45-JB-20	JB/IO-Link Master 20	74-PS-002	Fire Water Pumps Pressure Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	188	45-JB-20-WG01/74-PS-003	45-JB-20	JB/IO-Link Master 20	74-PS-003	Fire Water Pumps Pressure Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	189	45-JB-20-WG01/74-PS-004	45-JB-20	JB/IO-Link Master 20	74-PS-004	Fire Water Pumps Pressure Switch	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	190	45-JB-20-WG01/74-PT-002	45-JB-20	JB/IO-Link Master 20	74-PT-002	Fire Water Pumps Pressure Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	191	45-JB-21-WG01/84-FI-001	45-JB-21	JB/IO-Link Master 21	84-FI-001	Leakage Water Return Pump 1 Discharge Flow Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	192	45-JB-22-WG01/84-FI-002	45-JB-22	JB/IO-Link Master 22	84-FI-002	Leakage Water Return Pump 2 Discharge Flow Indicator	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	193	45-JB-21-WG01/84-LT-001	45-JB-21	JB/IO-Link Master 21	84-LT-001	Leakage Water Return Pump 1 Inlet Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	194	45-JB-22-WG01/84-LT-002	45-JB-22	JB/IO-Link Master 22	84-LT-002	Leakage Water Return Pump 2 Inlet Level Transmitter	15	PVC	Copper	600/1 000 V	None	None	3	1.5	IO-Link	
T0	195	RIO-CHB-01-WG01/84-LT-003	RIO-CHB-01	Inlet Remote IO	84-LT-003	Muldersvlei Reservoir Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	196	RIO-CHB-01-WG01/84-LT-004	RIO-CHB-01	Inlet Remote IO	84-LT-004	Muldersvlei Reservoir Level Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	197	RIO-CHB-01-WG01/84-XV-001	RIO-CHB-01	Inlet Remote IO	84-XV-001	Water Feed Line from Wemmershoek WTW On/Off Valve	15	PVC	Copper	600/1 000 V	IOS	None	8pair	1.5	N/A	
T0	198	RIO-CHB-01-WG01/84-FT-001	RIO-CHB-01	Inlet Remote IO	84-FT-001	Water Feed Line from Wemmershoek WTW Flow Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	199	RIO-CHB-01-WG01/84-AT-001	RIO-CHB-01	Inlet Remote IO	84-AT-001	Water Feed Line from Wemmershoek WTW Analyser Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	200	RIO-CHB-02-WG01/84-FT-002	RIO-CHB-02	Outlet Remote IO	84-FT-002	Water outlet to Glen Garry Reservoir Flow Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	201	RIO-CHB-02-WG01/84-FCV-001	RIO-CHB-02	Outlet Remote IO	84-FCV-001	Water outlet to Glen Garry Reservoir Flow Control Valve	15	PVC	Copper	600/1 000 V	IOS	None	8pair	1.5	N/A	
T0	202	RIO-CHB-02-WG01/84-FCV-002	RIO-CHB-02	Outlet Remote IO	84-FCV-002	Water outlet to Glen Garry Reservoir Flow Control Valve	15	PVC	Copper	600/1 000 V	IOS	None	16pair	1.5	N/A	
T0	203	RIO-CHB-02-WG01/84-AT-002	RIO-CHB-02	Outlet Remote IO	84-AT-002	Water outlet to Glen Garry Reservoir Analyser Transmitter	15	PVC	Copper	600/1 000 V	IOS	None	2pair	1.5	N/A	
T0	204	PLC-WC01/45-JB-01	PLC	PLC	45-JB-01	JB/IO-Link Master 01	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 01 Ethernet Connection to PLC/Switch
T0	205	PLC-WC01/45-JB-02	PLC	PLC	45-JB-02	JB/IO-Link Master 02	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 02 Ethernet Connection to PLC/Switch
T0	206	PLC-WC01/45-JB-03	PLC	PLC	45-JB-03	JB/IO-Link Master 03	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 03 Ethernet Connection to PLC/Switch
T0	207	PLC-WC01/45-JB-04	PLC	PLC	45-JB-04	JB/IO-Link Master 04	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 04 Ethernet Connection to PLC/Switch
T0	208	PLC-WC01/45-JB-05	PLC	PLC	45-JB-05	JB/IO-Link Master 05	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 05 Ethernet Connection to PLC/Switch
T0	209	PLC-WC01/45-JB-06	PLC	PLC	45-JB-06	JB/IO-Link Master 06	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 06 Ethernet Connection to PLC/Switch
T0	210	PLC-WC01/45-JB-07	PLC	PLC	45-JB-07	JB/IO-Link Master 07	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 07 Ethernet Connection to PLC/Switch
T0	211	PLC-WC01/45-JB-08	PLC	PLC	45-JB-08	JB/IO-Link Master 08	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 08 Ethernet Connection to PLC/Switch
T0	212	PLC-WC01/45-JB-09	PLC	PLC	45-JB-09	JB/IO-Link Master 09	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 09 Ethernet Connection to PLC/Switch
T0	213	PLC-WC01/45-JB-10	PLC	PLC	45-JB-10	JB/IO-Link Master 10	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 10 Ethernet Connection to PLC/Switch
T0	214	PLC-WC01/45-JB-11	PLC	PLC	45-JB-11	JB/IO-Link Master 11	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 11 Ethernet Connection to PLC/Switch
T0	215	PLC-WC01/45-JB-12	PLC	PLC	45-JB-12	JB/IO-Link Master 12	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 12 Ethernet Connection to PLC/Switch
T0	216	PLC-WC01/45-JB-13	PLC	PLC	45-JB-13	JB/IO-Link Master 13	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 13 Ethernet Connection to PLC/Switch
T0	217	PLC-WC01/45-JB-14	PLC	PLC	45-JB-14	JB/IO-Link Master 14	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 14 Ethernet Connection to PLC/Switch
T0	218	PLC-WC01/45-JB-15	PLC	PLC	45-JB-15	JB/IO-Link Master 15	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 15 Ethernet Connection to PLC/Switch
T0	219	PLC-WC01/45-JB-16	PLC	PLC	45-JB-16	JB/IO-Link Master 16	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 16 Ethernet Connection to PLC/Switch
T0	220	PLC-WC01/45-JB-17	PLC	PLC	45-JB-17	JB/IO-Link Master 17	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 17 Ethernet Connection to PLC/Switch
T0	221	PLC-WC01/45-JB-18	PLC	PLC	45-JB-18	JB/IO-Link Master 18	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 18 Ethernet Connection to PLC/Switch
T0	222	PLC-WC01/45-JB-19	PLC	PLC	45-JB-19	JB/IO-Link Master 19	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 19 Ethernet Connection to PLC/Switch
T0	223	PLC-WC01/45-JB-20	PLC	PLC	45-JB-20	JB/IO-Link Master 20	50	N/A	CAT6E	N/A	OS	None	N/A	N/A	Industrial Ethernet	JB/IO-Link Master 20 Ethernet Connection to PLC/Switch
T0	224	PLC-WC01/RIO-DIS-01	PLC	PLC	RIO-DIS-01	JB/Remote IO 01	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Multi mode fibre	
T0	225	PLC-WC01/RIO-CHB-01	PLC	PLC	RIO-CHB-01	Inlet Remote IO	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Multi mode fibre	
T0	226	PLC-WC01/RIO-CHB-02	PLC	PLC	RIO-CHB-02	Outlet Remote IO	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Multi mode fibre	

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Rev	Item No	Plant Reference Number	Service Description	Digital Input										Digital Output			Analog Input					Analog Output		IO Link	Comments
				CB Tripped	Fault	E-Stop	Running/ Stopped	Opened	Closed	Auto/Man/Off	Overheat	Seal Failure	Other	Start/Stop	Open/Close Forward/Reverse	Other	Measured Value	Amps	Volt	kW	kWh	Set Point	Other	Data	
			GEN-PNL: GENERATOR CHANGEOVER PANEL																						
T0	1	GEN-PNL-Q01	Incomer 1	1	1			1	1				4					1	1	1	1				Alarms for Amps and Voltage as per MCC Table
T0	2	GEN-PNL-Q02	Incomer 2 (Generator)	1	1			1	1				4					1	1	1	1				Alarms for Amps and Voltage as per MCC Table
T0	3	MCC-DIS-01-Q51	Disinfection MCC	1	1																				
T0	4	MCC-DIS-02	Fire Pump Panel	1	1																				
			MCC-DIS-01: DISINFECTION MCC																						
T0	1	MCC-DIS-01-Q01	Incomer	1	1			1	1				4					1	1	1	1				Alarms for Amps and Voltage as per MCC Table
T0	2	MCC-DIS-01-Q02	Control incomer	1	1																				Control Supply Healthy
T0	3	74-PMP-001	Site Service Water Pump #1	1	1	1	2			2	1			2			1	1	1	1					
T0	4	74-PMP-002	Site Service Water Pump #2	1	1	1	2			2	1			2			1	1	1	1					
T0	5	74-PMP-003	Site Service Water Pump #3	1	1	1	2			2	1			2			1	1	1	1					
T0	6	74-PMP-004	Site Service Water Pump #4	1	1	1	2			2	1			2			1	1	1	1					
T0	7	98-CT-001	Chiller	1	1																				
T0	8	45-CR-001	Overhead Travelling Crane	1	1																				
T0	9	45-CR-002	Overhead Travelling Crane	1	1																				
T0	10	45-CR-003	Overhead Travelling Crane	1	1																				
T0	11	45-EC-001	OSEC Unit #1	1	1																				
T0	12	45-EC-002	OSEC Unit #2	1	1																				
T0	13	45-EC-003	OSEC Unit #3	1	1																				
T0	14	45-EC-004	OSEC Unit #4	1	1																				
T0	15	46-BL-001	Storage Tank Blower #1	1	1	1	2			2	1			2	1			1	1	1					
T0	16	46-BL-002	Storage Tank Blower #2	1	1	1	2			2	1			2	1			1	1	1					
T0	17	46-BL-003	Storage Tank Blower #3	1	1	1	2			2	1			2	1			1	1	1					
T0	18	46-BL-004	Storage Tank Blower #4	1	1	1	2			2	1			2	1			1	1	1					
T0	19	46-PMP-001	Sodium Hypochlorite Dosing Pump #1	1	1	1	2			2	1			2			1	1	1	1					
T0	20	46-PMP-002	Sodium Hypochlorite Dosing Pump #2	1	1	1	2			2	1			2			1	1	1	1					
T0	21	46-PMP-003	Sodium Hypochlorite Dosing Pump #3	1	1	1	2			2	1			2			1	1	1	1					
T0	22	46-PMP-004	Sodium Hypochlorite Dosing Pump #4	1	1	1	2			2	1			2			1	1	1	1					
T0	23	46-PMP-005	Sodium Hypochlorite Dosing Pump #5	1	1	1	2			2	1			2			1	1	1	1					
T0	24	46-PMP-006	Sodium Hypochlorite Dosing Pump #6	1	1	1	2			2	1			2			1	1	1	1					
T0	25	46-PMP-007	Chemical Pump	1	1	1	2			2	1			2			1	1	1	1					
T0	26	47-PMP-001	Calcium Hypochlorite Dosing Pump #1	1	1	1	2			2	1			2			1	1	1	1					
T0	27	47-PMP-002	Calcium Hypochlorite Dosing Pump #2	1	1	1	2			2	1			2			1	1	1	1					
T0	28	47-PMP-003	Calcium Hypochlorite Dosing Pump #3	1	1	1	2			2	1			2			1	1	1	1					
T0	29	47-PMP-004	Calcium Hypochlorite Dosing Pump #4	1	1	1	2			2	1			2			1	1	1	1					
T0	30	47-PMP-005	Calcium Hypochlorite Dosing Pump #5	1	1	1	2			2	1			2			1	1	1	1					
T0	31	47-PMP-006	Calcium Hypochlorite Dosing Pump #6	1	1	1	2			2	1			2			1	1	1	1					
T0	32	84-PMP-001	Leakage Water Return Pump 1	1	1	1	2			2	1			2			1	1	1	1					
T0	33	84-PMP-002	Leakage Water Return Pump 2	1	1	1	2			2	1			2			1	1	1	1					
T0	34	84-PMP-003	Reservoir Sump Pump 1	1	1	1	2			2	1			2			1	1	1	1					
T0	35	84-PMP-004	Reservoir Sump Pump 2	1	1	1	2			2	1			2			1	1	1	1					
T0	36	DB-OSEC	SP&L DB Feeder - OSEC Building																						
T0	37	DB-ADM	SP&L DB Feeder - Admin Building																						
T0	38	DB-FLD-01	Field DB 01 Feeder																						
T0	39	DB-FLD-04	Field DB 04 Feeder																						
T0	40	DB-FLD-06	Field DB 06 Feeder																						
T0	41	-	Salt Tanks Internal Light																						
T0	42	-	Salt Tanks Internal Light																						

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Rev	Item No	Plant Reference Number	Service Description	CB Tripped	Fault	E-Stop	Running/ Stopped	Opened	Closed	Auto/Man/Off	Overheat	Seal Failure	Other	Start/Stop	Open/Close Forward/Reverse	Other	Measured Value	Amps	Volt	kW	kWh	Set Point	Other	Data	Comments
MCC-DIS-02: FIRE PUMP PANEL																									
T0	1	MCC-DIS-02-Q01	Incomer	1	1			1	1				4					1	1	1	1				Alarms for Amps and Voltage as per MCC Table
T0	2	MCC-DIS-02-Q02	Control incomer	1	1			1	1				4					1	1	1	1				Control Supply Healthy
T0	3	74-PMP-005	Fire Water Pump #1	1	1	1	2			2	1			2			1	1	1	1					
T0	4	74-PMP-007	Fire Water Pump #3 (Jockey)	1	1	1	2			2	1			2			1	1	1	1					
INSTRUMENTATION																									
T0	1	45-XV-001	Salt Dissolution Tank 1 Inlet On/Off Valve																					2	Digital signals connect to IO Link Master
T0	2	45-XV-002	Salt Dissolution Tank 1 Outlet On/Off Valve																					2	Digital signals connect to IO Link Master
T0	3	45-XV-003	Salt Dissolution Tank 2 Inlet On/Off Valve																					2	Digital signals connect to IO Link Master
T0	4	45-XV-004	Salt Dissolution Tank 2 Outlet On/Off Valve																					2	Digital signals connect to IO Link Master
T0	5	45-LT-001	Salt Dissolution Tank 1 Level Transmitter																					1	IO-Link instrument
T0	6	45-LT-002	Salt Dissolution Tank 2 Level Transmitter																					1	IO-Link instrument
T0	7	45-LS-001	Salt Dissolution Tank 1 Level Switch																					1	IO-Link instrument
T0	8	45-LS-002	Salt Dissolution Tank 1 Level Switch																					1	IO-Link instrument
T0	9	45-LS-003	Salt Dissolution Tank 1 Level Switch																					1	IO-Link instrument
T0	10	45-LS-004	Salt Dissolution Tank 1 Level Switch																					1	IO-Link instrument
T0	11	45-LS-005	Salt Dissolution Tank 2 Level Switch																					1	IO-Link instrument
T0	12	45-LS-006	Salt Dissolution Tank 2 Level Switch																					1	IO-Link instrument
T0	13	45-LS-007	Salt Dissolution Tank 2 Level Switch																					1	IO-Link instrument
T0	14	45-LS-008	Salt Dissolution Tank 2 Level Switch																					1	IO-Link instrument
T0	15	98-FS-001	Plate Heat Exchanger Feed Flow Switch																					1	IO-Link instrument
T0	16	98-TT-001	Plate Heat Exchanger Outlet Temperature Transmitter																					1	IO-Link instrument
T0	17	98-TT-002	Plate Heat Exchanger Feed Temperature Transmitter																					1	IO-Link instrument
T0	18	45-FT-001	Water Softener 1 Flow Transmitter																					1	IO-Link instrument
T0	19	45-AT-001	Water Softener 1 Discharge Analyser Transmitter																					1	IO-Link instrument
T0	20	45-XV-005	Softened Water Feed to Electrolytic Reactor 1 On/Off Valve																					2	Digital signals connect to IO Link Master
T0	21	45-FT-002	Softened Water Feed to Electrolytic Reactor 1 Flow Transmitter																					1	IO-Link instrument
T0	22	45-TT-001	Softened Water Feed to Electrolytic Reactor 1 Temperature Transmitter																					1	IO-Link instrument
T0	23	45-SIC-001	Brine pump for electrolytic reactor 1 Speed Indicator Controller																					1	IO-Link instrument
T0	24	45-ZS-001	Softened Water Feed to Electrolytic Reactor 1 Position Switch																					1	IO-Link instrument
T0	25	45-ZS-002	Softened Water Feed to Electrolytic Reactor 1 Position Switch																					1	IO-Link instrument
T0	26	45-ZS-003	Saturated Brine Solution Feed to Electrolytic Reactor 1 Position Switch																					1	IO-Link instrument
T0	27	45-TT-002	Electrolytic Reactor 1 Temperature Transmitter														1								
T0	28	45-LS-009	Electrolytic Reactor 1 Level Switch					1	1																
T0	29	45-XV-006	Softened Water Feed 1 to Salt Dissolution Tank On/Off Valve																					2	Digital signals connect to IO Link Master
T0	30	45-AT-002	On-site Sodium hypo Generator Analyser Transmitter														1								Instrisically safe instrument
T0	31	45-AT-003	On-site Sodium hypo Generator Analyser Transmitter														1								Instrisically safe instrument
T0	32	45-FT-003	Water Softener 2 Flow Transmitter																					1	IO-Link instrument
T0	33	45-AT-004	Water Softener 2 Discharge Analyser Transmitter																					1	IO-Link instrument
T0	34	45-XV-007	Softened Water Feed to Electrolytic Reactor 2 On/Off Valve																					2	Digital signals connect to IO Link Master
T0	35	45-FT-004	Softened Water Feed to Electrolytic Reactor 2 Flow Transmitter																					1	IO-Link instrument
T0	36	45-TT-003	Softened Water Feed to Electrolytic Reactor 2 Temperature Transmitter																					1	IO-Link instrument
T0	37	45-SIC-002	Brine pump for electrolytic reactor 2 Speed Indicator Controller																					1	IO-Link instrument
T0	38	45-ZS-004	Softened Water Feed to Electrolytic Reactor 2 Position Switch																					1	IO-Link instrument
T0	39	45-ZS-005	Softened Water Feed to Electrolytic Reactor 2 Position Switch																					1	IO-Link instrument
T0	40	45-ZS-006	Saturated Brine Solution Feed to Electrolytic Reactor 2 Position Switch																					1	IO-Link instrument
T0	41	45-TT-004	Electrolytic Reactor 2 Temperature Transmitter														1								
T0	42	45-LS-010	Electrolytic Reactor 2 Level Switch					1	1																
T0	43	45-XV-008	Softened Water Feed 2 to Salt Dissolution Tank On/Off Valve																					2	Digital signals connect to IO Link Master
T0	44	45-FT-005	Water Softener 3 Flow Transmitter																					1	IO-Link instrument
T0	45	45-AT-005	Water Softener 3 Discharge Analyser Transmitter																					1	IO-Link instrument
T0	46	XV-009	Softened Water Feed to Electrolytic Reactor 3 On/Off Valve																					2	Digital signals connect to IO Link Master

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Rev	Item No	Plant Reference Number	Service Description	CB Tripped	Fault	E-Stop	Running/ Stopped	Opened	Closed	Auto/Man/Off	Overheat	Seal Failure	Other	Start/Stop	Open/Close Forward/Reverse	Other	Measured Value	Amps	Volt	kW	kWh	Set Point	Other	Data	Comments
T0	47	45-TT-005	Softened Water Feed to Electrolytic Reactor 3 Temperature Transmitter																					1	IO-Link instrument
T0	48	45-SIC-003	Brine pump for electrolytic reactor 3 Speed Indicator Controller																					1	IO-Link instrument
T0	49	45-ZS-007	Softened Water Feed to Electrolytic Reactor 3 Position Switch																					1	IO-Link instrument
T0	50	45-ZS-008	Softened Water Feed to Electrolytic Reactor 3 Position Switch																					1	IO-Link instrument
T0	51	45-ZS-009	Saturated Brine Solution Feed to Electrolytic Reactor 3 Position Switch																					1	IO-Link instrument
T0	52	45-TT-006	Electrolytic Reactor 3 Temperature Transmitter														1								
T0	53	45-LS-011	Electrolytic Reactor 3 Level Switch					1	1																
T0	54	45-XV-010	Softened Water Feed 3 to Salt Dissolution Tank On/Off Valve																					2	Digital signals connect to IO Link Master
T0	55	45-FT-007	Water Softener 4 Flow Transmitter																					1	IO-Link instrument
T0	56	45-AT-006	Water Softener 4 Discharge Analyser Transmitter																					1	IO-Link instrument
T0	57	45-XV-011	Softened Water Feed to Electrolytic Reactor 4 On/Off Valve																					2	IO-Link instrument
T0	58	45-FT-008	Softened Water Feed to Electrolytic Reactor 4 Flow Transmitter																					1	Digital signals connect to IO Link Master
T0	59	45-TT-007	Softened Water Feed to Electrolytic Reactor 4 Temperature Transmitter																					1	IO-Link instrument
T0	60	45-SIC-004	Brine pump for electrolytic reactor 4 Speed Indicator Controller																					1	IO-Link instrument
T0	61	45-ZS-010	Softened Water Feed to Electrolytic Reactor 4 Position Switch																					1	IO-Link instrument
T0	62	45-ZS-011	Softened Water Feed to Electrolytic Reactor 4 Position Switch																					1	IO-Link instrument
T0	63	45-ZS-012	Saturated Brine Solution Feed to Electrolytic Reactor 4 Position Switch																					1	IO-Link instrument
T0	64	45-TT-008	Electrolytic Reactor 4 Temperature Transmitter														1								
T0	65	45-LS-012	Electrolytic Reactor 4 Level Switch					1	1																
T0	66	45-XV-012	Softened Water Feed 4 to Salt Dissolution Tank On/Off Valve																					2	Digital signals connect to IO Link Master
T0	67	46-LS-001	Sodium Hypo Storage Tanks Basement Level Switch														1								Intrisically safe instrument
T0	68	46-LS-002	NaOCl Storage Tank 1 Level Switch														1								Intrisically safe instrument
T0	69	46-LS-003	NaOCl Storage Tank 2 Level Switch														1								Intrisically safe instrument
T0	70	46-LS-004	NaOCl Storage Tank 1 Level Switch														1								Intrisically safe instrument
T0	71	46-LS-005	NaOCl Storage Tank 2 Level Switch														1								Intrisically safe instrument
T0	72	46-ZS-001	Commercial NaOCl Feed to NaOCl Storage Tank 1 Position Switch														1								Intrisically safe instrument
T0	73	46-ZS-002	Commercial NaOCl Feed to Chemical Injector Position Switch														1								Intrisically safe instrument
T0	74	46-ZS-003	NaOCl Feed to Storage Tank 2 in Series Position Switch														1								Intrisically safe instrument
T0	75	46-ZS-004	Diluted Commercial NaOCl Feed to NaOCl Storage Tank 2 Position Switch														1								Intrisically safe instrument
T0	76	46-LT-001	NaOCl Storage Tank 1 Level Transmitter														1								Intrisically safe instrument
T0	77	46-YA-001	NaOCl Storage Tank 1 Siren														1								Intrisically safe instrument
T0	78	46-LT-002	NaOCl Storage Tank 2 Level Transmitter														1								Intrisically safe instrument
T0	79	46-YA-002	NaOCl Storage Tank 2 Siren														1								Intrisically safe instrument
T0	80	46-FS-001	NaOCl Storage Tank 1 Outlet Air Flow Switch														1								Intrisically safe instrument
T0	81	46-FN -001	Storage Tank Blower 1 Fan														1								Intrisically safe instrument
T0	82	46-FN -002	Storage Tank Blower 2 Fan														1								Intrisically safe instrument
T0	83	46-LS-006	NaOCl Storage Tank 3 Level Switch														1								Intrisically safe instrument
T0	84	46-LS-007	NaOCl Storage Tank 4 Level Switch														1								Intrisically safe instrument
T0	85	46-LS-008	NaOCl Storage Tank 3 Level Switch														1								Intrisically safe instrument
T0	86	46-LS-009	NaOCl Storage Tank 4 Level Switch														1								Intrisically safe instrument
T0	87	46-ZS-005	Commercial NaOCl Feed to NaOCl Storage Tank 3 Position Switch														1								Intrisically safe instrument
T0	88	46-ZS-006	Commercial NaOCl Feed to Chemical Injector Position Switch														1								Intrisically safe instrument
T0	89	46-ZS-007	NaOCl Feed to Storage Tank 4 in Series Position Switch														1								Intrisically safe instrument
T0	90	46-ZS-008	Diluted commercial NaOCl Feed to NaOCl Storage Tank 4 Position Switch														1								Intrisically safe instrument
T0	91	46-LT-003	NaOCl Storage Tank 3 Level Transmitter														1								Intrisically safe instrument
T0	92	46-YA-003	NaOCl Storage Tank 3 Siren														1								Intrisically safe instrument
T0	93	46-LT-004	NaOCl Storage Tank 4 Level Transmitter														1								Intrisically safe instrument
T0	94	46-YA-004	NaOCl Storage Tank 4 Siren														1								Intrisically safe instrument
T0	95	46-FS-002	NaOCl Storage Tank 3 Outlet Air Flow Switch														1								Intrisically safe instrument
T0	96	46-FN -003	Storage Tank Blower 1 Fan														1								Intrisically safe instrument
T0	97	46-FN -004	Storage Tank Blower 2 Fan														1								Intrisically safe instrument

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Rev	Item No	Plant Reference Number	Service Description	CB Tripped	Fault	E-Stop	Running/ Stopped	Opened	Closed	Auto/Man/Off	Overheat	Seal Failure	Other	Start/Stop	Open/Close Forward/Reverse	Other	Measured Value	Amps	Volt	kW	kWh	Set Point	Other	Data	Comments
T0	98	46-FS-003	NaOCl Reservoir Inlet Dosing Pump 1 Discharge Flow Switch																					1	IO-Link instrument
T0	99	46-FS-004	NaOCl Reservoir Inlet Dosing Pump 2 Discharge Flow Switch																					1	IO-Link instrument
T0	100	46-FS-005	NaOCl Reservoir Inlet Dosing Pump 3 Discharge Flow Switch																					1	IO-Link instrument
T0	101	46-FT-001	NaOCl Reservoir Inlet Dosing Pumps Combined Discharges Flow Transmitter																					1	IO-Link instrument
T0	102	46-FS-006	NaOCl Reservoir Outlet Dosing Pump 1 Discharge Flow Switch																					1	IO-Link instrument
T0	103	46-FS-007	NaOCl Reservoir Outlet Dosing Pump 2 Discharge Flow Switch																					1	IO-Link instrument
T0	104	46-FS-008	NaOCl Reservoir Outlet Dosing Pump 3 Discharge Flow Switch																					1	IO-Link instrument
T0	105	46-FT-002	NaOCl Reservoir Outlet Dosing Pumps Combined Discharges Flow Transmitter																					1	IO-Link instrument
T0	106	46-XV-001	Commercial NaOCl Feed On/Off Valve																					2	Digital signals connect to IO Link Master
T0	107	46-ZS-009	Commercial NaOCl Manifold Position Switch																					1	IO-Link instrument
T0	108	46-ZS-010	Dilution Water Feed to Injector 1 Position Switch																					1	IO-Link instrument
T0	109	46-ZS-011	Dilution Water Feed to Injector 1 Position Switch																					1	IO-Link instrument
T0	110	46-ZS-012	Injectors Combined Discharge Position Switch																					1	IO-Link instrument
T0	111	46-XV-002	Dilution Water Feed On/Off Valve																					2	Digital signals connect to IO Link Master
T0	112	47-FT-001	Service Water Feed Flow Transmitter																					1	IO-Link instrument
T0	113	47-FI-001	Service Water Feed Flow Indicator																					1	IO-Link instrument
T0	114	47-XV-001	Service Water Feed On/Off Valve																					2	Digital signals connect to IO Link Master
T0	115	47-LS-001	Calcium Hypo Tanks Basement Level Switch																					1	IO-Link instrument
T0	116	47-LS-002	Calcium Hypo Storage Tank 2 Level Switch																					1	IO-Link instrument
T0	117	47-LS-003	Calcium Hypo Storage Tank 2 Level Switch																					1	IO-Link instrument
T0	118	47-LT-001	Calcium Hypo Storage Tank 2 Level Transmitter																					1	IO-Link instrument
T0	119	47-YA-001	Calcium Hypo Storage Tank 2 Siren																					1	IO-Link instrument
T0	120	47-ZS-001	Calcium Hypo Storage Tank 2 Feed Position Switch																					1	IO-Link instrument
T0	121	47-LS-004	Calcium Hypo Storage Tank 3 Level Switch																					1	IO-Link instrument
T0	122	47-LS-005	Calcium Hypo Storage Tank 3 Level Switch																					1	IO-Link instrument
T0	123	47-LT-002	Calcium Hypo Storage Tank 3 Level Transmitter																					1	IO-Link instrument
T0	124	47-YA-002	Calcium Hypo Storage Tank 3 Siren																					1	IO-Link instrument
T0	125	47-ZS-002	Calcium Hypo Storage Tank 3 Feed Position Switch																					1	IO-Link instrument
T0	126	47-FS-001	Calcium Hypo Reservoir Inlet Dosing Pump 1 Discharge Flow Switch																					1	IO-Link instrument
T0	127	47-FS-002	Calcium Hypo Reservoir Inlet Dosing Pump 2 Discharge Flow Switch																					1	IO-Link instrument
T0	128	47-FS-003	Calcium Hypo Reservoir Inlet Dosing Pump 3 Discharge Flow Switch																					1	IO-Link instrument
T0	129	47-FT-002	Calcium Hypo Reservoir Inlet Dosing Pumps Combined Discharges Flow Transmitter																					1	IO-Link instrument
T0	130	47-FS-004	Calcium Hypo Reservoir Outlet Dosing Pump 1 Discharge Flow Switch																					1	IO-Link instrument
T0	131	47-FS-005	Calcium Hypo Reservoir Outlet Dosing Pump 2 Discharge Flow Switch																					1	IO-Link instrument
T0	132	47-FS-006	Calcium Hypo Reservoir Outlet Dosing Pump 3 Discharge Flow Switch																					1	IO-Link instrument
T0	133	47-FT-003	Calcium Hypo Reservoir Outlet Dosing Pumps Combined Discharges Flow Transmitter																					1	IO-Link instrument
T0	134	74-LT-001	Service Water Sump Level Transmitter																					1	IO-Link instrument
T0	135	74-LT-002	Service Water Sump Level Transmitter																					1	IO-Link instrument
T0	136	74-PI-001	Site Service Water Pump 1 - Suction Pressure Indicator																					1	IO-Link instrument
T0	137	74-PI-002	Site Service Water Pump 1 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	138	74-FS-001	Site Service Water Pump 1 - Discharge Flow Switch																					1	IO-Link instrument
T0	139	74-PI-003	Site Service Water Pump 2 - Suction Pressure Indicator																					1	IO-Link instrument
T0	140	74-PI-004	Site Service Water Pump 2 - Discharge Pressure Indicator																					1	IO-Link instrument
	141	74-FS-002	Site Service Water Pump 2 - Discharge Flow Switch																					1	IO-Link instrument
	142	74-PI-005	Site Service Water Pump 3 - Suction Pressure Indicator																					1	IO-Link instrument

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Rev	Item No	Plant Reference Number	Service Description	CB Tripped	Fault	E-Stop	Running/ Stopped	Opened	Closed	Auto/Man/Off	Overheat	Seal Failure	Other	Start/Stop	Open/Close Forward/Reverse	Other	Measured Value	Amps	Volt	kW	kWh	Set Point	Other	Data	Comments
T0	143	74-PI-006	Site Service Water Pump 3 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	144	74-FS-003	Site Service Water Pump 3 - Discharge Flow Switch																					1	IO-Link instrument
T0	145	74-PI-007	Site Service Water Pump 4 - Suction Pressure Indicator																					1	IO-Link instrument
T0	146	74-PI-008	Site Service Water Pump 4 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	147	74-FS-004	Site Service Water Pump 4 - Discharge Flow Switch																					1	IO-Link instrument
T0	148	74-FT-002	Site Service Water Pumps - Combined Discharge Flow Transmitter																					1	IO-Link instrument
T0	149	74-PT-001	Site Service Water Pumps - Combined Discharge Pressure Transmitter																					1	IO-Link instrument
T0	150	74-PI-010	Fire Water Pump 1 - Suction Pressure Indicator																					1	IO-Link instrument
T0	151	74-PI-011	Fire Water Pump 1 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	152	74-FS-005	Fire Water Pump 1 - Discharge Flow Switch																					1	IO-Link instrument
T0	153	74-PI-012	Fire Water Pump 2 - Suction Pressure Indicator																					1	IO-Link instrument
T0	154	74-PI-013	Fire Water Pump 2 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	155	74-FS-006	Fire Water Pump 2 - Discharge Flow Switch																					1	IO-Link instrument
T0	156	74-PI-014	Fire Water Pump 3 - Suction Pressure Indicator																					1	IO-Link instrument
T0	157	74-PI-015	Fire Water Pump 3 - Discharge Pressure Indicator																					1	IO-Link instrument
T0	158	74-FS-007	Fire Water Pump 3 - Discharge Flow Switch																					1	IO-Link instrument
T0	159	74-PI-016	Fire Water Pumps Pressure Indicator																					1	IO-Link instrument
T0	160	74-PI-017	Fire Water Pumps Pressure Indicator																					1	IO-Link instrument
T0	161	74-PI-018	Fire Water Pumps Pressure Indicator																					1	IO-Link instrument
T0	162	74-PS-001	Fire Water Pumps Pressure Switch																					1	IO-Link instrument
T0	163	74-PS-002	Fire Water Pumps Pressure Switch																					1	IO-Link instrument
T0	164	74-PS-003	Fire Water Pumps Pressure Switch																					1	IO-Link instrument
T0	165	74-PS-004	Fire Water Pumps Pressure Switch																					1	IO-Link instrument
T0	166	74-PT-002	Fire Water Pumps Pressure Transmitter																					1	IO-Link instrument
T0	167	84-FI-001	Leakage Water Return Pump 1 Discharge Flow Indicator																					1	IO-Link instrument
T0	168	84-FI-002	Leakage Water Return Pump 2 Discharge Flow Indicator																					1	IO-Link instrument
T0	169	84-LT-001	Leakage Water Return Pump 1 Inlet Level Transmitter																					1	IO-Link instrument
T0	170	84-LT-002	Leakage Water Return Pump 2 Inlet Level Transmitter																					1	IO-Link instrument
T0	171	84-LT-003	Muldersvlei Reservoir Level Transmitter		1												1								
T0	172	84-LT-004	Muldersvlei Reservoir Level Transmitter		1												1								
T0	173	84-XV-001	Water Feed Line from Wemmershoek WTW On/Off Valve		1			1	1	3			1		1		2								Other: Overtorque fault
T0	174	84-FT-001	Water Feed Line from Wemmershoek WTW Flow Transmitter		1												2								
T0	175	84-AT-001	Water Feed Line from Wemmershoek WTW Analyser Transmitter		1												2								
T0	176	84-FT-002	Water outlet to Glen Garry Reservoir Flow Transmitter		1												2								
T0	177	84-FCV-001	Water outlet to Glen Garry Reservoir Flow Control Valve		1			1	1	3			1		1		2								Other: Overtorque fault
T0	178	84-FCV-002	Water outlet to Glen Garry Reservoir Flow Control Valve		1			1	1	3			1		1		2								Other: Overtorque fault
T0	179	84-AT-002	Water outlet to Glen Garry Reservoir Analyser Transmitter		1												2								
			Totals					**313**						**61**			**177**					**0**		**144**	

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3.7.8.3 ELECTRICAL DATA SHEETS

The Electrical Data Sheets are included immediately hereafter, comprising 20 pages.

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DATA SHEET No. DST-EE-0010A: LV SWITCHGEAR AND CONTROLGEAR ASSEMBLIES - MOTOR CONTROL CENTRES

CLIENT N°.	PAGE
ZUTARI N°. 1001757	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0010A: LV SWITCHGEAR AND CONTROLGEAR ASSEMBLIES - MOTOR CONTROL CENTRES	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	This data sheet is applicable to the following Motor Control Centres: • Disinfection building			
1	**GENERAL**			
1.01	MCC Manufacturer			
2	**CONSTRUCTION REQUIREMENTS**			
2.01	Steel Work Manufacturer			
2.02	Size of Panel	*HxWxD*	H <2100	
2.03	Doors / Removable Panels		Doors	
2.04	Corrosion protection		Epoxy coated HDG	
2.05	Gland Plates		Not painted, Alu for single core cables	
2.06	Estimated Weight	*kg*		
	ELECTRICAL COMPONENTS	-		
3	**Air Circuit Breakers**			
3.01	Manufacturer			
3.02	Type		Withdrawable	
3.03	Model			
3.04	Overload release		Electronic	
3.05	Short-circuit release		Electronic	
3.06	Motorised	*Yes / No*	Yes	
4	**Moulded Case Circuit Breakers**			
4.01	Manufacturer			
4.02	Type		Fixed	
4.03	Model			
4.04	Overload release		Thermal/ Electronic	
4.05	Short-circuit release		Magnetic/ Electronic	
5	**Miniature Circuit Breakers**			
5.01	Manufacturer			
5.02	Type			
5.03	Model			
5.04	Tripping Curve		C or as per SLD	
6	**Fuse Switch-Disconnector**			
6.01	Manufacturer			
6.02	Model			
7	**High Rupture Capacity (HRC) Fuse Links**			
7.01	Manufacturer			
7.02	Model			
8	**Surge Arrestors**			
8.01	Power Circuits - Manufacturer			
8.02	Power Circuits - Model			
8.03	Power Circuits - Rating	*kA*		
8.04	Control Circuits - Manufacturer			
8.05	Control Circuits - Model			
9	**Contactors**			
9.01	Manufacturer			
9.02	Model			
10	**Intelligent Motor Starter**			
10.01	Manufacturer			
10.02	Type			
10.03	Model			
10.04	Rated Current	*A*		
10.05	Fieldbus Enabled	*Yes / No*	Yes	
10.06	Fieldbus Protocol		Ind. Ethernet	
10.07	Voltage Measuring Unit	*Yes / No*	Yes	
10.08	Ground Fault Measuring Unit	*Yes / No*	For submersible equipment	
10.09	HMI	*Yes / No*	Yes	
11	**Miniature Relays**			
11.01	Manufacturer			
11.02	Model			

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
12	**Control switches and pushbuttons**			
12.01	Manufacturer			
12.02	Model			
13	**Indicating Lamps**			
13.01	Manufacturer			
13.02	Model			
14	**Power Meter for Incomer(s)**			
14.01	Manufacturer			
14.02	Model			
14.03	Communication Protocol		Ind. Ethernet	
14.04	Harmonics Measurement	*Yes / No*	Yes	
14.05	Time of use measurement	*Yes / No*	Yes	
14.06	Datasheet provided with tender	*Yes / No*	Yes	
14.07	Data logging functionality	*Yes / No*	Yes	
14.08	Metering compliance standard		IEC 61557-12 <=0.5	
15	**Control-Circuit and auxiliary supply transformer**			
15.01	Manufacturer			
16	**Power Factor Correction (where applicable)**			
16.01	Controller			
16.02	Manufacturer			
16.03	Model			
16.04	Capacitors			
16.05	Manufacturer			
17	**ACTIVE HARMONIC FILTER (where applicable)**			
17.01	Manufacturer			
17.02	Model			
17.03	Type			
17.04	Datasheets included with tender	*Yes / No*		
18	**FIELD E-STOP/START CONTROL STATIONS**			
18.01	Manufacturer			
19	**SUPPLEMENTARY DETAILS**			

Regardless of any information provided in this technical detail sheet, the equipment to be provided will comply with the specified requirements

Name (Print): ***Signature:***

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To

DATA SHEET No. DST-EE-0011: LV CABLES	CLIENT N°.	PAGE
	ZUTARI N°. 1001757	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0011: LV CABLES	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	LOW VOLTAGE CABLES			
1.01	Manufacturer			
1.02	Operating Voltage	V	600/1000	
1.03	Number of Cores	No	Fire resistant cables for generator and fire equipment. See Specifications and SLDs for others.	
1.04	Size	mm^2		
1.05	Conductor Type	Cu/Al		
1.06	Cable Type			
1.07	Full Load Current	A		
2	VSD EMC Cables			
2.01	Manufacturer			
2.02	Operating Voltage	V	600/1000	
2.03	Cable Type		EMC, Double Screened	
3	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EE-0012: CABLE SUPPORTS

CLIENT N°.	PAGE
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0012: CABLE SUPPORTS	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	CABLE LADDER			
1.01	Manufacturer			
1.02	Type			
1.03	Material		316 Stainless Steel	
1.04	Application			
2	WIRE MESH TRAY			
2.01	Manufacturer			
2.02	Type			
2.03	Material		316 Stainless Steel	
2.04	Application			
3	CONDUITS			
3.01	Manufacturer			
3.02	Type			
3.03	Material		316 Stainless Steel	
3.04	Application			
4	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EE-0023A: VARIABLE FREQUENCY CONVERTERS - VFCs SMALLER THAN 90kW

CLIENT N°.

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0023A: VARIABLE FREQUENCY CONVERTERS - VFCs SMALLER THAN 90kW	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	GENERAL			
1.01	Manufacturer			
1.02	Model			
1.03	Place of manufacture			
1.04	Expected life (for spares availability)	Years		
	ELECTRICAL SERVICE CONDITIONS			
2	Supply network characteristics			
2.01	Source impedance (at minimum fault level) at PCC	Ohms		
2.02	Fault level (maximum) at PCC	MVA		
2.03	Fault level (n-1 contingency/minimum) at PCC	MVA		
2.04	Voltage total harmonic distortion limit at PCC	%	30	
3	VFC input current harmonic limits and actual			
3.01	5th	%		
3.02	7th	%		
3.03	11th	%		
3.04	13th	%		
3.05	17th	%		
3.06	19th	%		
3.07	23rd	%		
3.08	25th	%		
3.09	29th	%		
3.10	31st	%		
3.11	THD	%		
4	ENVIRONMENTAL SERVICE CONDITIONS			
4.01	Forced ventilation or Air Conditioning in VFC room	FV/AC	AC	
4.02	Airflow required per VFC	m³/s		
4.03	Heat load per VFC	kW		
5	LOAD DETAILS			
5.01	Type of motor-driven load		As per mechanical specification	
5.02	Load torque characteristic		Quadratic	
5.03	Number of operation quadrants		1	
5.04	Operating speed range		As per mechanical specification	
6	CONVERTER CONFIGURATION			
6.01	Form of converter (package/chassis/cabinet unit)		Package	
6.02	Rectifier type: diode- or active front end (DFE/AFE)		DFE	
6.03	Rectifier pulse number		6	
6.04	Input semi-conductor fuses	Yes/No	Yes	
6.05	Input contactor	Yes/No	Yes	
7	CONVERTER FILTERS			
7.01	Line-side reactor	Yes/No	Yes	
7.02	Line-side reactor relative short-circuit voltage	%		
7.03	Line harmonic filters (LHF)	Yes/No		
7.04	LHF free-standing (FS) or integral to VFC (I)	FS/I		
7.05	Motor-side reactor	Yes/No	Yes, > 50kW Yes, cable length > 100m	
7.06	Motor-side dv/dt filter	Yes/No		
7.07	Motor-side sine filter	Yes/No		
7.08	Motor-side common-mode filter	Yes/No		
8	CONVERTER PROTECTION			
8.01	Overcurrent and overload	Yes/No	Yes	
8.02	Undervoltage and overvoltage	Yes/No	Yes	
8.03	Phase loss and unbalance	Yes/No	Yes	
8.04	Earth fault	Yes/No	Yes	
8.05	Over-temperature	Yes/No	Yes	
8.06	DC link overvoltage and overcurrent	Yes/No	Yes	
8.07	Over-temperature of DC link reactor (if installed)	Yes/No		
9	MOTOR PROTECTION			Indicate if provided by VFC or MPR
9.01	Short-circuit	Yes/No	Yes	
9.02	Start(max starting time)/Stall	Yes/No	Yes	
9.03	Earth fault	Yes/No	Yes	
9.04	Overload	Yes/No	Yes	
9.05	Number of starts	Yes/No	Yes	
9.06	Loss of phase	Yes/No	Yes	
9.07	Unbalance	Yes/No	Yes	
9.08	Loss of load/undercurrent	Yes/No		

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
9.09	Thermal by means of motor thermistors/RTDs	Yes/No	Yes	
10	CONVERTER RATINGS			
10.01	Rated system voltage	V	420	
10.02	Line-side rated current	A		
10.03	Input total power factor	pu		
10.04	Line-side displacement power factor	pu		
10.05	Rated continuous output current	A		
10.06	Overload capability and time	A & s	120% for 50 s	
10.07	Efficiency of complete drive module	%	> 96 %	
10.08	Total losses of complete drive module	W		
11	CONTROL PERFORMANCE REQUIREMENTS			
11.01	Open loop speed control	Yes/No	Yes	
11.02	Steady state deviation band	%	±1 to ±2	
12	OPERATOR CONTROL INTERFACE			
12.01	Integral operator control interface		Yes	
12.02	Remote operator control interface in compartment door		Yes	
13	PROCESS CONTROL INTERFACE			
13.01	Compliant with SANS 61800-7	No/Yes	Yes	
13.02	Communications Interface Quantity	No.		
13.03	Communications Interface Type(s) and Connector(s)	No.		
13.04	Communications Interface Protocol(s)		Ind. Ethernet	
13.05	Communications Interface Power Drive System Profile	Process / Drive/ Motion Control	Process	
13.06	Communications Interface Message Structure to SANS 61800-7		Yes	
14	TESTING			
14.01	Where indicated the following tests shall be carried out in addition to the specified mandatory tests:			
15	Drive System Site Tests			
15.01	Witnessed factory acceptance test	Yes/No	Yes, as part of MCC FAT	
16	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EE-0025A: LV ELECTRICAL MOTORS - MOTORS < 50kW	CLIENT N°.	PAGE
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0025A: LV ELECTRICAL MOTORS - MOTORS < 50kW	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**GENERAL**			
1.01	Manufacturer			
1.02	Model			
2	**MOTOR RATING**			
2.01	Duty type		S1	
2.02	Output margin above load absorbed power	%	20	
2.03	Speed at rated output, voltage and frequency	rpm		
2.04	Full load current	A		
2.05	Rated torque	Nm		
3	**WINDINGS TYPE, INSULATION & TEMPERATURE RISE**			
3.01	Stator winding type (random/formed diamond coil)		Formed	
3.02	Insulation and impregnation system		VPI	
3.03	Insulation thermal class	(F/H)	F	
3.04	Temperature rise class	(B/F)	B	
3.05	Maximum temperature rise at rated output (Zone A supply)	K		
3.06	Maximum temperature rise at rated output (Zone C supply)	K		
3.07	Windings thermal protection (thermistor/PT100) per winding			
4	**GENERAL PERFORMANCE**			
4.01	Efficiency at rated output	%		
4.02	Efficiency at rated 75% output	%		
4.03	Efficiency at rated 50% output	%		
4.04	Power factor at rated output	pu		
4.05	Power factor at 75% rated output	pu		
4.06	Power factor at 50% rated output	pu		
4.07	Sound power level at rated load	dBA		
5	**STARTING PERFORMANCE**			
5.01	Motor moment of inertia	kg.m²		
5.02	Number of starts per hour (cold/hot)		6/2	
5.03	Starting current (x full load current)	A		
5.04	Starting torque (x rated torque)	N m		
5.05	Pull-up torque (x rated torque)	N m		
5.06	Breakdown torque (x rated torque)	N m		
5.07	Starting power factor	pu		
5.08	Run up time of driven load (state pu starting current)	s		
6	**DRIVEN LOAD AND COUPLING**			
6.01	Load moment of inertia at motor speed	kg.m²		
6.02	Coupling method (direct/gearbox/V-belt)			
7	**BEARINGS**			
7.01	Manufacturer			
7.02	DE bearing type (ball/roller/sleeve)		Ball/roller	
7.03	DE bearing lubrication type (sealed/regreasable)			
7.04	DE bearing life (L10)	h		
7.05	DE bearing regrease interval	h		
7.06	NDE bearing type (ball/roller/sleeve)		Ball/roller	
7.07	NDE bearing lubrication type (sealed/regreasable)			
7.08	NDE bearing life (L10)	h		
7.09	NDE bearing regrease interval	h		
7.10	Bearing thermal protection (thermistor/PT100)			
8	**DIMENSIONS AND WEIGHT**			
8.01	Motor frame number			
8.02	Motor weight	kg		
9	**VARIABLE SPEED APPLICATIONS**			
9.01	Maximum safe operating speed	rpm		
9.02	Peak voltage withstand level	V		
9.03	Voltage gradient withstand level	V/s		
9.04	Separately-powered cooling fan			
10	**OPTIONAL ITEMS**			
10.01	Anti-condensation heaters	Yes / No	Yes	
10.02	Adjusting bolts required	Yes / No	Yes	
	FACTORY TESTS	-		
11	Routine tests in addition to SANS 1804-2 requirements			
11.01	Insulation resistance check	Yes / No	Yes	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
		-		
12	**Type tests in addition to SANS 1804-2 requirements**			
12.01	Current vs speed curve	*Yes / No*	Yes	
12.02	Torque vs speed curve	*Yes / No*	Yes	
13	**DRAWINGS / CURVES TO BE PROVIDED WITH TENDER**			
13.01	Motor general arrangement with dimensions	*Yes / No*	Yes	
13.02	Main terminal box with fault rating indicated	*Yes / No*	Yes	
13.03	Current vs speed curve	*Yes / No*	Yes for >=30kW	
13.04	Torque vs speed curve	*Yes / No*	Yes for >=30kW	
14	**SUPPLEMENTARY DETAILS**			

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DATA SHEET No. DST-EE-0026: ELECTRICAL ACTUATORS	CLIENT N°.	PAGE
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0026: ELECTRICAL ACTUATORS	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	GENERAL			
1.01	Make			
1.02	Model			
1.03	Type			
1.04	Mains power	*V / Hz*	400V / 50 Hz	
1.05	Design Life (according to SANS 60034-1)	*Class*		
1.06	Weight - Actuator	*kg*		
2	CONTROL	-		
2.01	Control voltage	*V*	24VDC	
2.02	Process control and interface	*mA*	4 - 20 mA	
2.03	Actuator Torque Monitor (4-20mA) Required	*Yes / No*	Yes	
2.04	Communication	*Yes / No*	No, hardwired	
3	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EE-0050: DIESEL POWERED GENERATOR SETS

CLIENT N°.	PAGE
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EE-0050: DIESEL POWERED GENERATOR SETS	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	This data sheet is applicable to the Diesal Generators:			
1	**GENSET REQUIREMENTS**			
1.01	Local Genset supplier			
1.02	Genset Manufacturer			
1.03	Typical generator power output (PRP)	kVA	> 400	
1.04	Typical generator power output (ESP)	kVA	> 450	
1.05	Generator power output after site derating (PRP)	kVA	> 400	
1.06	Generator power output after site derating (ESP)	kVA	> 450	
1.07	**Alternative generator system**			
1.08	Number of units required	No.		
1.09	Typical generator power output (PRP)	kVA		
1.10	Generator power output after site derating (PRP)	kVA		
2	**ENGINE**			
2.01	Manufacturer			
2.02	Model Number			
2.03	Type			
2.04	Rating			
2.05	Revolutions at 100 % load r/min	r/min	1500 to 3000	
2.06	Starting time from no load to full load	Max/Min	1 min maximum	
2.07	Guarantee that the engine will deliver full load within the required starting period	Yes/No	Yes	
2.08	Guaranteed fuel consumption under site conditions			
2.09	Full load l/kWh	l/kWh		
2.10	3/4 load l/kWh	l/kWh		
2.11	1/2 load l/kWh	l/kWh		
2.12	Drip tray to be provided	Yes/No	Yes, or functional equivalent to drip tray	
2.13	Type of service (excluding load test)		Unlimited Prime	
3	**COOLING**			
3.01	Cooling medium	air/water/ other	Water	
3.02	Method of cooling, if one method preferred		Radiator	
4	**EXHAUST SYSTEM**			
4.01	Type of exhaust system		Industrial	
4.02	Exhaust emission tier level		Tier 2	
4.03	Material for lagging		304 Stainless Steel	
4.04	Cladding required	Yes/No	Yes	
4.05	Type of cladding		Stainless Steel	
5	**ALTERNATOR**			
5.01	Manufacturer			
5.02	Model number			
5.03	Proposed rated standby output power	kVA	> 550	
5.04	Prime power	kVA	> 500	
5.05	Main air circuit breaker rating	A		
5.06	Motor starting capability @ 30% voltage dip	skVA		
5.07	Range of adjustment of nominal voltage %	%	± 10	
5.08	Steady state voltage regulation at 0.8 power factor and 4.5% engine speed variations	%	± 1	
5.09	Frequency	Hz	50 ± 2	
5.10	Nominal speed	r/min	1500	
5.11	Maximum rated overspeed %	%	120	
5.12	Excitation method		Brushless	
5.13	Parallel operation required	Yes/No	No	
5.14	Neutral earthing method		Solid earth	
5.15	Anti-condensation heaters required?	Yes/No	Yes	
6	**ALTERNATOR PROTECTION**			
6.01	Is sustained short-circuit current rating required?	Yes/No	Yes	
6.02	If Yes, minimum value of current		≥ 3 x In sust 10secs	
6.03	Under/overspeed protection required?	Yes/No	Yes	
6.04	Under/over frequency protection required	Yes/No	Yes	
6.05	Over curent protection required	Yes/No	Yes	
6.06	Specific earth fault protection requirements		Sensitive E/F	
7	**ALTERNATOR CONSTRUCTION**			
7.01	Single bearing arrangement	Yes/No	Yes	
7.02	Alternator insulation class			
7.03	Stator		F	
7.04	Rotor		H	
7.05	Exciter		B	
7.06	Maximum alternator temperature rise	°C		
8	**TRANSIENT OUTPUT VARIATIONS**			
8.01	Maximum permissible voltage drop	%	30	
8.02	during sudden application of a load step of	kVA	90% of nominal	
8.03	for a maximum duration of	msec	300	
8.04	Maximum frequency deviation of	%	20	
8.05	during sudden application of a load step	kVA	90% of nominal	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
9	MECHANICAL BUILD			
9.01	ISO container	Yes/No	Yes, as per CCT specifications	
9.02	Simplex or duplex frame			
9.03	Dimensions			
9.04	Length	mm		
9.05	Width	mm		
9.06	Height	mm		
9.07	Overall mass of set (for lifting purposes)	kg		
9.08	Layout drawing of proposed construction required	Yes/No	Yes	
10	LOUVRES			
10.01	Sound level at 7m		65dBA	
10.02	Intake louvres size according to manufacturers requirements (W x H)	mm X mm		
10.03	Outlet louvres size according to manufacturers requirements (W x H)	mm X mm		
10.04	Intake louvres sound attenuator depth required	mm		
10.05	Outlet louvres sound attenuator depth required	mm		
11	CONTROL PANEL AND ENGINE CONTROLLERS			
11.01	Automatic / Manual		Automatic	
11.02	Remote / Local		Remote	
11.03	Make of controllers		Deepsea or equivalent	
11.04	Model of engine controller		Deepsea or equivalent	
11.05	Model of synchronisation and load share controller		DSE 8660 MKII or equivalent	
11.06	Remote monitoring	Yes / No	Industrial Ethernet	
11.07	Automatic Mains Sensing incorporated	Yes / No	Yes	
11.08	Change over switch incorporated		Yes, and rotary switch in MV switchgear	
12	FUEL SYSTEM			
12.01	Bulk fuel tank		Yes	
12.02	Day fuel tank	Yes/No	No	
12.03	Location		Base mounted	
12.04	Capacity of tank	L	min. 1600	
12.05	Generating time at rated output	hr	24	
12.06	Bulk tank dimensions	mm		
12.07	Fuel lines/pipes – type		Stainless Steel 316	
12.08	Double-bunded fuel tank	Yes/No	Yes	
12.09	Fuel tank material		Polyethylene inner fuel tank, 304 stainless steel safety outer tank	
12.10	Fuel tank filter type		Replacement element type	
12.11	Fuel pump		Manual, self-lubricated	
12.12	Method to determine bulk tank fuel level		Ultrasonic level sensor	
12.13	Fill of fuel to full level for commissioning	Yes/No	Yes	
12.14	First fill of fuel to full level after commissioning	Yes/No	Yes	
13	BATTERIES AND BATTERY CHARGER			
13.01	Starter battery type			
13.02	Manufacturer			
13.03	Voltage	V	24/26	
13.04	Capacity	Ah	6 consecutive cold starts	
14	EARTHING			
14.01	Earthing system	Type	TN-S	
14.02	Neutral earthed in	Alt/DO panel/ source	4 pole, earthed in alternator and source	
15	CORROSION PROTECTION AND FINISH			
15.01	Are tests on painted surfaces required	Yes/No	Yes, visual inspection	
15.02	Final colour of finishes (SANS 1091)			
15.03	Engine			
15.04	Alternator			
15.05	Frame			
15.06	Enclosure			
15.07	Control panel colour		Red	
16	FIRE PROTECTION			
16.01	Type of approved fire extinguishers to be fitted		5kg CO2	
16.02	Cable fire-retardant characteristics			
16.03	Fail safe fuel shut-off system type		Mechanical	
16.04	Bund for full capacity plus 10% required around bulk tank	Yes/No	Yes	
16.05	Fireman switch		Yes	
17	TESTS			
17.01	Type tests and certificates required		Yes	
17.02	Factory acceptance test prior to shipping required		Yes	
17.03	Location of factory acceptance testing			
17.04	Operational works and load test required		Yes	
17.05	Minimum duration of test hr	Min	30 Min	
17.06	Site tests required		Yes	
18	DUMMY LOADS			
18.01	Dummy loads required	Yes / No	No	
18.02	Min. loading of generator engine	% of Generator Capacity	0.3	
19	GENERAL			
19.01	Datasheet from manufacturer included with tender	Yes/No	Yes	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
20	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EL-0001: DISTRIBUTION BOARDS

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DS-EL-0001: Distribution Boards	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**OPERATING ENVIRONMENT**			
1.01	Inland / Coastal		Coastal	
1.02	Indoor / Outdoor		Various, as per specification	
1.03	Site Conditions - Altitude	*m*	5-10	
1.04	Site Conditions - Min. / Max Ambient Temp.	*°C / °C*	0 / 45	
1.05	Site Conditions - Max. Relative Humidity	*%*	95	
2	ELECTRICAL CHARACTERISTICS			
2.01	Supply Voltage	*V*	420	
2.02	Frequency	*Hz*	50	
2.03	DB Main Busbar Rating	*A*	As per SLDs	
2.04	Fault Level Rating	*kA*	As per SLDs	
2.05	Number of Phases	*Num*	3	
2.06	Cascading Allowed	*Yes / No*	No	
2.07	Control Voltage	*V*	230	
2.08	Supplied From		Various	
2.09	Upstream Supply size	*kVA*	Various	
2.10	Estimated Load (After Diversification)	*kVA*	Various	
2.11	Earthing	*Earth Bar /*	Earth Bar	
2.12	Neutral	*Full / Half*	Full Neutral	
3	**INDOOR DISTRIBUTION BOARDS**			
3.01	Manufacturer			
3.02	Type			
3.03	Details		See Single Line Drawings	
3.04	SABS approved	*Yes/No*	Yes	
4	**OUTDOOR KIOSK / DISTRIBUTION BOARDS**			
4.01	Manufacturer			
4.02	Type			
4.03	Details		See General Arrangement and Single Line drawings	
4.04	SABS approved	*Yes/No*	Yes	
4.05	Ingress Protection	*IP*	IP65	
	COMPONENTS			
4	**Busbars**			
4.01	Material		Copper	
4.06	Tinned	*Yes / No*	Yes	
4.07	Current Density	*A/mm²*	2	
5	**Moulded Case Circuit Breakers**			
5.01	Manufacturer			
5.02	Type		Fixed	
5.03	Model			
5.04	Rated Current	*A*	As per SLD	
5.05	Service short-circuit breaking capacity (Ics)	*kA*		
5.06	Overload release		Thermal/ electronic	
5.07	Short-circuit release		Magnetic/ electronic	
6	**Miniature Circuit Breakers**			
6.01	Manufacturer			
6.02	Type			
6.03	Model			
6.04	Rated Current	*A*		
6.05	Service short-circuit breaking capacity (Ics)	*kA*		
6.06	Tripping Curve		C or as per SLD	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
7	**Fuse-Switch-Disconnector**			
7.01	Manufacturer			
7.02	Model			
8	**Contactors**			
8.01	Manufacturer			
8.02	Model			
8.03	Contactor rating		AC1	
8.04	Coordination			
9	**GENERAL**			
9.01	Warranty / guarantee	*months*	12	
9.02	Delivery time (after official order number received)	*weeks*		
10	**SUPPLEMENTARY DETAILS**			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

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DATA SHEET No. DST-EL-0002: SMALL POWER AND LIGHTING

CLIENT N°.	PAGE
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DS-EL-0002: Small Power and Lighting	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	POWER OUTLETS	-		
1	**Normal Switched Socket Outlets**			
1.01	Manufacturer		Crabtree Classic or equivalent	
1.02	Type			
1.03	Ingress Protection	IP	55	
1.04	Faceplate Colour			
1.05	Mounting		Various	
1.06	SABS approved	Yes / No	Yes	
2	**Industrial Switched Socket Outlets**			
2.01	Manufacturer			
2.02	Type			
2.03	Ingress Protection	IP	65	
2.04	Faceplate Colour		White	
2.05	Mounting		Various	
2.06	SABS approved	Yes / No	Yes	
3	**3 Phase Industrial Switched Socket Outlets**			
3.01	Manufacturer		Crabtree Classic or equivalent	
3.02	Type			
3.03	Ingress Protection	IP	65	
3.04	Mounting		Surface mounted	
3.05	SABS approved	Yes / No	Yes	
4	**Normal Dedicated Switched Socket Outlets**			
4.01	Manufacturer			
4.02	Type			
4.03	Ingress Protection	IP	55	
4.04	Faceplate Colour		Red	
4.05	Mounting		Various	
4.06	SABS approved	Yes / No	Yes	
	ISOLATORS	-		
5	**Double Pole**			
5.01	Manufacturer			
5.02	Type			
5.03	Ingress Protection	IP	65	
5.04	Mounting		Various	
5.05	SABS approved	Yes / No	Yes	
6	**3 Pole**			
6.01	Manufacturer			
6.02	Type			
6.03	Ingress Protection	IP	65	
6.04	Mounting		Flush	
6.05	SABS approved	Yes / No	Yes	
7	**TELEPHONE AND DATA OUTLETS**			
7.01	Manufacturer			
7.02	Type		RJ45/RJ11 combo	
7.03	Colour		White	
7.04	Mounting	Flush/recessed	Various	
7.05	SABS approved	Yes / No	Yes	
	LIGHTING (FOR LUMINAIRES SEE EL-0003)			
8	Photocell (Day//Night Switch) (for kiosk)			
8.01	Manufacturer			
8.02	Model			
8.03	SABS approved	Yes / No	Yes	
9	**Photocell (Day/Night Switch) Mounted outside building**			
9.01	Manufacturer			
9.02	Model			
9.03	SABS approved	Yes / No	Yes	
10	**Lighting Ballast**			
10.01	Manufacturer			
10.02	Type			
10.03	Details			
10.04	SABS approved	Yes/No	Yes	
11	**Light Switches**			
11.01	Colour		White	
11.02	Flush mounted	Yes/No	Yes	
11.03	Manufacturer			
11.04	Type			
12	**Occupancy Sensors**			
12.01	Colour		White	
12.02	Flush mounted	Yes/No	Yes	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
12.03	Manufacturer			
12.04	Type			
13	**GRP Poles**			
13.01	Manufacturer /Supplier		BEKA or equivalent	
13.02	Height		Various, refer to drawings	
14	**SINGLE CORE PVC INSULATED CABLE**			
14.01	Manufacturer			
14.02	Type			
15	**SINGLE CORE SUBMERSIBLE CABLE**			
15.01	Manufacturer			
15.02	Type		Submersible	
15.03	Ingress Protection	IP	68	
16	**HOUSE WIRE**			
16.01	Manufacturer			
16.02	Type			
17	**WIREMESH CABLE TRAY**			
17.01	Manufacturer / Type			
17.02	Details			
18	**CABLE TRAY**			
18.01	Manufacturer / Type			
18.02	Details			
19	**CABLE LADDER**			
19.01	Manufacturer / Type			
19.02	Details			
20	**TRUNKING**			
20.01	Manufacturer / Type			
20.02	Details			
21	**POWERSKIRTING**			
21.01	Manufacturer / Type			
21.02	Colour			
22	**CONDUITS (HDG)**			
22.01	Manufacturer / Type			
22.02	Material	*PVC/HDG*	HDG	
23	**CONDUITS (PVC)**			
23.01	Manufacturer / Type			
23.02	Material	*PVC/HDG*	PVC	
24	**SUPPLEMENTARY DETAILS**			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

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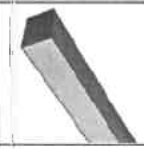
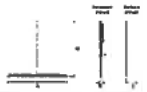
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	ZUTARI N°. 1001757	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0003: Lighting Schedule	KF	CA	RDP		27/09/2024

Luminaire / Device Type:	Description	Supplier / Manufacturer:	Image:	Product Name / Code:	Special Notes	Mounting Height/ Location:	Typical Mounting Detail	Usage Areas:	Lamp Type:	Lamp (W)	Lamp (Colour)	Luminaire Size (mm)	Plug/Lead type:
A	Bracket mounted LED	Regent or equivalent approved		REGENT LINEAR PRO 70	-	Mounted on bespoke bracket		Offices	LED	55	4000K	152x355x126	N/A - Hard wired
B	Surface mounted LED	BEKA Schréder or equivalent approved		BEKA QVAL 36 W	-	Wall mounted		Outdoor	LED	36	4000K	200x340x134	N/A- Hard Wired
C	600x600 Lay-in LED	BEKA Schréder or equivalent approved		LED Ceiling Panel	-	Ceiling mounted fitting		Offices	LED	36	4000K	595x595x34	5A socket outlet with 3m lead
D	Suspended LED	BEKA Schréder or equivalent approved		BEKA RONDO 20W LED downlighter	Suspended LED downlighter	Recessed		Admin Building	LED	20	4000K	230 diameter	N/A - Hard wired
F	Surface Mounted LED	BEKA Schréder or equivalent approved		BEKA VLN LED 49W	Industrial vapor proof light fitting complete with stainless steel brackets and clips	Suface mounted		Plant rooms	LED	49	4000K	1573x101x101	N/A- Hard Wired

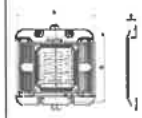
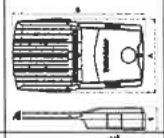
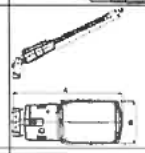
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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0003: Lighting Schedule	KF	CA	RDP		27/09/2024

Luminaire / Device Type:	Description	Supplier / Manufacturer:	Image:	Product Name / Code:	Special Notes	Mounting Height/ Location:	Typical Mounting Detail	Usage Areas:	Lamp Type:	Lamp (W)	Lamp (Colour)	Luminaire Size (mm)	Plug/Lead type:
G	Surface mounted LED	BEKA Schréder or equivalent approved		BEKA LEDTEC 110W	-	Surface mounted		Plant rooms	LED	110	4000K	434x397x53	N/A- Hard Wired
I	Surface Mounted LED	BEKA Schréder or equivalent approved		LEDLUME MINI 45W	-	Pole mounted		Outdoor streets	LED	45	4000K	244x535x107	N/A- Hard Wired
J	Surface mounted LED	BEKA Schréder or equivalent approved		LEDFLOOD MIDI 131W	-	Pole mounted		Outdoor streets	LED	131	4000K	618x345x111	N/A- Hard Wired
K	Surface mounted LED	BEKA Schréder or equivalent approved		IZYLUM 3 IP67	Suited to humid environment inside reservoir	Pole mounted		Inside reservoir	LED	~150	4000K	673x368x94	N/A- Hard Wired

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DATA SHEET No. DST-EL-0004: ROOFTOP SOLAR PV

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DS-EL-0004: Rooftop Solar PV	KF	CA	RDP		27/09/2024

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**ELECTRICAL OPERATING CONDITIONS**			
1.01	AC voltage (nominal)	*V*	400	
1.02	AC Number of phases		3	
1.03	Frequency	*Hz*	50	
1.04	AC voltage harmonic limits		8% THDv	
1.05	DC voltage	*V*	As per Contractor's design	
1.06	Grid tie-in voltage (nominal)	*V*	400	
2	**PV MODULES**			
2.01	Manufacturer			
2.02	Tier Rating		1	
2.03	Model			
2.04	Cell type			
2.05	Country of origin			
2.06	Rated output (at STC)	*W*	As per Contractor's design	
2.07	Output voltage (maximum)	*VDC*		
2.08	Overall/weighted efficiency	*%*	>18	
2.09	STC short circuit current (Isc)	*A*		
2.10	STC open circuit voltage (Voc)	*V*		
2.11	Cable/lead (size, rating, UV)		min. 4mm²	
2.12	Cable/lead length	*m*		
2.13	Cable connector (type)			
2.14	Protection (Quantity of bypass diodes)			
2.15	Operating temperature range	*°C*	-20 to 60	
2.16	Weight	*kg*		
2.17	Dimensions	*mm (LxWxH)*		
2.18	Frame material of construction			
2.19	Glass material			
2.20	Fixed / tracking		Fixed	
2.21	Mounting system		Flat on steel roofs, angled on brackets on concrete roof	
2.22	Number of modules allowed for this project		As per Contractor's design	
2.23	Guaranteed performance after 10 years	*%*	>90	
2.24	Guaranteed performance after 25 years	*%*	>80	
3	**DC CABLING**			
3.01	Manufacturer			
3.02	Cable Type			
3.03	Size	*mm²*	>=4	
3.04	Maximum Voltage	*VDC*	1000	
3.05	Temperature range	*°C*		
3.06	Conductor Type	*Cu/Al*	Cu	
3.07	Maximum Current	*IDC*		
3.08	Armouring	*Yes/No*	NO	
4	**DC CABLE CONNECTORS**			
4.01	Manufacturer			
4.02	Connector Type			
4.03	Maximum Voltage	*VDC*		
4.04	Maximum Current	*IDC*		
4.05	Temperature range	*°C*		
4.06	Enclosure degree of protection	*IP*	67	
5	**INVERTER**			
5.01	Manufacturer			
5.02	Model			
5.03	Type	*Grid-tied/Hybrid/Stand-alone*	Hybrid	
5.04	Nominal output rating	*kVA*	As per Contractor's design	
5.05	Maximum input voltage	*VDC*	<1000	
5.06	Electrical output (VAC, frequency, number of phases)	*VAC, Hz, ph*	400, 50, 3	
5.07	Overall/weighted efficiency	*%*	>95	
5.08	Strings and input switches (internal/external)	*No*		
5.09	Country of origin			
5.10	Weight	*kg*		
5.11	Dimensions	*mm (HxWxD)*		
5.12	Enclosure degree of protection	*IP*	54	
5.13	Anti-islanding	*Yes / No*	Yes	
5.14	Output Power control	*Yes / No*	Yes	
5.15	Zero power export control	*Yes / No*	Yes	
5.16	Internal MPPT	*Yes / No*	Yes	
5.17	Ambient operating temperature range	*°C*	-10 to 40	
5.18	Maximum operation humidity	*%*		
5.19	Manufacturer's Warranty	*Years*	min. 10	
5.20	Noise emmission	*db(A)*	<55	
5.21	Approval		On the City of Cape Town's approved list	
6	**POWER OPTIMISER (as per contractors design)**			
6.01	Manufacturer		SolarEdge or equivalent	
6.02	Model			
6.03	Rated output	*W*	As per Contractor's design	
7	**TEMPERATURE SENSOR**			
7.01	Manufacturer			
7.02	Model			
7.03	Ambient operation temperature range	*°C*		

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
7.04	Measurement temperature range	°C		
7.05	Network communication		Ethernet	
8	**IRRADIANCE SENSOR (reference cell or pyranometer)**			
8.01	Manufacturer			
8.02	Model			
8.03	Class		B	
8.04	Ambient operation temperature range	°C		
8.05	Network communication		Ethernet	
9	**BATTERY**			
9.01	Manufacturer			
9.02	Model			
9.03	Manufacturer Country of origin			
9.04	Frame material of construction		Lithium-ion	
9.05	Cell Chemistry		LFP	
9.06	Package (single or modules)		Single	
9.07	Cell Manufacturer			
9.08	Cell Country of origin			
9.09	Cooling Method		Forced Ventialtion or Natural Ventilation	
9.10	Nominal Voltage	V		
9.11	Unit Total (100% DoD) Energy Capacity	kWh		
9.12	Unit 80% DoD Energy Capacity	kWh		
9.13	Minimum C-rating Capability	C	>=1	
9.14	Maximum Current Capacity	Ah		
9.15	Maximum Power	kW		
9.16	Round-trip Efficiency	%	>=95	
9.17	Battery Management System	Yes/No	Yes	
9.18	Internal Trip Protection	Yes/No	Yes	
9.19	Operating temperature range	°C	0 to 40	
9.20	Weight	kg		
9.21	Dimensions	mm (LxWxH)		
9.22	Frame material of construction			
9.23	Installation Method	Wall Mounted/ Floor standing	As per Contractor's design	
9.24	Minimum number of cycles under performance warranty conditions	No	4000	
9.25	Minimum nominal energy capacity at end of warranty period	%	>=60%	
9.26	Minimum warranty period under battery warranty operating conditions	Years	10	
10	**BATTERY DC BUSBAR**			
10.01	Manufacturer			
11	**Gateway Device**			
11.01	Manufacturer			
11.02	Model			
11.03	Communication Protocol		Incl. Ethernet	
12	**Power Meter**			
12.01	Manufacturer			
12.02	Model			
12.03	Communication Protocol		Incl. Ethernet	
12.04	Harmonic Measurement	Yes/No	Yes	
12.05	Time of Use measurement	Yes/No	Yes	
12.06	Datasheet provided with tender	Yes/No	Yes	
12.07	Data logging functionality	Yes/No	Yes	
12.08	Metering compliance standard	Yes/No	Yes	
13	**Panel Mounting Bracket**			
13.01	Manufacturer			
13.02	Model			
13.03	Flat Roof Type		Ballast/Plinth Mounted	
13.04	Pitched Roof Type			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

Name (Print): ***Signature:***

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3.7.9 ELECTRONIC SPECIFICATION

The electrical specifications consist of the following sections:

3.7.9.1 DETAILED ELECTRONIC SPECIFICATION
3.7.9.2 ELECTRONIC DATA SHEETS

3.7.9.1 DETAILED ELECTRONIC SPECIFICATIONS

The Detailed Electrical and Electronic Specification is included immediately hereafter, comprising 48 pages.

These specifications shall be read in conjunction with the relevant Particular Specifications and form an integral part of this contract.

In the event of any discrepancy between these specifications and a part of the Particular Specifications, the schedule of quantities, or the drawings, these specifications shall take precedence.

In certain clauses the Particular Specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the specifications. It also contains additional specifications required for this particular Contract.

Replace the term "Engineer" wherever it may occur in any of the specifications with "Employer's Agent".

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1. GENERAL

The electronic portion of the Works shall comply with the Standard Specifications in C3.7.5, but as varied by this Detailed Electronic Specification, the Data Sheets and Drawings.

References in the Standard Specifications to "Project Specification" shall be read as referring to this Detailed Electronic Specification.

The electrical portion of the Works is covered by Section C3.7.8.

The works shall include a complete control, security and safety systems to facilitate the operation of the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure.

For all major equipment provided, Cape Town based maintenance with basic spare holding shall be available. The design shall follow a standardized approach using common equipment such as power supplies, communication devices and control platforms across the different process areas to reduce the number of required spares and ensure ease of maintenance.

1.1 NORMATIVE REFERENCES

The overarching normative references to which the Contractor shall comply are:

- All equipment supplied and installed shall comply with the requirements of the Occupational health and Safety Act, Act 85 of 1993, and the regulations promulgated thereunder.
- All electrical and electronic installations shall comply with the requirements as set out in SANS 10142, and the normative references listed therein.

Normative references which deal with specific sections and/or items within this Detailed Electronic Specification are included in the relevant subsections.

1.2 DESIGN SCHEDULES

The following tables and schedules are included in C3.7.8.2 and form part of this the Detailed Electronic Specification.

a) Instrumentation List

b) Control and Instrumentation Cable Schedule

c) Programmable Logic Controllers (PLC) and Remote Inputs / Outputs (RIO) IO Lists

These schedules may be affected by the mechanical and electrical equipment offered by the Contractor and OEM preferences. Tenderers shall price for any changes to the control and instrumentation design that are caused by their selection and offer of mechanical equipment. Where anticipated cable lengths are given, these are done so in good faith to assist in cable sizing and cost estimation. Quantities in the BOQ are based on the tender design; final quantities shall be as measured on site after installation, based on the Contractor's design.

The schedules shall be finalized by the Contractor during the contract based on equipment offered and shall be submitted for approval to the Engineer before procurement and manufacture of equipment.

1.3 PLANT NUMBERING SYSTEM

The equipment tags used throughout the Tender documentation are indicative. The onus shall be on the Contractor to source the latest revision of the City of Cape Town Plant

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Numbering System Standard and generate equipment tags based thereon after the Contract is awarded.

1.4 DATA SHEETS

Data sheets for the electronic equipment included under this contract are included in C3.7.9.2. The data sheets shall be completed after the Contract is awarded. The data sheets form part of the Detailed Electronic Specification and shall be read in conjunction with the specification.

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2. ELECTRONIC SCOPE OF WORK

The electronic portion of this Contract shall include the following:

a) PLC based control system for the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure.
b) Master SCADA system for the whole scheme, located on site.
c) Historian, Management Information System and Business Intelligence Platforms.
d) Industrial ethernet network on the site.
e) VPN link to the CoCT decision support system server at the Water and Sanitation Head Office.
f) Discrete and Analog Instrumentation including all mounting materials and brackets.
g) Uninterruptible power supplies for the PLCs, HMIs, and all instrumentation.
h) Control and instrumentation cables including data communications cables and associated materials.
i) Control and instrumentation cable racking and supports.
j) IO-Link control and instrumentation equipment and cables.
k) Earthing and surge protection for power, instrumentation, and control components.
l) Detailed Functional Design Specification for the complete process control system.
m) Programming of the PLCs, HMIs, and SCADA.
n) Factory simulation, site testing and commissioning of the complete control system including calibration of the instrumentation.
o) Building electronic services, including access control, closed circuit television (CCTV), fire detection, a gallery panic alarm system, and a dedicated network.
p) Certificate(s) of Completion.
q) As-built drawings and documentation.
r) Operation and maintenance manuals.
s) Training the Employer's staff in the operation and maintenance of the new electronic equipment.
t) Spares.

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3. FUNCTIONAL DESIGN SPECIFICATION

The Contractor shall produce a detailed Control System Functional Design Specification (FDS) suitable for the offered equipment and installation, for review, discussion and approval by the Engineer and the Employer before programming of the control system commences.

Tenderers shall allow for at least five (5) iterations in the design, testing, and review of the Control System Functional Specification, PLC code, and associated HMI and SCADA screens and mimics.

A typical contents list for the FDS is given below:

ITEM NO	DESCRIPTION OF CONTENT
1	**General**
1.1	Contents List (including Appendixes)
1.2	Revision page
1.3	Introduction
1.4	Abbreviations and Definitions
1.5	Reference Documents
1.6	Tagging System
2	**Control Philosophy**
	Plant should be broken down into its various functional units (filtration, dosing, etc) and systems within systems as per ISA 88. For each process cell the following shall be provided (if lists are too long separate documents may be referenced). Descriptions that are general to all process cells might be included once under a general section.
2.1	Control Modes Description / Modes of Operation (Manual/off/auto/field)
2.2	Motor List
2.3	Instrumentation List
2.3.1	Instrumentation Signals
2.3.2	Output signal during instrument error
2.3.3	Operating range
2.4	Valve list and Failsafe positions of valves
2.5	Interlocks
2.5.1	Safety Interlocks
2.5.2	Process Interlocks
2.6	Duty selection and changeover
2.7	Startup/Shutdown Procedures (including for back-up power supply if applicable)
2.8	Setpoints
2.9	Trended variables
2.10	Variables for Reporting and Logging

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ITEM NO	DESCRIPTION OF CONTENT
2.11	SCADA/HMI display
2.12	Alarms List and alarm handling
3	**Control Network Architecture Drawing and Description**
3.1	Description of Control Network
3.2	Hardware specifications
3.3	Software specifications
4	**PLC**
4.1	PLC Configuration
4.2	PLC Hardware
4.3	PLC Networks
4.4	PLC IO list
4.5	Protocols
4.6	PLC functional blocks design and description
5	**SCADA/HMI**
5.1	SCADA Configuration
5.2	Tags List with Tag count
5.3	Mimics (mock ups before programming)
5.3.1	Plant Overview
5.3.2	Navigation Bar
5.3.3	Sub Plant overviews (if applicable)
5.3.4	Functional Unit Overview
5.3.5	System Page
5.3.6	Comms Network (based on network architecture)
5.3.7	Electrical Distribution Network
5.3.8	Instrument Overview Screen
5.3.9	Symbol colours
5.4	Process Unit/Drive/Instrumentation/valves faceplates
5.5	Process sequence pages
5.6	Alarms Page
5.7	PID Control Loops and Set point pages
5.8	Trending
5.9	Security Features
5.9.1	Security Passwords
5.9.2	Access Hierarchy

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ITEM NO	DESCRIPTION OF CONTENT
6	**Alarm Management**
7	**Historian**
7.1	Configuration
8	**Management Information System and Business Intelligence Reporting**
8.1	ETL design and description
8.2	Reports and Dashboard Design
8.3	Data Maintenance Scheduling (e.g. storing, archiving of data and log file)

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4. PROCESS CONTROL SYSTEM (PCS)

4.1 GENERAL REQUIREMENTS

The proposed control system architecture is shown on the control system network architecture drawing.

The process control system shall be designed to provide fully automated operation of the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure, with the exception of batch make-up, which requires operator intervention. The control philosophy shall be as outlined in this specification and the control narrative in Section C3.7.4.

The PLC panels shall be installed in the MCC room and the Fire Water Pump Room, as shown on the layout drawings.

Local Control Panels (LCPs), Remote IO (RIO) panels, and IO-Link Masters shall be installed near its relevant process. Positions of all LCPs and RIOs shall be approved by the Engineer before installation commences.

All soft starters, variable speed drives, intelligent motor starters, UPSs, power meters, generator controller and instrumentation associated with each process area shall be interfaced and / or connected to the PLC for fully automatic control and monitoring purposes.

All PCS and PLC software produced under this contract shall be easily integrable or open source (i.e. unlocked) and become the property of the Employer.

Vendor control panels (such as those associated with the OSEC units) may include their proprietary system interfaces, but with full functionality to connect back to the main PCS for monitoring and initiation of processes. Set points shall be adjustable from the control room and HMI.

4.1.1 DESIGN

The Contractor shall offer a complete solution for automation and control, power monitoring, motor control, drives as well as a common operating and monitoring platform to monitor and control the process and support energy efficiency.

The Contractor's System Integrator (SI) shall involve the Original Equipment Manufacturer (OEM) for consultation and specification of the PCS configuration and architecture before any engineering commences. The SI and OEM shall present the offered solution to the Employer first before engineering commences. The OEM shall further be involved for fault finding and commissioning testing on site.

The Contractor shall allow for at least two (2) scoping meetings between the Contractor, the SI, the OEM, the Engineer, and the Employer to finalize the PCS and discuss the latest technology developments.

4.1.2 OEM SUPPORT

The PCS original equipment manufacturer (OEM) or supplier shall be able to maintain a sales and/or service facility, to provide start-up service, emergency service calls, repair work, spare parts, service contracts, maintenance, and training of department personnel upon requests of the customer. Emergency service shall be available within twenty-four hours of notification. A 24-hour per day telephone and web global support shall be available to provide technical and installation support. The Contractor shall provide all engineering and operational software with an OEM support agreement of minimum five (5) years.

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4.2 PERFORMANCE REQUIREMENTS

The Contractor shall provide a PCS with the following main features:

- The PCS shall consist of a single engineering and operations environment.
- The PCS shall make available any operational information to operators and decision makers.

The PCS shall provide a single environment to implement or integrate all the parts of the plant including:

- Core process
- Automation islands
- Power distribution and management

The Contractor shall offer a complete solution for automation and control of the plant. All hardware and software components, including drivers and integration services, shall be off-the-shelf components, readily available from reputable suppliers.

PLC and Remote IO hardware for all process areas shall be from the same OEM and product range, as far as possible, for seamless integration to the device and control networks. Where it is not possible to have all devices supplied from the same OEM product range, a datasheet is to be submitted and approved by the engineer. Device layer network equipment shall be from the same range of equipment certified for use with the chosen PLC platform.

The control network switches shall be from the same OEM and product range, configured and managed in a single network management software package and project. The network management software shall be licensed, supplied, and configured as part of the scope of this contract.

Control panels shall follow a common design standard, populated with the same equipment, and installed in a common layout. Layout and schematic drawings for control panels shall follow the same sequence of pages or sheets with a common component labelling and wire numbering scheme.

A single PLC engineering software environment shall be provided for setting up, configuring, and programming the Main PLC programs, remote IO, and IO-Link master units, and inter PLC communications. All PLCs and remote IO shall be updated to the same version of firmware and all PLC programs shall be based on the same set of common libraries, function blocks and software standards.

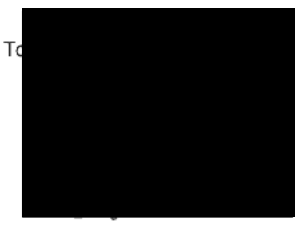
HMI panels shall be from the same OEM and product range. All HMIs shall be configured and programmed from a single HMI engineering software environment if the HMI screens and software is not developed in the same engineering software package as the PLC. All HMI projects will be built on the same libraries and software standards.

The Functional Design Specification for the PCS shall detail how PLC, remote IO, network configuration, and any other software projects that form part of the PCS will be created, maintained, backed up, and how the version control shall be managed. It shall be possible to update all components on the supervisory and control layer networks from the engineering PC installed in the main control room.

The offered solution shall follow an open data architecture with standard interfaces to make collected and stored data available to third party systems where required.

Where control panels are supplied as part of a vendor package, these panels will integrate seamlessly with the PCS and allow control from or feedback to the overall control system.

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The system shall be scalable to allow for future upgrades and expansion of the works.

4.3 CONTROL NETWORK

4.3.1 GENERAL

An indicative control network architecture is shown on drawing 1001757-2000-DRG-II-2950.

The Control network shall be an Industrial Ethernet network where all network resident devices will use TCP/IP based communications with a minimum bandwidth of 1Gbit/sec for the backbone network and 1Gbit /sec for device networks.

A fibre optic ring network shall be provided to link the PLC to the system servers, as shown on the control network architecture drawing. A floor-standing 19" Industrial Network panel (minimum 16U) shall be provided for the server room in the administration building, and a wall mounted 19" Industrial Network panel (minimum 9U) shall be provided for the MCC room.

The network panels shall house patch panels, brush panels, networking equipment, power supplies, power distribution, terminals, patch leads and wiring, as required for their respective purposes. The networking panels shall be used to splice and terminate the Industrial fibre optic network.

The Contractor shall provide drawings for the network design that includes the internet protocol (IP) addressing tables as well as the network redundancy and security setup. The network design shall be signed by a certified network engineer from the Industrial Ethernet switch Original Equipment Manufacturer (OEM) before being submitted for approval to the Engineer.

The Contractor shall provide network management and monitoring software that allows the site to monitor the industrial ethernet network in real time and configure alarming. The network management software shall be able to configure network switches remotely to ensure seamless replacement of faulty modules.

Failure events shall be reported to the operator via the Operator workstation, and it shall be possible to repair/replace faulty sections of the Control Network without affecting the overall system operation.

Data and control communications over the network shall operate on separate fibre optic core pairs as indicated in Section 11.7.

The Contractor shall provide test results for the fibre optic installation. The test results should be generated using standalone certified network testing equipment.

The PCS shall be able to synchronize all the nodes across the entire control network to within +/- 10 milliseconds using Network Time Protocol (NTP).

4.3.2 NETWORK SWITCHES

Industrial Ethernet switches shall be provided as required to connect Ethernet devices, the Ethernet switches shall be provided as part of a standard product offering. The Ethernet switches shall satisfy the following requirements:

a) The Managed Ethernet Switches shall be designed to operate in industrial environments with specifications and MTBF figures that are consistent with the rest of the system.

b) The system must support a range of Managed Ethernet Switches that includes models that have 4 Ethernet ports up to models that include 24 Ethernet ports. The

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basic models of the Switches shall support for communications over copper cable distance up to 100 meters. The range shall include models that have Fibre Optic communication ports supporting Multimode fibre optic cable lengths up to 5000m for multi mode or single mode fibre optic cables lengths up to 30,000m, for long distances and for use in high electrical noise environments.

c) Faulty device replacement, with a centralized storage of the configuration (remote server or a USB stick) and the ability to automatically restore the switch configuration.

d) Capability for user to configure security (port security, SNMP security, etc.)

e) Embedded diagnostics (i.e., hardware or port failures, communication errors, etc.).

4.3.3 COMMUNICATION LINKS

The following communications links shall be provided with the PLC under this contract:

a) PLC CPU rack to Ethernet Remote IO Racks: Industrial Ethernet (Modbus TCP or EtherNetIP)

b) PLC to HMIs: Industrial Ethernet (Modbus TCP or EtherNetIP)

c) PLC to Digital Power Meters: Industrial Ethernet (Modbus TCP).

d) PLC to VFCs, Intelligent motor starters and soft starters: Industrial Ethernet (Modbus TCP or EtherNetIP).

e) PLC to Generator Controller: Industrial Ethernet (Modbus TCP or EtherNetIP).

f) PLC to OSEC controllers: Industrial Ethernet (Modbus TCP or EtherNetIP). Should the OSEC controller not be able to use Industrial Ethernet inherently, a gateway shall be provided to convert Modbus (RTU) to Industrial Ethernet.

g) PLC to Analyser station controllers: Industrial Ethernet (Modbus TCP or EtherNetIP), Should the Analyser controller not be able to use Industrial Ethernet inherently, a gateway shall be provided to convert Modbus (RTU) to Industrial Ethernet.

h) PLC to Electro-magnetic flow transmitters: Industrial Ethernet (Modbus TCP or EtherNetIP), and IO-Link or 4-20mA.

i) PLC to analogue instrument transmitters: IO-Link or 4-20mA.

j) PLC to other digital instruments: IO-Link or Digital IO.

k) PLC to Remote Terminal Unit (RTU): Industrial Ethernet (Modbus TCP or EtherNetIP).

The Control network shall not be connected to the internet. Any connection to the internet or networks outside of the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure shall be approved by the Engineer and Employer before use. This connection shall be made to the Supervision network via Ethernet and shall be made secure with secure authentication and firewall.

4.4 PROGRAMMABLE LOGIC CONTROLLERS (PLC)

4.4.1 NORMATIVE REFERENCES

The work under this clause shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 25.
- Data Sheet DS-II-0002: Process Control System (PLC Section)

4.4.2 GENERAL REQUIREMENTS

A PLC based control system shall be provided for the site to execute the control narrative described in Section C3.7.4.

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An indicative control system architecture is shown on the network architecture drawing.

An indicative IO list for each PLC is included under the design schedules in C3.7.8.2.

All PLC software produced under this contract shall remain open source (i.e. unlocked) and become the property of the Employer.

4.4.3 DESIGN

The Contractor's System Integrator (SI) shall involve the Original Equipment Manufacturer (OEM) for a consultation and specification meeting with the Engineer and Employer to confirm the control architecture before any engineering commences. The OEM shall further be involved for fault finding and pre-commissioning testing on site.

The Contractor shall allow for at least one scoping meeting between the Contractor, the SI, the OEM, the Engineer, and the Employer.

4.4.4 PLC PANEL HARDWARE

The following PLCs shall be provided under this Contract:

Table 1: PLCs

PLC PROCESS DESIGNATION MCC	PLC NAME	LOCATION
Disinfection MCC	PLC-DIS-01	On-Site Electro-Chlorination Building MCC Room
Fire Pump Panel	PLC-DIS-02	On-Site Electro-Chlorination Building Fire Water Pump Room

The PLC panels shall be installed in the MCC room and Fire Water Pump Room. The panels shall house the PLC, HMI, DC power supply, UPS, and networking equipment, as shown on the PLC panel general arrangement drawing. The PLC panels shall also serve as a marshalling panel for field instrumentation with the rear of the panel being used for this purpose.

Full length doors shall be fitted to the front and rear of the PLC panels and the front door shall include an armour-plated glass window for viewing the status of the PLC, as indicated on the typical PLC panel general arrangement drawing.

The panels shall be of similar materials and dimensions as the MCC and shall be installed directly adjacent to the MCC and the Fire Water Pump Panel.

The enclosures shall be properly ventilated by extractor fans with dust filters. Cooling shall include adequate cooling for the Uninterruptible Power Supply (UPS).

The PLC CPU shall be located in the top front section of the PLC panel. I/O blocks, relays, and controls (front) shall be wired to the terminal blocks in the marshalling panel (rear) from where cables to field instruments and other equipment shall be run.

Power distribution and instrument supply circuit breakers shall be located in the front of the PLC panel.

A 16A SANS 164 compliant socket outlet (red in colour) shall be provided in the front bottom of the PLC panel for the programmer's laptop.

A light emitting diode (LED) panel light, connected to a door switch shall be provided.

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A separate protective earth bar (front) and an insulated earth bar (marshalling rear) shall be supplied at the bottom of the PLC panel and both earth bars shall be tied back to the MCC room trench earth system.

4.4.5 REMOTE IO PANEL HARDWARE

The following remote I/O panels (RIOs) shall be provided under this Contract:

Table 2: RIOs

RIO TAG	ASSIOCIATED PLC	RIO DESCRIPTION / LOCATION
RIO-CHB-01	PLC-DIS	Inlet Valve chamber DB 1 (DB-CHB-01)
RIO-CHB-02	PLC-DIS	Outlet Valve chamber DB 2 (DB-CHB-02)
RIO-DIS-01	PLC-DIS	On-Site Electro Chlorination Building: Intrinsically Safe Area

Each RIO panel shall be supplied inclusive of all internal equipment required for a fit-for-purpose design, including but not limited to the remote I/O unit, networking equipment, UPS, distribution equipment, etc. RIO panels shall be wall-mounted as far as possible, and otherwise installed on a purpose-built pedestal. A typical RIO panel general arrangement is shown on the drawings.

Each RIO panel shall be connected to the PLC via Industrial Ethernet (Modbus TCP or EtherNetIP).

The instrumentation and actuated valves associated with each RIO panel, the required cabling, and IO are indicated on the design schedules. RIO panels shall be offered with sufficient I/O and power capacity for the associated instrumentation and actuated valves.

4.4.6 IO LINK MASTER

All the instrumentation in the On-Site Electro Chlorination Building and outside the intrinsically safe area will be, preferably, IO-Link sensor type and thus connected to an IO-Link master located nearby via M12 connectors. The IO-Link masters shall be rated for on-machine installation with IP rating as indicated on the technical datasheets.

Each IO-Link master shall be connected to the PLC via Industrial Ethernet (Modbus TCP or EtherNetIP).

If IO-Link is not used in all areas, more RIO panels in addition to those listed in Table 2 may be required.

4.4.7 PLC SOFTWARE

PLC Programming shall be structured in accordance with ISA 88 philosophy. Programming of the PLC shall be done using CCT standard PLC function blocks.

The PLC shall be able to communicate using Modbus RTU and Modbus TCP/IP.

All PLC software produced under this contract shall remain open source (i.e. unlocked) and become the property of the Employer and shall be included on a USB flash disk as part of the final Operational and Maintenance (O&M) manuals.

Additional software, e.g. the PLC development environment required to maintain and update the PLC code, and hardware shall be included with the source code.

The CCT is currently in possession of an unlimited site licence for the Unity PLC programming software. The Contractor may receive this, free issue for the duration of the

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contract, with the limitations as described in CCT Standard Specification for Electrical Installations, Section 25.3.

4.4.8 INPUTS AND OUTPUTS

Digital input/output (IO) cards shall be provided with the PLC for potential free and transistor 24 Vdc signals, and analogue IO cards provided for 4-20 mA current loops. Digital outputs shall drive interposing relays to slave devices at other voltages such as MCC contactors, unless stated otherwise.

The IO modules shall be provided with their own power supply independent from the CPU power supplies.

4.4.9 DEVICE NETWORKS

The device network shall integrate all soft starters, variable speed drives, intelligent motor starters, remote IO, flow meters, analysing transmitters, solenoid valves and control valve actuators using Ethernet based fieldbus communications as described in the Technical Datasheets, to the specific PLC.

Where required, converters or gateways shall be installed to convert serial fieldbus to Ethernet. Converters shall be kept to a minimum in the design.

Switches, level sensors and other instrumentation that is not integrated on fieldbus shall be integrated to the device network through IO-Link and IO-Link master units, or hard wired digital and analogue signals to Remote IO. Safety and protection interlocks shall be hard-wired to the relevant MCC bucket of the protected equipment.

Device networks shall be configured and cabled such that devices can be disconnected or replaced without affecting network connectivity of any other device on the network. Where a large number of instrument remote junction boxes are installed on a device network, they shall be configured in a ring network or several ring networks to minimise cable distances and quantity while providing redundancy.

The device networks shall be formed by unmanaged switches connected to the PLC Ethernet card.

Each device network shall be configured on its own sub-net and broadcast domain. Device networks shall be isolated from the control and supervisory level networks. Network access to device layer network components shall physically be restricted to the area that it is installed in.

4.4.10 TESTING REQUIREMENTS

Comprehensive control system factory tests which shall be witnessed by the Employer (1 person) and the Engineer (1 person), shall be carried out by the Contractor. The system integrator and OEMs shall also attend these tests. Travel and accommodation costs for all persons shall be included in the tender pricing.

The control system factory testing shall include a fully setup PLC and HMI configuration to test the software according to the functional design specifications. The Contractor shall allow for at least two tests of 1 day each.

The PLCs shall be tested and commissioned as described in the City of Cape Town's Standard Specification for Electrical Installations, with specific attention to the following:

a) During development, software shall be electronically verified apart from the process it controls using a simulation / diagnostic package.

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b) The control systems shall be tested with the software loaded into the programmable devices, and with simulation of the physical IO devices to equipment such as MCCs and Field Instrumentation and the Operator interface HMI and / or PCS Operator Interface.

4.5 HUMAN MACHINE INTERFACES (HMI)

4.5.1 NORMATIVE REQUIREMENTS

The work under this clause shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 24.
- Data Sheet DS-II-0002: Process Control System (HMI section)

4.5.2 GENERAL REQUIREMENTS

One 17" graphical human machine interface (HMI) shall be provided on the PLC panel.

The HMI shall be an industrial panel PC and the HMI software shall be the same as the SCADA software or an edge version of the SCADA software that complies with the specification.

The HMI shall be configured to provide the operator with local control and status information, current alarms, graphical trends and limited data logging.

The complete HMI configuration shall be clearly described and documented in the PLC Functional Design Specification (FDS) for review and approval by the Engineer and Employer before programming commences. Symbols and mimics shall be based on the Employer's standard visual requirements and libraries.

4.5.3 PERFORMANCE REQUIREMENTS AND REPORTING

PLC control parameter changes shall be possible from the HMI, which shall be password protected and logged. Operator actions, selections or set point changes described in the control philosophy shall all be possible via the HMI.

The HMI shall be configured with a simple graphic display (mimic) showing all pertinent equipment, its status (running, tripped or stopped) and instantaneous instrument readings.

For motors larger than 50kW, the instantaneous motor efficiency shall be shown against the efficiency measured at commissioning on HMIs installed in MCC rooms.

The HMI graphics shall be designed using the situational awareness design philosophy.

Mode selection (i.e. auto, manual, etc.) on related electrical equipment (e.g. motorized valves, motor starters, etc.) shall be clearly indicated on the HMI.

Status shall be indicated by different state colours (such as white for ready, green for running, amber for tripped and red for 'E-stop' or other fault states) as defined in C3.4.1.3.

A trending page shall be provided showing all measured and calculated value readings over time. The trend page shall show live and historical data of at least a week. Critical parameter trends for at least one month shall be logged to the HMI memory and external mini-USB flash disk in a first in first out rolling log file.

An alarm page shall be provided showing all outgoing and incoming alarms. Alarms shall also be stored in a first in first out file in the HMI memory. It shall be possible to scroll backward and forward in the alarm list.

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4.5.4 INSTALLATION

The HMIs shall be installed at such a height in the PLC panel that it can be easily used by an operator. The HMIs shall be installed above the Controller CPU and IO in such a way that the Controller CPU and IO are still visible through the glass door of the PLC panel when the door is closed.

4.6 UPS

4.6.1 NORMATIVE REFERENCES

The work under this clause shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 23.
- Data Sheet DS-II-0002: Process Control System (UPS Section)

UPSs shall comply with SANS 62040.

4.6.2 GENERAL REQUIREMENTS

A UPS shall be installed per PLC and RIO panel to power the PLC / RIO and instruments. The UPS shall be box type, installed in the bottom of the relevant panel. All electronic equipment and instruments shall be backed up with UPS power.

All Radio Telemetry shall be separately backed up by internal batteries.

Each network panel shall be equipped with UPS backup power, either a dedicated UPS installed in the relevant network panel or supplied from the UPS in a nearby PLC or RIO panel.

A central UPS shall be installed per SCADA control station (and server) and shall be floor standing.

An isolation transformer for the PLC and PCS, equally rated to the UPS, shall be included on the input side of all UPSs to allow for separate earthing and isolation from power supply transients.

The transformer shall be installed in the relevant MCC feeding the UPS complete with rated circuit protection devices for each feeder and related electrical distribution equipment.

Adequate provision shall be made for ventilation of a UPS when it is installed in a panel.

4.6.3 TESTING REQUIREMENTS

Each UPS system shall be load tested on site and the Contractor shall ensure that the associated PLC shutdown and restart automatically without losing information or requiring operator intervention should the UPS standby period expire before standby generator power is available.

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5. SCADA AND HISTORIAN

5.1 NORMATIVE REFERENCES

The work under this clause shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 26
- Data Sheet DS-II-0003: SCADA

5.2 GENERAL REQUIREMENTS

A master SCADA station shall be provided in the control room at the Muldersvlei 300 Mℓ reservoir, disinfection facility, and associated infrastructure that shall control the local system and monitor the whole water scheme.

The plant shall have a modern open data architecture. This shall be achieved by creating a plant wide Unified Namespace (UNS) for the plant that would allow:

a) Interoperability of multiple software applications
b) Scalability (the ease of adding more network nodes)
c) Edge driven (nodes are initiated and configured from the field and discovered by the other applications e.g., the SCADA, historian, other applications)
d) Report by exception (only data that changed are sent over the network and stored)
e) Light weight (allow more data to be monitored over lower bandwidths)

The unified namespace (UNS) shall be the single source of truth for the current state of the plant and the historian shall store these historical current states. Each software application, e.g. SCADA, historian, data warehouse shall be treated as a node in the data architecture that connects to the unified namespace.

The data (current state from UNS, historical data, other data sources) shall be exposed to the different software applications as shown in the data architecture diagram below.

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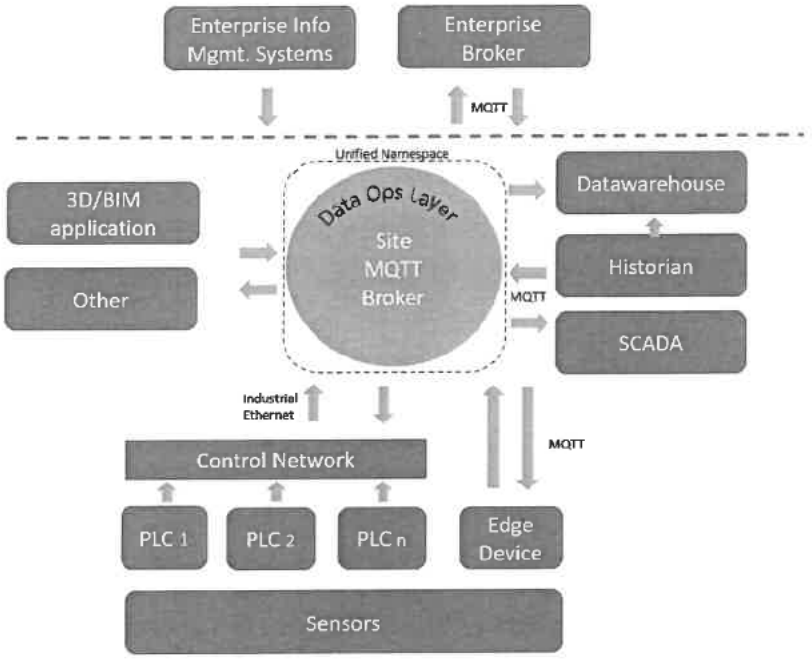


Figure 1: Data Architecture Diagram

The data architecture for the plant shall include the following nodes (software applications):

a) SCADA software
b) Historian
c) Data Warehouse for aggregating and contextualising data from the historian.
d) Building information model (BIM) software
e) Enterprise information management systems (e.g. ERP or LIMS)
f) Enterprise level decision support systems (DSS)
g) All other applications that would generate plant related data or requires data from the UNS.

Data ops layer functionality may be fulfilled by the SCADA software and/or a separate data ops application.

The two hot standby SCADA and a historian hardware servers shall be installed in the server room adjacent to the control room.

The SCADA hardware included in the scope of this Contract are listed in the subsections below and shown on the control architecture drawings.

The Contractor's System Integrator (SI) shall involve the Original Equipment Manufacturer (OEM) for consultation and specification of the SCADA configuration and architecture, before any engineering commences. The OEM shall further be involved for fault finding and pre-commissioning testing on site.

The Contractor shall allow for at least one scoping meeting between the Contractor, the SI, the OEM, the Engineer and the Client to finalise the scope and discuss the latest technology developments.

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5.3 CONTRACTOR'S DESIGN AND TEAM

The Contractor shall produce a detailed Control System Functional Specification based on the approved design, explaining all interlocks and controls, for discussion and approval by the Engineer and the Employer as well as attend a meeting with the Employer and the Engineer for discussion hereof. This shall also include the SCADA and HMI mimics. The details of the FDS requirements are stipulated in Section 3.

Thereafter, the Contractor shall configure the SCADA system to the agreed requirements and present the system to the Engineer and Employer in a control system FAT, along with all control components (PLCs etc.).

The SCADA mimics will be reviewed by the Engineer before these are presented in the control system FAT or are implemented on site. Tenderers shall allow for at least three iterations in the design and review of the SCADA design and mimics.

The development team shall have specialist experience in the following fields and proof shall be provided after appointment. A list of projects shall be provided to prove specialist experience if certification is not available:

a) Experienced and certified SCADA engineers/developers (two people).
b) Experienced and certified historian/timeseries engineer/developer.
c) Experienced and certified data warehouse and business intelligence engineer/developer.
d) Experienced SQL developer

5.4 DATA SOURCES

The data architecture shall allow for following data sources:

a) Sensor data, real-time and historical data
   - Process control system
   - Electronic Building Services and building management system
   - Embedded generation control systems
b) Laboratory Information Management System (LIMS)
   - Data from the independent laboratory
   - LIMS data from on-site labs
c) Network data applicable to the site (e.g. up-stream and down-stream network data).
d) BIM data from asset information model (AIM) which shall include:
   - Equipment and Instrument list
   - Maintenance Schedules
   - Acquisition value
   - Remaining useful life

5.5 DATA PROTOCOLS

The data architecture shall use the following standard open data protocols:

a) Industrial Ethernet or MQTT (Sparkplug B) for control system networks
b) MQTT (Sparkplug B) for all raw sensor data to the MQTT broker
c) MQTT (Sparkplug B or vanilla MQTT), SQL, REST or GraphQL APIs to read/write from data sources such as historian, data warehouse or other relational databases.
d) MQTT to off-site enterprise broker

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All connections to off-site locations shall communicate over a virtual private network (VPN) and shall be encrypted with TSL/SSL encryption.

5.6 ASSET DATA MODEL

The UNS and data architecture shall be structured in an asset model that is aligned with the Employer's asset information model and numbering system.

The static asset data (from instrument and plant equipment list) shall be used to add context to the real-time and calculated metrics that is produced. This information shall be available on the various user interfaces.

5.7 TELEMETRY CONNECTION TO GLEN GARRY

The SCADA system as installed at the Muldersvlei Reservoir shall be viewable in its entirety at the Glen Garry Reservoir control room, to enable monitoring of operations at Muldersvlei from Glen Garry.

A dedicated telemetry link shall be provided for this purpose, inclusive of all equipment to achieve the specified functionality. The telemetry system shall comply with the CCT Standard Specification for Electrical Works, clause 27.2.

The Contractor shall allow for a radio propagation study as well as repeater stations and antennas as required.

5.8 TELEMETRY CONNECTION TO BULK WATER HQ

The SCADA system as installed at the Muldersvlei Reservoir shall allow high-level supervision of the plant indicating important KPIs and performance parameters on the Bulk Water SCADA located at the Bulk Water Headquarters in Bellville.

The Contractor shall develop a new mimic on the Bulk Water SCADA dedicated to the Muldersvlei Reservoir and update all required databases and navigation menu's.

5.9 SCADA AND HISTORIAN HARDWARE

The SCADA hardware shall include the following:

a) Two standby duty SCADA servers installed in the server room
b) One Historian Server installed in the server room
c) PC based operator workstations, including operating system, antivirus software and SCADA control client licenses, for the following functions:
    - Two workstations for main control room
    - Engineering PC in main control room
d) Desktop displays (Two per operator PC, one for Engineering PC)
e) Overhead displays (2 per operator workstation)
f) Control Room Furniture
g) Laser colour printer
h) Managed Switches as indicated on the drawings
i) VPN routers
j) UPS for SCADA servers and operator PCs
k) GPS clock
l) All other ancillaries needed for a fit for purpose design

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Total [redacted]

5.10 INTELLIGENT REMOTE ACCESS DEVICE

An industrial VPN router shall provide secure access to SCADA over the internet for remote assistance and allow MQTT traffic out from the plant to enterprise broker.

The router shall be connected to the internet via a stable connection from a 5G or local internet service provider. The contractor shall allow for an internet connection of 50Mbp/s or faster from pre-commissioning till the end of the Defects Liability Period for the Engineer and Employer for remote assistance.

5.11 SCADA AND HISTORIAN SOFTWARE

The SCADA software shall include the following:

a) SCADA software
b) Two Clustered MQTT brokers that is sparkplug B enabled.
c) MQTT client software modules for all edge nodes
d) Industrial Historian software
e) Business intelligence platform for data analysis
f) Visualisation software
g) Virtualisation software (The different software platforms shall be installed on virtual machines)
h) Anti-virus software
i) Cyber security measures and software

5.12 SCADA AND DATAOPS SOFTWARE

The SCADA software shall be a comprehensive industrial internet of things (IIOT) platform to provide the following functionality:

a) User interface to monitor and control the plant
b) Process data acquisition
c) Real-time and historical trending
d) Alarm monitoring
e) User authentication
f) Data operations (DataOps), data modelling, contextualisation and transformation of data and publishing data to the plant broker.
g) Logging data to the historian
h) Mobile and Web-based viewing
i) Operational reporting
j) Support MQTT and SparkplugB
k) Integration of external data sources such as loadshedding schedule or weather data.

5.13 SCADA PROCESS VISUALISATION AND OPERATION

The visualisation shall be based on the Employer's standards and the minimalist situational awareness philosophy, only attracting attention to items that require action from the operators.

Mobile versions of all mimics shall be provided.

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5.14 HISTORIAN (HIGH RESOLUTION TIMESERIES DATA STORAGE)

The historian shall be comprehensive purpose-made time series data storage solution.

The historian shall be optimised for time-series data and shall not just be a SQL database like Microsoft SQL.

It shall automatically manage data as the data scale and not require special database administration skills.

The historian shall provide fast read/write performance for data that is stored. At least 1 million writes per second and 2 million reads per second. Performance shall not degrade as the database grows.

The historian shall be easy to use and not require special programming to configure.

The historian shall allow for at least 5000 tags to be historised.

The historian shall connect directly to the UNS and historise the tags. The SCADA software shall visualise historised data from the historian.

5.15 DATA WAREHOUSE

High-resolution data from the historian shall be aggregated into a separate low-resolution database that shall form part of a comprehensive business intelligence data warehouse package (see next section).

The database shall store long term data (>20 years).

The low-resolution database shall form part of data storage system that shall include other dimensions that would allow business intelligence type queries. At a minimum the following dimension tables shall be allowed as shown in Figure 2:

a) Date table (Time related queries such as YTD, seasonal etc)

b) Equipment and instrument list (Tag name, description, location, make, model, ratings, efficiency etc.)

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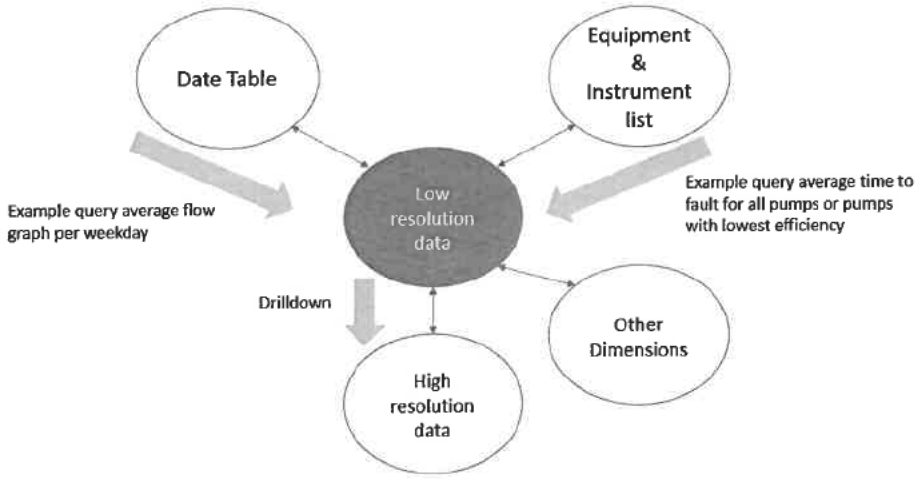


Figure 2: Data Warehouse Star Schema

The data warehouse system shall allow queries to drill down to the high-resolution historian if more detail is required.

The low-resolution database shall be designed with multiple resolutions if query performance is poor for longer time intervals. I.e., some metrics shall be stored at 10-minute intervals and 1-hour intervals.

The low-resolution database shall be continuously updated (at least hourly).

Database tables shall be designed to ensure scalability of the database and shall be optimised for timeseries data. Database tables shall be indexed and partitioned for optimal query performance.

5.15.1 TABLES

The data warehouse database shall as a minimum have the following tables and columns:

Table 3: Low-resolution Database Analogue Table Structure

Datetime	Tag name	Average	Max	Min	Std Dev	Count of data points	Quality

Table 4: Low-resolution Database Digitals Table Structure

Datetime	Tag name	On/off count	On/off duration	Count of data points	Quality

Table 5: Low-resolution Database Totalisers' Table Structure

Datetime	Tag name	Value	Increment	Count of data points	Quality

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[redacted]

5.15.2 DATA LOGGING AND MANAGEMENT

The data logging philosophy shall be optimised for memory storage and performance.

Analogue signals shall as far as possible only be stored if there is a significant change in value. Storing polling data of signals that rarely change shall be avoided.

Digital or discrete signals shall be stored based on change of state.

All tagging shall be done according to the existing CCT numbering system.

Data shall be timestamped as close to the source as possible, i.e., at the PLC, edge device or HMI.

All calculations, such as efficiency calculations of pump systems shall be done as close to the source as possible. Unless otherwise specified, this shall be done in the PLC.

The database shall be designed to ensure scalability of the database and shall be optimised for timeseries data. Database tables shall be indexed and partitioned for optimal query performance.

During commissioning and the trial operation period of the new installation, the historian and database growth shall be monitored and reported on. Tables with the highest growth shall be analysed and measures shall be implemented to optimise the database performance (read/write and query performance) such as splitting the table into smaller tables with fewer tags or revisiting the logging philosophy.

5.16 BUSINESS INTELLIGENCE REPORTING

The business intelligence (BI) reporting software shall be a comprehensive low code business intelligence and data modelling software.

The business intelligence dashboards and reports shall be visual and make use of charts, dials, and tables to present data in a user-friendly way.

The dashboards shall allow dynamic roll-up, drill-down, slicing and dicing, and pivoting of data.

5.17 DASHBOARDS AND VISUALISATIONS

5.17.1 DASHBOARD DEVELOPMENT

Dashboards shall be designed to meet the end-user requirements. These requirements shall be obtained from the end-users (plant supervisors, operators, regional manager and the DSS users) and Engineers via interviews or end-user workshops.

The Contractor shall allow for at least two workshops, a user requirement workshop and workshop to gather feedback from stakeholders after the first prototype dashboards are developed.

Dashboard development shall be developed in an iterative approach and feedback on dashboard prototypes shall be sought during the process.

The Contractor shall ensure that it is easy to add dashboards after implementation as required by end users, i.e., the self-service BI concept. Therefore, it is important that the data model and architecture is designed for flexibility. Training shall be provided for key end users on how new dashboards and KPIs can be added.

5.17.2 DASHBOARD TIME PERIODS

It shall be possible to view real-time trends and historical longer-term trends of the KPIs.

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Any given dashboard (see list below) can be made up of a mix of real-time and longer term KPI visualisations.

It shall be possible to "drill through" the lower resolution data visualisations to high resolutions data.

The real time visualisations shall show current values as well as high resolution trends (typically 1s to 10s) of the past day up to weekly time periods where relevant. The real-time visualisation shall be based on the high-resolution historian or timeseries database.

Visualisations based on lower resolution historical data (5min to daily) shall show weekly, monthly, YTD and yearly time period and shall query from the data warehouse to ensure fast querying speeds.

Automated reports of the dashboards shall be scheduled for periods as the Employer requires.

5.17.3 DASHBOARD LIST

The dashboards listed shall be developed and accessible via clickable icons on the Overview page. These dashboards can be one or multiple pages except for Overview page which shall be one page. The overview page shall allow the user to see the overview summarised KPIs on one page and allow drill down functionality to detailed dashboards for further interrogation of the data. Details of metrics required per dashboard are listed lower down.

Table 6:Dashboard

Dashboard	Description
Overview	A one-page high level dashboard with summarised metrics of detailed dashboards below.
Plant and equipment Availability	Availability metrics, A list of motors/equipment, with run hours, downtime, and other information available. Drill down from Availability
Flow	Flows and losses per process and overall plant.
Compliance	Compliance compared to regulatory and performance limits.
Water Quality and Process Performance	Percentage removal of water quality parameters E.g. percentage Iron or turbidity removal. Inflow quality, backwashing and desludging counters
Geo Hydrology	Borehole level, Extraction volumes vs license, Recover time
Chemical usage	Chemical usage metrics
Chemical efficiency	Chemical usage per Ml treated
Energy & Generation	Energy usage of plant and per system and cost associated
Energy Efficiency	Energy used per volume produced.
Communication	Availability metrics of communication network.
Server Performance	Data storage growth and other server metrics.
Alarms	Alarm system metrics.
User logs	Shift reports

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5.17.4 METRICS

5.17.4.1 General

Dashboards shall represent the most important metrics in a visual and easy to understand manner. Metrics shall be shown in a format that provides the most appropriate context. Statistical context shall be provided where it makes sense such as minimum, maximum, average, and standard deviation values.

Specific attention shall be paid to the user needs with reference to granularity of information (e.g. real time, daily, weekly, monthly, yearly), type of information (e.g. run hours or process compliance).

5.17.4.2 KPIs

The metrics or key performance indicators (KPIs) for each dashboard shall be developed in conjunction with the Engineer.

The Engineer will issue a detailed KPI listed during the Contractor's design development.

Allow for at least 500 KPIs to be included in the system.

5.18 CONTROL DESK REQUIREMENTS

The control desk furniture shall accommodate workstations and displays as shown on the control architecture drawings. This shall include at least the following:

The control desk shall include the following:

a) Clean aesthetic look, matching the interior design and furniture colours of the rest of the room it is located in.
b) Durable materials (high-pressure laminate and wood veneers)
c) Ergonomic design for chairs and desks
d) Rear access panels for desk
e) PC storage under the desk, hidden away
f) Hidden cable management system
g) Back plate with cantilever arm to mount flat screens
h) Power distribution system behind or below desk
i) Dedicated UPS
j) Printer(s), printer paper and ink cartridges. (The compartment shall make provision to store both the used and unused printer paper.)
k) Dust proof (IP6X) compartments are required for workstation computers and dedicated UPSs.
l) Furniture for the SCADA workstation shall also be utilised for building electronic services and security surveillance where applicable. At least one workstation position shall be allowed for at the control desk.
m) Operator displays shall be mounted in the vertical upstand section(s) of the control desk at ergonomical angles. Display supports shall be capable of supporting displays in a configuration of multiple columns and up to 2 rows. All cabling shall be done neatly in the desk recesses and no cables other than the keyboard and mouse cables shall be routed outside of the desk.
n) The control desk shall further contain a section where the Employer's telephone equipment and security surveillance equipment (if applicable) can be housed.

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o) Sufficient storage space shall be provided in the control desk for the operations and maintenance manuals, operator logbooks, report files and any other general stationary.

The SCADA furniture shall be designed and supplied by a control room specialist. The layout shall be approved by the Engineer.

5.19 TESTING REQUIREMENTS

The data, SCADA, historian, reporting configuration and hardware as described shall be tested as part of a comprehensive factory acceptance testing process.

The tests shall be witnessed by the Employer (1 person) and the Engineer (2 persons) Travel and accommodation costs (traveling from Cape Town) for all persons shall be included in the tender pricing.

The factory acceptance testing shall include the following tests:

a) Thin slice

b) SCADA factory testing

c) Data and reporting testing

5.19.1 THIN SLICE

Acceptance testing of the configuration of the proposed architecture, unified namespace, tagging system, templates, and user interface (UI) design on which the rest of the system shall be developed. Allow at least one day of acceptance testing for the thin slice.

5.19.2 SCADA FACTORY TESTING

Acceptance testing of the SCADA system and historian configuration and logging. Some of the SCADA testing might be combined with the control system acceptance testing as the HMI screens for the process areas would be the same. Allow at least three days of acceptance testing.

5.19.3 DATA AND REPORTING TESTING

Acceptance testing of the data and reporting systems. This shall include the data pipeline from the historian to data warehouse, the real time and business intelligence dashboards and business intelligence dashboard design. Allow at least 2 days of reporting and data acceptance testing.

For the testing of the historian and business intelligence software a testing dataset and simulation routines shall be developed for testing the performance of the historian and to develop the reports before live data is available.

The reports and dashboards shall be used as inputs to the reports on the pre-commissioning, commissioning and trial operation periods as asked for under the Contractor's Documents.

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6. PV METERING AND MONITORING

6.1 GENERAL

The Admin Building PV System shall interface to the plant SCADA system. The SCADA system shall provide real time monitoring and historical trends to the facility management personnel of the PV system. The PV system shall be metered, all data logged and displayed as part of the site wide SCADA system.

All electronic components (as a minimum, the inverters, string optimisers, digital power meters, power plant controllers, sensors/instruments and smart sync breakers) shall be connected to the control network (not through wireless technology) for monitoring and display on the SCADA. The status of each fuse shall also be shown. Additional sensors and meters might be required to achieve the overall reporting and control requirements stipulated below; these shall be included in the hardware offering to achieve these requirements.

The Contractor shall set up the metering to allow process controllers to easily track the power offset from the grid by the PV system. The Contractor shall carry out an installation audit to determine final power consumption and amount offset by the PV system.

The performance of the PV system shall be included in the advanced reporting and dashboard on the SCADA. In the reporting, credit for the PV power that offset Eskom power, shall first be given to the building services usage.

All software licensing required to achieve the performance and functionality requirements shall be included in the design and priced offer.

6.2 MIMICS AND DASHBOARDS

A dedicated mimic shall be developed showing the performance and net power result of the PV system.

The following parameters from the system shall be available for viewing on the SCADA in the control room (for the system as a whole, per building and per inverter level):

- AC output voltage and current
- Output power production (peak, average and yield)
- Output power factor
- DC input voltage and current
- System active time and system disabled time
- Inverter performance and adjustable protective function limits (AC over voltage, AC under voltage, over frequency, under frequency, ground fault, PV starting voltage and PV stopping voltage)
- Status of protection systems, circuit breakers and fuses
- System idle time and system healthy
- Module mismatch
- Temperature performance of ambient air, system and PV modules
- Potential induced degradation (PID) per module and per string
- Meteorological measurements
- Fill Factor (FF) of modules (manual calculation required if not provided by inverter)

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The current values, previous values for up to 12 months, and the average values shall be made available for energy auditing.

Data shall be time and date stamped, recorded date wise chronologically in a common worksheet. The data file shall be MS Excel compatible. Data shall be represented in both tabular and graphical form.

Provision for real-time Internet monitoring and the download of historical data shall be provided.

6.3 MOBILE APPLICATION

An application ('app') for use on mobile devices (free of subscription) shall be included for use by the Employer for remote monitoring and partial control, showing real-time performance of the PV system, down to module level.

6.4 SCADA INTEGRATION

One of the fibre optic ring network layers shall be dedicated for energy metering, which shall also include the monitoring and control of the PV system.

Modbus TCP/IP connection / Ethernet communication shall be used. IP addressing shall tie into the larger plant IP structure as per the Employer's requirements.

Use one data logger per set of inverters at each tie in location.

The communication network including the network switches and cables used shall be robust and suitable for the Site conditions, geotechnical conditions, pests and rodents, electrical interference and the effects of surge/fault/lighting transient voltages.

Where the different sub-contractors or OEM's are involved, the Contractor shall coordinate the supply and commissioning of the overall SCADA, network and PV system.

6.5 DATA COLLECTION AND STORAGE

All data shall be recorded by the SCADA system historian. The data recorded should be both regular time series data (e.g. irradiance, power, temperature etc.) and event data (faults, warnings, alarms, errors, changes of state, operator-initiated changes, etc.). Processed data must be stored locally in the historian so that no data is lost if the communications network is temporarily unavailable.

6.6 ENVIRONMENTAL / METEOROLOGICAL MEASUREMENT SENSORS

The following minimum PV power plant environmental sensors shall be installed and integrated into the PV monitoring system:

- 1 x irradiance sensor (reference cell or pyranometer)
- 1 x PV module temperature sensor on Admin Building roof
- 1 x PV module temperature sensor any steel roof
- 1 x ambient temperature sensor

Wind speed and wind direction sensors (anemometers and wind vanes) to support the PV System management and maintenance.

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7. INSTRUMENTATION

7.1 NORMATIVE REFERENCES

The work under this clause shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 22.
- W&S-BW016-STD: City of Cape Town's Standard Specification for Electromagnetic Flow Meters
- Engineering Specification SPE-EE-0007: Instrumentation
- Data Sheet DS-II-0007: Instrumentation

7.2 GENERAL REQUIREMENTS

Instrumentation shall be supplied as per the control and instrumentation schedule and the Piping and Instrumentation Diagrams (P&IDs).

All the instruments associated with the NaOCl Storage Tanks shall be intrinsically safe rated instruments. The Hydrogen sensors shall be intrinsically safe rated instruments.

The instrumentation shall be sourced from a supplier who is a recognised and registered agent to deal in such products. Proof of agency must be supplied on request.

The OEM must be capable of, and willing to, provide technical assistance on all supplied products, which includes back up service and support from the manufacturer if need be.

The supplier shall be capable of rendering on-site technical assistance within 24 hours of being contacted by the City.

The supplier shall provide the City with all drawings, manuals, and software pertaining to the instruments and make known any and all access codes which may be necessary for configuration, programming or setup of the instruments.

7.3 DETAILED REQUIREMENTS

All instrumentation shall be IO-Link devices or have either discrete 24 VDC potential free signals or 4-20mA current loops. IO-Link enabled instruments shall be the first preference in non-intrinsically safe areas. Ethernet (wired, not wireless) connectivity is required for all flow and analytical measurement signals.

Where signals are used for safety purposes a hardwired cable shall be taken directly to the MCC cubicle, but also relayed to the process control system for monitoring. It should be noted that no safety function shall be transmitted via Ethernet unless the entire signal loop is certified with a safety function and approved in advance.

The Contractor shall select the instrumentation equipment taking into account the operating conditions, consider materials compatible with the medium measured or surroundings with which the equipment comes into contact with, and the measuring range required to be measured.

7.4 INTRINSICALLY SAFE INSTRUMENTATION

The instrumentation on and around the sodium hypochlorite storage tanks, which are classified as a hazardous area, shall be intrinsically safe. The instruments required to be intrinsically safe are indicated on the design schedules indicatively, however, the Contractor shall allow for a Hazardous Area Classification (HAC) to be completed as part of the HAZOP. The detail design shall be developed based on the findings of the HAC.

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The Contractor shall be responsible to certify the intrinsically safe installation. All intrinsically safe loops shall be approved by a registered, qualified professional.

7.5 INSTALLATION

Process instrumentation shall be provided with separate transmitters that shall be mounted inside the dedicated instrumentation section, or in a dedicated transmitter enclosure easily accessible as well as adequately protected from the environment. Separate instrument transmitters shall be provided where local indication is specified in the Instrumentation List.

Instrumentation installed outdoors shall have their transmitters installed in a 3CR12 IP 65 weatherproof epoxy powder coated enclosure near the point of measurement. Instrument transmitters installed indoors shall be wall mounted. The outdoor enclosure shall have a glass window to view the transmitter display without opening the enclosure door. The outdoor enclosure shall be provided with a rubber flap to provide UV protection covering the glass window.

All mounting material and brackets shall be stainless steel.

Where ultrasonic level transmitters and hydrostatic level transmitters are used to measure level in a closed water retaining structure / reservoir, these shall be entered from the top through dedicated holes in the concrete structure. Stainless steel mounting plates and brackets shall be used to ensure sensors are easily accessible for maintenance purposes, while also closing the roof structure behind the sensor installed. Stainless steel telescopic rods will be used to lower the hydrostatic sensors to the bottom of the reservoirs.

Field instrumentation shall be connected to the PLCs to provide the required monitoring and control specified in the Control Philosophy and in the Instrumentation List.

Instruments for critical pump protection (safety interlocks) shall also be hard-wired to the MCCs to ensure tripping by hardwiring in all modes of operation.

All instrumentation that is not an integral part of mechanical equipment or package plant shall be supplied and installed by the Contractor together with all brackets, adaptors and connectors that may be necessary.

The scope for installation of instrumentation shall include all process connections, adapters, brackets, utility junction boxes, glands, wires and labels as well as set-up, calibration and certification of the instrumentation.

7.6 TESTING REQUIREMENTS

All instruments shall be calibrated, and calibration certificates shall be supplied.

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8. WIFI ACCESS POINTS

8.1 GENERAL REQUIREMENTS

The Contractor shall provide a WiFi network for the Disinfection Plant and Administration Building. The WiFi network shall be accessible throughout the buildings on site and outdoor areas.

The Contractor shall perform a radio propagation study based on his/her offered solution to indicate that all areas described above are covered.

The Contractor shall provide all the necessary WiFi access point routers complete with installation accessories and cabling.

The WiFi access points/routers shall be connected to the supervision network throughout the plant as required. The Contractor shall provide all interface equipment required for a fully functional WiFi system.

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9. OPERATOR CONTROL ROOM FURNITURE

9.1 GENERAL REQUIREMENTS

The furniture for the control room in the administration building control room shall be designed and supplied by a control room specialist. The layout shall be approved by the Employer and Engineer, and include the following:

a) Clean aesthetic look, matching the interior design of the rest of the Admin Building.

b) Durable materials (high-pressure laminate and wood veneers), matching the colour and materials of other Admin Building furniture (specified elsewhere)

c) Ergonomic design for chairs and desk

d) Rear access panels for desk

e) PC storage under the desk, hidden away

f) Hidden cable management system (integrated over floor boxes supply)

g) Back plate with cantilever arm to mount flat all screens

The computer cabinets and control desk for the master and remote view Operation clients shall be physically located in a dedicated control room in the administration building and the design and construction of the control room will be done by others.

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10. EARTHING AND BONDING

10.1 NORMATIVE REFERENCES

The earthing and bonding shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works, clause 13.

10.2 GENERAL

All electrical and electronic equipment shall be earthed.

All accessible extraneous conductive parts of electrical equipment / electrically driven equipment shall be bonded in accordance with SANS 10142-1.

An earth continuity conductor shall be installed between each distribution board or kiosks and the feeding MCC/DB alongside the power cable.

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11. GENERAL ELECTRONIC INSTALLATION

11.1 NORMATIVE REFERENCES

The electronic installation shall be provided in accordance with the relevant paragraphs of City of Cape Town's Standard Specifications for Works.

11.2 GENERAL REQUIREMENTS

The electronic installation shall be provided to suit the control system architecture proposed by the Engineer, the Process and Instrumentation Diagrams as well as the proposed equipment Control Philosophy and OEM specific requirements.

It shall however remain the Contractor's responsibility to provide a complete installation to suit the Contractor's control system architecture drawing, a full set of Process and Instrumentation Diagrams, Detail Control Philosophy as well as a control system Functional Design Specification (FDS) for the offered works under this tender, for approval by the Engineer and the Employer before any detailed design or programming is done, or equipment is purchased or manufactured.

11.3 ELECTRICAL SUPPLY

All electronic equipment associated with the various portions of the works, shall receive power from a single-phase 230V/400V 50Hz supply, which shall be sourced from each of the relevant MCC load centers and routed to the relevant PLC panels.

All equipment in the PLC panel and instrumentation associated with the PLC shall be powered via control transformer and from a battery backed up single phase Uninterruptible Power Supply (UPS).

Electrical power (230V ac and 24V dc) shall be distributed to all equipment associated with the PLC panels such as field instrumentation and peripherals.

Sampling pumps and valves shall be supplied with a three-phase 400V 50Hz supply, which shall be sourced from the relevant MCC panel or field DB.

Although the Works is located in an area with low lightning incidence, protective fuses and surge protection shall be provided in the supplies to all electronic equipment and instrumentation, and surge protection shall be provided on all signal circuits.

The Power Supply Unit (PSU) for each PLC shall be in accordance with the Data Sheet no. DS-II-0002. PSU calculations shall be provided as part of the Contractor's documents for approval by the Engineer before any equipment is ordered.

The PCS Operation computers in the Control Rooms shall be equipped with a dual power supplies – one from the mains power (dedicated red SSO) and one from the UPS power.

11.4 CONTROL CABLES

Control cables shall be provided as detailed in the Control and Instrumentation Cable Schedule for discrete instrumentation and MCC motor control.

The Contractor shall however develop a final control cable schedule and cable block diagram to suit his/her equipment offered under the tender and the Contractor shall be deemed to have allowed in his/her tender for all control cabling required to complete the installation.

The control cables shall comply with the relevant section in data sheet no. DS-II-0001: Control, Instrumentation, Data Cables and Junction Boxes.

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[redacted]

Control cables shall be 600 / 1000V multicore 1.5mm² stranded copper conductor, PVC-insulated cables with galvanized steel wire armouring and PVC serving when installed outdoors or in the ground, and unarmoured cable when installed indoors in protected wireways.

Multicore cables may be used to group several control signals in an area and connect them from a suitable Junction Box to the relevant PLC. A minimum of 2 cores or 10% spare shall be provided in the cables.

11.5 INSTRUMENTATION CABLES

Instrumentation cables shall be provided as detailed in the Control and Instrumentation Cable Schedule for all analogue instrumentation, transmitters and VFC analogue signals.

The Contractor shall however develop a final instrumentation cable schedule and cable block diagram to suit his/her equipment offered under the tender and the Contractor shall be deemed to have allowed in his/her tender for all instrumentation cabling required to complete the installation.

The instrumentation cables shall comply with the relevant section in data sheet DS-II-0001: Control, Instrumentation, Data Cables and Junction Boxes.

For digital and analogue instrumentation and transmitters, the instrumentation cables shall be twisted pair or triad, 1.5mm² stranded copper conductor, individually and overall screened, PVC-insulated with galvanized steel wire armouring and PVC serving when installed outdoors or in the ground, and unarmoured cable when installed indoors in protected wireways.

All IO-Link master and sensor cabling shall have M12 connector with the same IP rating as the devices they are connected to.

Multi-pair cable may be used to group several instrument signals in an area and connect them from a suitable Instrument Cable Junction Boxes to the relevant PLC. A minimum of 2 cores or 10% spare shall be provided in the cables.

11.6 DATA CABLES

Data cables shall be provided as detailed on the architecture drawings and the control network description. Ethernet Copper data cables shall be CAT6E Screened Twisted Pair (STP).

The different communication services shall be distinguished by the following colours:

a) Control data and Engineering – Teal green
b) ICT services – Yellow
c) CCTV - Purple

11.7 FIBRE OPTIC CABLES

A 12-core, armoured multimode fibre optic cable shall be used. Control and engineering communication shall be separated from data transfer (supervision). This shall be achieved by using different set of cores in the cable. The fibre core layer allocation shall be as follow:

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Table 7 - Fibre Optic Network Layers

CORE NUMBERS	SERVICE
01 - 02	Plant Control
03 - 04	Plant Supervisory
05 - 06	Gallery Panic Alarm System
07 - 08	Spare
09 - 10	Spare
11 - 12	Spare

All new fibre optic cable shall be as per chapter 20 of City of Cape Town's Standard Specification for Electrical Installations.

11.8 CABLE SUPPORT SYSTEMS

Control and instrumentation cables shall be installed on medium duty stainless steel wire mesh cable tray.

Control and instrument cables may be run on the same cable tray/ladder as power cables, except where electromagnetic interference may affect the instrumentation signals. Control and Instrumentation cables shall be installed at least 300 mm away from power cables.

Cables shall enter and exit the PLC panels, LCPs and Junction Boxes from the bottom of the panels.

All surface-mounted conduits shall be stainless steel complete with stainless steel saddles and end caps.

11.9 JUNCTION BOXES

Instrumentation sensors with integral cables shall be connected either directly to their transmitters, or in the case of discrete signals to a local instrument junction box, from where they shall be cabled to the relevant PLC with a multicore/multipair cable(s) as per the instrumentation and control cable schedules.

The integral cables shall be connected to conventional cables via screw type terminal strips in the junction boxes. For single (or dual signals associated with for example valve positions) the junction box shall be a utility type junction box with round screw lid cover and appropriately sized enviro type compression glands. For multiple instrumentation in any given area, junction boxes shall be wall / pedestal mounted boxes and cables shall enter and exit the junction box from the bottom and be properly glanded to the bottom of the box using enviro type compression glands.

Junction boxes shall be installed in an easily accessible location on a purpose made stand or bracket, which is not in the way of maintenance equipment to be serviced in that area. Junction Box locations will be agreed with the Engineer before cable support systems are constructed.

Junction boxes shall be manufactured from 3CR12 and be powder coated and shall have an environmental protection rating of IP65.

Junction boxes shall be provided with an integral earth bar that shall be bonded to the installation earthing system.

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12. BUILDING ELECTRONIC SERVICES

The building electronic services portion of this contract shall include design, supply, installation and commissioning of the following:

a) Access control.
b) CCTV system.
c) Fire detection system.
d) Site wide building services fibre optic ring network.
a) Data outlets and data cabling.
b) Labelling of all equipment.
c) Factory testing, site testing and commissioning of the electronic installation.
d) Certificates of Compliance.
e) As-built drawings.
f) Operation and maintenance manuals.
g) Training manuals and training.
h) Spares

12.1 DESIGN COORDINATION AND APPROVAL

The Contractor shall employ a certified Designer for all sections of this scope to review with the Engineer, the Employers, and on-site personnel to finalise all design requirements and ensure all industry regulations are adhered to.

The Contractor shall attend at least three (3) iterations of design coordination meetings with the Engineer, the Employers, and on-site personnel to finalise all design requirements and ensure all industry regulations are adhered to. Where conduits shall be required to run on surface mounted routes, the routes shall be approved by the Engineer. All surface mounted conduit shall be stainless steel.

The Contractor shall also be responsible to liaise between the electronic and electrical subcontractors to ensure conduits outlets are installed to all electronic equipment and socket outlets are installed for all electronic equipment requiring power.

Manufacturer's data sheets of the offered electronic equipment shall be included in the tender offer. All equipment lists and data sheets shall be neatly presented to the Engineer in an electronic format for approval. Samples of all equipment shall also be presented to the Engineer for approval before any equipment is ordered.

The Contractor shall review the project construction program and plan accordingly the building electronics installation taking into consideration critical path items such as fibre ring installation.

Indicative preliminary designs are shown on the drawings to aid in pricing.

12.2 FIBRE AND ETHERNET NETWORK

12.2.1 NORMATIVE REFERENCES

The Building Electronic Services Fibre and Ethernet network shall comply with:

- The City of Cape Town Standard Specifications for Electrical Works

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12.2.2 FIBRE OPTIC CABLE NETWORK

12.2.2.1 System Requirements

The fibre optic cable shall consist of 12 cores with the following core layer allocations:

- Cores 1-2: CCTV
- Cores 3-4: Building Services (Access Control, Fire and Operator Network)
- Cores 5-6: 3rd Party Plant Operator Network
- Cores 7-8: Spare
- Cores 9-10: Spare
- Cores 11-12: Spare

The fibre optic cable shall be terminated in each building's dedicated buildings services network panel/rack.

12.2.2.2 Installation Requirements

The installation shall include but not be limited to, the supply, installation, and commissioning of the following:

- Fibre optic cable
- Cable trenching, ducts, and all cable accessories
- Fibre optic patch panels
- All fibre optic splicing equipment (patch leads, mid-couplers, pigtails, splice trays, etc.)
- Network racks
- Wireways

The fibre installation shall not consist of spliced joints. Patching in racks is the only splice in fibre cores allowed.

The fibre optic cable shall be installed according to TIA-598-C colour code.

The Contractor shall co-ordinate fibre entry and exit details for each building with other building services.

Fibre optic patch panels shall be installed at the top of each network panel/rack.

Point-to-point tests shall be undertaken according to SANS 60793-1-22/40/41 or TIA 598 test procedures and test report provided for each core.

12.2.3 ETHERNET NETWORK

12.2.3.1 System Requirements

The network shall be installed in all buildings as per the network architecture drawing.

All network switches and associated equipment shall be installed in buildings' dedicated network racks.

The network shall create a ring topology with the use of RSTP redundancy protocol or a proprietary protocol to switch Original Equipment Manufacturer (OEM) if the same brand of network switches is used throughout the network.

The Contractor shall confirm by design and calculation, and submit to the Engineer for review, that the backbone network bandwidth requirements and setup are achievable prior to procurement of any network equipment.

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The network shall consist as a minimum of the following Virtual LAN (VLANs). Additional VLANs may be required as requested by the Employer.

- VLAN 1: Access Control
- VLAN 2: Fire
- VLAN 3: Operator Network
- VLAN 4: Process SCADA Network Interface
- VLAN 5: Spare

The Contractor shall issue a VLAN list and corresponding IP ranges to the Employer or Engineer prior to installation.

No connection to an external network to the plant or internet access shall be made without approval from the Employer or Engineer.

12.2.3.2 Installation Requirements

The installation shall include but not be limited to, the supply, installation, and commissioning of the following:

- Network switches
- Cables and all cable securing accessories.
- Wireways and conduits.
- Patch panels.
- All patching equipment (connectors, boots, keystones).
- Network racks and enclosures.
- Power distribution units, circuit breakers, power supplies etc.

Ethernet cable terminations shall be installed with the use of a patch panel.

CAT cable lengths shall not exceed 90m. Any lengths requiring more than 90 meters shall be networked via a fibre cable.

All network equipment installed in an external enclosure shall include a circuit breaker, surge protection device to isolate and protect the power supply.

All racks and enclosures shall be suitable sized for required networking equipment.

All network equipment shall be on a UPS backup power supply.

Network racks required in industrial rooms shall make use of IP54 rated enclosures with sufficient allowance for ventilation.

Point-to-point tests shall be undertaken, and test report provided for each ethernet connection.

The ethernet cable installation shall not consist of joints. Patching in racks is the only splice in fibre cores allowed.

12.3 ACCESS CONTROL

12.3.1 NORMATIVE REFERENCES

The Access Control System (ACS) shall comply with:

- Datasheet DS-EL-0009: Access Control

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12.3.2 GENERAL

The purpose of the Access Control System (ACS) shall be to control and monitor access to the following locations:

- Plant entrance boom gate
- All buildings main entrance doors
- Entrance doors to MCC rooms
- Entrance door to admin building control room
- Entrance door to laboratory room and,
- Entrance door to the server room.

The Contractor shall employ a certified ACS designer to review the Engineer's ACS design, providing comments and updates to the Contract drawings for the Engineer and Employer's approval. At least three (3) iterations of design review meetings with the Engineer and Employer shall be allowed for.

12.3.3 OVERALL SYSTEM REQUIREMENTS

The installation shall include the supply, installation, and commissioning of the following:

- Access control card readers.
- Magnetic door locks.
- Infrared non-contact door release exit sensors.
- Emergency green break-glass units.
- Power supply unit.
- Conduit wireways and wiring as required.
- Labelling.
- Rack mounted panel PC.

The ACS shall be monitored and recorded on the ACS central monitoring station.

The following conditions shall be monitored and recorded on the ACS central monitoring system:

- Tampering of the ACS unit.
- Access points open for prolonged periods.
- Forced opening on access points.
- Access points open due to emergency break glass.
- Monitoring each door status having 'locked/not locked' monitoring and 'door-position' monitoring, using door contacts linked to maglocks.

12.3.4 PROCESS SCADA NETWORK INTERFACE

The Access Control System (ACS) software shall be capable of interfacing with the process SCADA network.

The Access Control System (ACS) software shall display on a mimic resembling the site layout, on the process SCADA, the following statuses:

- Staff accessing site via the main boom gate.
- Tampering of the ACS unit.
- Access points open for prolonged periods.

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- Forced opening on access points.
- Access points open due to emergency break glass.
- Monitoring each door status having 'locked/not locked' monitoring and 'door-position' monitoring.

The Access Control System (ACS) software shall store instances on the process SCADA network historian of the following events:

- Staff accessing site via the main boom gate.
- Staff accessing buildings.
- Tampering of the ACS unit.
- Forced opening on access points.
- Access points open due to emergency break glass.

12.4 CLOSED CIRCUIT TELEVISION (CCTV)

12.4.1 NORMATIVE REFERENCES

The CCTV system shall comply with:

- Datasheet DS-EL-0008: CCTV.

12.4.2 GENERAL

The purpose of the CCTV system shall be to monitor, alert and record the following:

- Main access point to the Muldersvlei site.
- Perimeter fence.
- Access to all buildings.
- Access and coverage inside building as per layout drawings.

The Contractor shall employ a certified CCTV designer to review the Engineer's CCTV design, providing comments and updates to the Contract drawings for the Engineer and Employer's approval. At least three (3) iterations of design review meetings with the Engineer and Employer shall be allowed for.

12.4.3 OVERALL SYSTEM REQUIREMENTS

The installation shall include the supply, installation, and commissioning of the following:

- All cameras and networking.
- All associated networking equipment.
- Power supply units (PSU).
- Uninterrupted power supply units (UPS).
- Network enclosures and all other ancillaries required to complete installation.
- Video recording equipment and software.
- Conduit wireways and wiring as required.
- Labelling.

A central monitoring system shall be installed in the admin building control room with the ability to monitor all the CCTV cameras.

A CCTV remote monitoring system shall be installed in the guard house to enable the guards to only monitor the perimeter CCTV cameras.

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All CCTV systems shall allow for at least 20% spare capacity for future expansion.

12.4.4 CAMERAS

Various types of cameras shall be used, as indicated on the CCTV layout drawings and data sheets.

The dome cameras shall be installed internal to buildings and bullet cameras for all external locations.

All cameras shall receive power via Ethernet (PoE).

Camera manufacturer technical data sheets shall be approved by the Engineer prior to procurement and contraction.

As far as possible, cameras must be installed at a minimum height of 2.8m. Specific applications requiring a lower height shall be approved by the Engineer prior to installation.

Perimeter CCTV poles shall be supplied complete with foundation, baseplate, gland plate, access door, stainless steel single side entry spigot and all other ancillaries required to complete installation. The CCTV utility box shall be mounted on the CCTV pole.

All shall be Onvif conformant.

All camera mountings shall be non-corrosive and camera housing vandal resistant / tamper proof.

12.4.5 NETWORKING

All cameras, NVRs and view nodes shall be connected to the dedicated building CCTV network switch.

Each building CCTV network switch shall use the dedicated CCTV cores on the building services fibre optic ring to the NVR. Video data shall not be transferred via a VLAN over another network service.

The network shall feature RSTP redundancy protocol or a proprietary protocol to switch Original Equipment Manufacturer (OEM) if the same brand network switches is used throughout the system.

A dedicated power supply shall be used for the CCTV network equipment.

Depending on the network switch power requirements, a DC power supply may be required.

Power supplies shall be sufficiently sized to power both the network switch and PoE injector where PoE is not internal to the network switch.

12.4.6 CABLING

Purple CAT6 copper cable shall be used from cameras and monitoring stations to the network stations.

CAT cable lengths shall not exceed 90m. Any length requiring more than 90m shall be networked via fibre cable.

12.4.7 VIDEO MANAGEMENT SOFTWARE

A site wide interactive map of all buildings with CCTV and the perimeter fence shall be developed. Clicking on the building or perimeter fence should open building layout(s) or the permitter fence layout.

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[redacted]

An interactive map of each building or the perimeter fence showing camera positions and coverage shall be developed. Clicking on the camera icon should show live footage of the camera.

The perimeter fence cameras shall be setup with object detection.

The software shall create a log of all events on the CCTV system and shall provide for playback management of the video.

Training shall be given to the site security team and site operators of the CCTV system software and alerting.

12.4.8 NETWORK VIDEO STORAGE

Primary storage recordings shall be on the NVR hard drives installed in the admin building server room.

Sufficient capacity shall be provided to store at least 30 days' worth of recordings at full frame rate and definition. Minimum spare capacity of 20% shall be provided.

NRV sizing / selection shall make sufficient allowance for system specific recordings rate, playback rate, memory, and processing power.

The system shall remind the operator to back up the data every 15 days. Once the initial 30-days limit is reached, a first-in-first-out (FIFO) approach shall be taken.

All drives shall be sufficiently backed up by using the RAID level 1 to ensure that no data is lost in case of drive failure.

Access to any stored recordings shall be limited to the people with the right access profile.

12.4.9 PROCESS SCADA NETWORK INTERFACE

The video management software shall be capable of interfacing with the process SCADA network.

The video management software shall store instances where a perimeter breach was detected on the process SCADA network historian.

12.5 FIRE DETECTION

12.5.1 NORMATIVE REFERENCES

The cables access control system shall comply with:

- Datasheet DS-EL-0005: Fire Detection and Suppression.

12.5.2 GENERAL

The Contractor shall employ a certified SAQCC Level 4 fire detection system designer to review the Engineer's fire detection design, providing comments and updates to the Contract drawings for the Engineer and Employer's approval, and ensuring all SAQCC certification on all five (5) levels are achieved before construction commences. At least three (3) iterations of design review meetings with the engineer and Employer shall be allowed for.

Only installers holding a SABS 1474 certificate shall be accepted.

12.5.3 OVERALL SYSTEM REQUIREMENTS

The fire detection system for all buildings shall be equipped with automatic fire detection.

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The fire detection systems installed within the buildings shall be installed according to the requirements of a system category L1 according to SANS 10139-2021 Code of practice for design, installation, commissioning and maintenance of fire detection and alarm systems in non-domestic premises.

The fire detection systems installed within the industrial buildings shall be installed according to the requirements of a system category P1 according to SANS 10139-2021 Code of practice for design, installation, commissioning and maintenance of fire detection and alarm systems in non-domestic premises.

The installation shall include the supply, installation, and commissioning of the following:

- Addressable fire detection panel, including 2 hours of back-up battery supply.
- Addressable optical smoke and heat detectors.
- Addressable laser beam smoke and fire detectors.
- Aspirated smoke detection systems.
- Linear heat cables.
- Combination siren and strobe units.
- Red break-glass units.
- Input/Output units as required for each building fire system.
- Enhanced fire resisting cables that should meet the PH 120 classification when tested in accordance with EN 50200 and the 120 min survival time when tested in accordance with BS 8434-2.
- Conduiting wireways.
- Labelling.

The Contractor shall ensure that the buildings' fire detection panels have sufficient loop inputs to accommodate the fire detection equipment for each building.

Building zones shall be programmed into the fire detection panel according to the detector equipment location within the building.

Each buildings fire detection system shall be controlled from the fire detection panel located within said building and monitored by the master fire detection panel in the admin building control room.

The red break-glass units (manual call points) installed at controlled doors as indicated on Contract drawings shall activate the fire alarm system.

The system shall have the capability to connect to the local fire department should requirements arise in future.

Sufficient input/output units shall be installed in line with the drawings.

12.5.4 PROCESS SCADA NETWORK INTERFACE

The fire detection system software shall be capable of interfacing with the process SCADA network.

The fire detection system software shall display on the process SCADA, the following:

- A site wide interactive map of all buildings with fire detection panels located within the buildings displaying the overall system status.
- A healthy system shall be displayed as green, an unhealthy system amber and a system which has been triggered shall be displayed as red.

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- An interactive layout of each building detailing the fire detection panel and its individual fire detection components and their associated statuses.
- Healthy fire detection component(s) shall be displayed as green, unhealthy component(s) amber and component(s) which has been triggered shall be displayed as red.

The fire detection system software shall store instances on the process SCADA network historian of the following events:

- Fire detection panel(s) with unhealthy statuses (amber).
- Fire detection panel(s) with triggered statuses (red).
- Fire detection equipment with unhealthy statuses (amber).
- Fire detection equipment with triggered statuses (red).

12.6 GALLERY PANIC ALARM SYSTEM

12.6.1 GENERAL

A panic alarm system shall be provided for the reservoir gallery. An indicative design is given on drawing 1001757-2000-DRG-EE-2681. The Contractor shall appoint a qualified entity to develop a detail design for the approval of the Engineer.

12.6.2 PERFORMANCE REQUIREMENTS

Panic buttons shall be installed throughout the reservoir gallery. Pressing any of the panic buttons shall activate visual and audio sirens installed at the gallery entrances. The sirens shall be audible across the entire site.

The panic alarm system shall interface with the control room and guard house via the building electronic services network, such that operators and guards are alerted of an alarm condition upon activation of the sirens.

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3.7.9.2 ELECTRONIC DATA SHEETS

The Electronic Data Sheets are included immediately hereafter, comprising 18 pages.

[redacted]

DATA SHEET No. DST-II-0001: CONTROL, INSTRUMENTATION, DATA CABLES AND JUNCTION BOXES

CLIENT N°.	PAGE
ZUTARI N°. 1001757	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B - FOR APPROVAL; C - FOR KNOWLEDGE; D - FOR QUOTATION; E - FOR CONSTRUCTION; F - AS PURCHASED; G - AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-II-0001: CONTROL, INSTRUMENTATION, DATA CABLES AND JUNCTION BOXES	KF	CA	RDP		29/01/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the Offered Column

II - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier: **Quantity:**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**CONTROL CABLES**			
1.01	Manufacturer			
1.02	Rated Insulation Voltage	*V*	Refer to Detailed Electronic Specification	
1.03	Operating Voltage	*V*		
1.04	Number of Cores	*No*		
1.05	Size	*mm²*		
1.06	Conductor Type	*Cu/Al*		
1.07	Cable Type			
1.08	Full Load Current	*A*		
1.09	Armouring	*Yes/No*		
2	**INSTRUMENTATION CABLES**			
2.01	Manufacturer			
2.02	Rated Insulation Voltage	*V*	Refer to Detailed Electronic Specification	
2.03	Operating Voltage	*V*		
2.04	Size	*mm²*		
2.05	Cable Type			
2.06	Screened	*Unscreened / Overall screened / Individual and overall Screened*		
2.07	Armouring	*Yes/No*		
3	**MULTIMODE FIBRE OPTIC (IF REQUIRED)**			
3.01	Manufacturer			
3.02	Type		Multimode	
3.03	Armouring	*Yes/No*	Yes, for outdoor exposed cables	
3.04	Armouring Type		Steel Tape Armoured	
3.05	Termination preference type		LC	
3.06	Cores	*No*	min 12	
3.07	Cable Category		min OM 2	
3.08	Modal Bandwidth	*MHz.km*	min 500 / 500	
4	**SINGLE FIBRE OPTIC**			
4.01	Manufacturer			
4.02	Transceiver Type		Single Mode	
4.03	Cable Type		OS2	
4.04	Typical wavelength	nm	1310	
4.05	Number of cores	No.	12	
4.06	Connector Type		Duplex	
4.07	Termination Type		LC	
4.08	Splice Type		APC	
4.09	No Polish Adaptor	*Yes/No*	Yes	
4.10	Armoured	*Yes/No*	Yes	
4.11	Armouring Type		SWA	
5	**DATA CABLES: ETHERNET**			
5.01	Manufacturer			
5.02	Type		CAT6 STP	
5.03	Armouring	*Yes/No*	No, APL for outdoor exposed cables	
5.04	Termination Type		RJ 45 Shielded with moulded boot or M12 Shielded Stainless steel coated with suitable material for saltwater environment	
6	**DATA CABLES: PROFINET**			
6.01	Manufacturer			
6.02	Type		CAT6 STP	
6.03	Armouring	*Yes/No*	No, APL for outdoor exposed cables	
6.04	Termination Type		RJ 45 Shielded with moulded boot or M12 Shielded Stainless steel coated with suitable material for saltwater environment	
7	**INSTRUMENTATION TERMINATION JUNCTION BOXES**			
7.01	Manufacturer		Pratley or equivalent	
7.02	Type		Enviro or equivalent	
7.03	Enclosure Material		Poly Carbonate	
7.04	Enclosure Colour		Black	
7.05	Enclosure Rating	*IP*	66/68	
7.06	Enclosure Mounting	*Floor Standing / wall mounted*	Wall or pedestal mounted on purpose made stands or brackets	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
8	SUPPLEMENTARY DETAILS			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.

Name (Print): _____ *Signature:* _____

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[redacted]

DATA SHEET No. DST-II-0002: PROCESS CONTROL SYSTEM

CLIENT N°.

ZUTARI N°. 1001757

PAGE

REV. T0

TI: TYPE OF ISSUE

A - PRELIMINARY B - FOR APPROVAL C - FOR KNOWLEDGE D - FOR QUOTATION E - FOR CONSTRUCTION F - AS PURCHASED G - AS BUILT H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-II-0002: PROCESS CONTROL SYSTEM	KF	CA	RDP		29/01/2024

Instructions on Filling Out This Form

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II - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier: Quantity:

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**PROGRAMMABLE LOGIC CONTROLLERS**			
1.01	Manufacturer		As per CCT Standard Specification	
1.02	Model		As per CCT Standard Specification	
1.03	CPU	*Model No.*	As per selected manufacturer and model	
1.04	CPU configuration	*Hot standby / standalone*	As per Detailed Electronic Specification	
1.05	Digital Inputs	*Model No.*		
1.06	Digital Outputs	*Model No.*		
1.07	Analogue Inputs	*Model No.*		
1.08	Analogue Outputs	*Model No.*		
1.09	Spare I/O	%	20	
1.10	Ethernet ports	*No.*		
1.11	Serial ports	*No.*	If required by vendor packages	
1.12	Other ports	*No.*		
1.13	Programming software			
1.14	All engineering software included with PLC	*Yes / No*	Yes	
1.15	Conformally coated	*Yes / No*	Yes	
2	**REMOTE IO**			
2.01	Manufacturer		As per selected PLC OEM	
2.02	Model		As per selected PLC OEM	
2.03	Ethernet ports	*No.*	min. 2	
2.04	Digital Inputs	*Model No.*		
2.05	Digital Outputs	*Model No.*		
2.06	Analogue Inputs	*Model No.*		
2.07	Analogue Outputs	*Model No.*		
2.08	Conformally coated	*Yes / No*	Yes	
3	**PLC PANEL**			
3.01	Terminal Block Manufacturer			
3.02	Terminal Block Range			
3.03	Gland Plates		Not painted	
3.04	Gland Range			
3.05	Power Supply Unit Manufacturer			
3.06	Power Supply Unit Model			
3.07	Miniature Circuit Breaker Manufacturer			
3.08	Miniature Circuit Breaker Model			
3.09	Trunking Type		Slotted PVC	
3.10	Panel Light Required	*Yes / No*	Yes	
3.11	Socket Outlet Required	*Yes / No*	Yes	
3.12	Physical Spare Space Required	%	30	
4	**HUMAN MACHINE INTERFACE (HMI)**			
4.01	Manufacturer		Similar to PLC manufacturer	
4.02	Model			
4.03	Type		Industrial PC	
4.04	Screen Size	*Inches*	17"	
4.05	Screen Type			
4.06	Resolution	*Pixels*		
4.07	Touch Screen	*Yes / No*	Yes	
4.08	Type of Touch Screen	*Capacitive/ Resistive*		
4.09	Enclosure Rating	*IP*	67	
4.10	Position of Installation	*Inside Panel / Flush Fronted / Front Access*	Flush Fronted	
4.11	Software			
5	**UPS**			
5.01	Manufacturer			
5.02	Model			
5.03	Place of manufacture			
5.04	Type		Industrial online double conversion with full static bypass	
5.05	Power	*W*	Load + 30%	
5.06	Backup Time	*min*	30	
5.07	Output Voltage	*V*	230V +- 1.5%	
5.08	Nominal Frequency	*Hz*	50	
5.09	Output Waveform		Pure sine wave	
5.10	Number of Phases	*1 or 3*	1	
5.11	Communication		Modbus TCP/IP	
5.12	Battery Life	*Years*	min. 10	
5.13	Battery Type		LiFePO4	
5.14	Battery Charger			

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
6	MANAGED ETHERNET SWITCH			
6.01	Manufacturer			
6.02	Type		Level 2 Managed	
6.03	Model			
6.04	Ethernet Ports (TX / RJ45) - 10/100 Mbits/s	No.	min. 8	
6.05	Fibre Ports (FX / SFP) - 1Gbits/s	No.	min. 2	
6.06	Fibre termination type		LC	
6.07	DIN Rail Mounted	Yes/No	Yes	
6.08	Power Supply	V	24Vdc	
6.09	PoE		PoE enabled	
7	FIBRE PATCH PANEL			
7.01	Manufacturer			
7.02	Model			
7.03	Fibre Patch ports	No.	min 12	
7.04	Mounting type		DIN rail or 19 inch rack mounted, as required	
7.05	Type of patch ports		LC	
8	SUPPLEMENTARY DETAILS			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

Name (Print): ***Signature:***

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To [redacted]

DATA SHEET No. DST-II-0003: SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM

CLIENT N°.

PAGE

ZUTARI N°.
1001757

REV.
T0

TI: TYPE OF ISSUE

A - PRELIMINARY C - FOR KNOWLEDGE E - FOR CONSTRUCTION G - AS BUILT
B - FOR APPROVAL D - FOR QUOTATION F - AS PURCHASED H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-II-0003: SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM	KF	CA	RDP		29/01/2024

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the Offered Column

II - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier: **Quantity:**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**OPERATOR WORKSTATION COMPUTER**			
1.01	Manufacturer			
1.02	Model			
1.03	CPU Type		Intel i9 or equivalent	
1.04	CPU Speed	*GHz*	min. 4	
1.05	CPU Memory	*GB*	min. 8	
1.06	Hard Drive Storage	*GB*	min. 256GB SSD	
1.07	Operating System		Latest Microsoft Windows or equivalent	
1.08	Network Card		Ethernet 10/100/1000	
1.09	Graphics Card Make		Nvidia or equivalent	
1.10	Graphics Card Model			
1.11	DirectX 11 Capable	*Yes / No*	Yes	
1.12	Shader Model 5	*Yes / No*	Yes	
1.13	Video memory	*GB*	8	
1.14	Graphics Card Ports		min. 3	
1.15	Keyboard	*Yes / No*	Yes	
1.16	Mouse	*Yes / No*	Yes	
2	**ENGINEERING WORKSTATION COMPUTER**			
2.01	Manufacturer			
2.02	Model			
2.03	CPU Type		Intel i9 or equivalent	
2.04	CPU Speed	*GHz*	min. 4	
2.05	CPU Memory	*GB*	min. 32	
2.06	Hard Drive Storage	*GB*	min. 512GB SSD	
2.07	Operating System		Latest Microsoft Windows or equivalent	
2.08	Network Card		Ethernet 10/100/1000	
2.09	Network Ports	*number*	2	
2.10	Graphics Card Make		Nvidia or equivalent	
2.11	Graphics Card Model			
2.12	DirectX 11 Capable	*Yes / No*	Yes	
2.13	Shader Model 5	*Yes / No*	Yes	
2.14	Video memory	*GB*	8	
2.15	Graphics Card Ports		min. 2	
2.16	Keyboard	*Yes / No*	Yes	
2.17	Mouse	*Yes / No*	Yes	
3	**APPLICATION SERVER**			
3.01	Manufacturer		Intel	
3.02	Model			
3.03	Fault Tolerant	*Yes / No*	Yes	
3.04	CPU Type		Intel® Xeon® Silver 4310 or equivalent	
3.05	CPU Clock Speed	*GHz*	min. 2.1	
3.06	CPU Cores	*No.*	12C/24T (HT)	
3.07	CPU Bus Speed	*GT/s*	min. 10.4	
3.08	CPU Cache Size	*MB*	18	
3.09	CPU Turbo Boost Technology	*Yes / No*	Yes	
3.10	CPU Thermal Design Power	*W*	120W	
3.11	CPU Memory Type and Speed	*MHz*	DDR4-2666	
3.12	CPU Quantity	*No.*	max. 2	
3.13	Pre-Installed Memory Modules	*GB*	2 x 16GB RDIMM	
3.14	Pre-Installed Memory Speed	*MT/s*	3200MT/s	
3.15	Pre-Installed Memory Rank		Dual Rank	
3.16	Memory Slots	*No.*	max. 16	
3.17	Pre-Installed Hard Drive Capacity	*TB*	1.2TB	
3.18	Pre-Installed Hard Drive Interface Type		SAS	
3.19	Pre-Installed Hard Drive equipped with ISE	*Yes / No*	Yes	
3.20	Pre-Installed Hard Drive Data Transfer Rate	*GBps*	12	
3.21	Pre-Installed Hard Drive Rotational Speed	*rpm*	10 000	
3.22	Pre-Installed Hard Drive Sector Size		512n	
3.23	Pre-Installed Hard Drive Form Factor		2.5in with 3.5in HYB CARR	
3.24	Hard Drive Bays	*No.*	max. 4	
3.25	Pre-Installed Optical Drive	*Yes / No*	No	
3.26	Backplane		3.5" Chassis with up to 4 Hard Drives (SAS/SATA) 1 CPU	
3.27	Raid Controller		Front PERC H755 Front Load	
3.28	Power Supply		Single, Hot-Plug, Power Supply (1+0), 600W	
3.29	Power Supply Quantity	*No.*	max. 2	
3.30	Operating System		Latest Microsoft Windows, x64 Edition with Media Kit, including latest Service Packs and 5 CAL's	
3.31	Networking		Broadcom 57412 Dual Port 10GbE SFP+, OCP NIC 3.0	
3.32	Management		IDRAC9, Enterprise 15G	
3.33	Mounting Type		Rack mountable	
3.34	Size	*Rack Units*	1U	
3.35	Service level agreement (SLA) up to end of Defects Liability	*Yes / No*	Yes	
3.36	Antivirus software required	*Yes / No*	Yes, with min. 1-year subscription	
3.37	Intrusion detection sofware required	*Yes / No*	Yes	
3.38	Virtualisation Required	*Yes / No*	Yes	
3.39	Warranty Required	*Yes / No*	Yes, 3-year basic	

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To

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
4	DATA SERVER / HISTORIAN			
4.01	Manufacturer		Dell or equivalent	
4.02	CPU Type		Intel Xeon or equivalent	
4.03	CPU Cores	*No.*	min. 8	
4.04	CPU Speed	*GHz*	min. 3.2	
4.05	Memory	*MB*	min. 32000	
4.06	Hard drives		Raid hot swappable	
4.07	Hard Drive Storage	*TB*	min. 4	
4.08	Hard Drive Speed	*RPM*	min. 10000	
4.09	Data transfer rate	*GB/s*	min. 12 SAS	
4.10	Motherboard		Industrial motherboard, conformal coating	
4.11	Power supplies		Dual redundant	
4.12	Operating System		Latest Windows Server or equivalent	
4.13	Network Card		Ethernet 10/100/1000	
4.14	Graphics Card		min. 256MB, Dual output to drive 1 x 23"	
4.15	Keyboard	*Yes / No*	Yes - shared KVM	
4.16	Mouse	*Yes / No*	Yes - shared KVM	
4.17	Mounting Type		Rack mountable	
4.18	Service level agreement (SLA) up to end of Defects Liability	*Yes / No*	Yes	
4.19	Antivirus software required	*Yes / No*	Yes, 1-year subscription	
4.20	Virtualisation Required	*Yes / No*	Yes	
5	TIME SYCHRONISATION			
5.01	GPS Clock synchronisation	*Yes / No*	Yes	
6	OVERHEAD DISPLAY SCREENS			
6.01	Display Make			
6.02	Display Model			
6.03	Type		4K LED	
6.04	Size	*inch*	min. 50	
6.05	Resolution		min. 4k	
6.06	Rating	*Hours per day*	24	
6.07	Graphics ports		HDMI	
7	OPERATOR DISPLAY SCREENS			
7.01	Manufacturer			
7.02	Model			
7.03	Type		4K LED, curved	
7.04	Size	*inch*	27	
7.05	Resolution		>=4k	
7.06	Graphics ports		HDMI	
8	PRINTER			
8.01	Manufacturer			
8.02	Model			
8.03	Type		Colour Laser	
8.04	Feeding Paper Size		A4	
9	UPS			
9.01	Manufacturer			
9.02	Model			
9.03	Place of manufacture			
9.04	Type		Industrial online double conversion with full static bypass	
9.05	Power	*W*	Load + 30%	
9.06	Backup Time	*min*	30	
9.07	Output Voltage	*V*	230V +- 1.5%	
9.08	Nominal Frequency	*Hz*	50	
9.09	Output Waveform		Pure sine wave	
9.10	Number of Phases	*1 or 3*	1	
9.11	Communication		Modbus TCP/IP	
9.12	Battery Life	*Years*	min. 10	
9.13	Battery Type		LiFePO4	
9.14	Battery Charger			
9.15	Rack mounted	*Yes / No*	Yes	
10	SUPERVISORY LAYER ETHERNET SWITCH			
10.01	Manufacturer			
10.02	Type		Level 3 Managed	
10.03	Model			
10.04	Ports	*No.*	min. 12	
10.05	Fibre ports (SFP/GBICs)	*No.*		
10.06	Rack mounted	*Yes/No*	Yes	
10.07	Power Supply	*VAC*	220VAC	
10.08	Speed	*Gbit*	10	
10.09	PoE		PoE enabled	
11	CONTROL LAYER ETHERNET SWITCH			
11.01	Manufacturer			
11.02	Type		Level 2 Managed	
11.03	Model			
11.04	Ports	*No.*	min. 8	
11.05	Fibre ports (SFP/GBICs)	*No.*	min. 4	
11.06	Rack mounted	*Yes/No*	Yes	
11.07	Power Supply	*VAC*	220VAC	
11.08	Speed	*Mbit*	1000	
11.09	PoE		PoE enabled	
12	CONTROL ROOM FURNITURE			
12.01	Manufacturer		Time Base Consoles or equivalent	
12.02	Model		ControlTrac or equivalent	
12.03	Range		C3 or equivalent	
12.04	Adjustable Height	*Yes / No*	Yes	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
13	**SERVER RACK CABINET**			
13.01	Manufacturer			
13.02	Model			
13.03	Size	*U*		
13.04	Dimensions	*(W x L) in mm*		
13.05	Lockable	*Yes/No*	Yes	
13.06	Mounting type		Floor standing	
13.07	Power Distribution	*Dedicated Multiplug / Hardwired*	Dedicated Multiplug	
13.08	Spare Capacity	*%*	20	
14	**SCADA SERVER ADMIN COMPUTER**			
14.01	Manufacturer			
14.02	Model			
14.03	Rack Mounted	*Yes/No*	Yes	
14.04	Network Card		Ethernet 10/100/1000	
14.05	Withdrawable	*Yes/No*	Yes	
14.06	Touch Screen	*Yes/No*	Yes	
14.07	Rack mounted KVM switch for mouse and keyboard	*Yes/No*	Yes	
15	**REMOTE ACCESS DEVICE**			
15.01	Manufacturer		Ewon or equivalent	
15.02	Model		Flexy or equivalent	
15.03	LAN Ports	*No.*	3	
15.04	WAN Ports	*No.*	1	
15.05	Licence Keys	*No.*	>10	
15.06	Support concurrent VPN connections	*Yes/No*	Yes >5	
15.07	Support all Internet connections (operator independent)	*Yes/No*	Yes	
15.08	Support dynamic, static and private IP addresses	*Yes/No*	Yes	
15.09	Built-In Firewall	*Yes/No*	Yes, NAT	
15.10	Power Supply Adapter Input	*VAC*	230V	
15.11	VPN throughput Speed	*Mb/s*	Up to 15Mb/s	
15.12	PoE		PoE enabled	
15.13	Built-In simcard slot and modem	*Yes/No*	Yes	
15.14	Data plan required	*Yes/No*	Yes	
15.15	Data plan duration		Up to end of defects liability period	
15.16	Public/ Fixed IP required	*Yes/No*	Yes	
16	**EXTERNAL ANTENNA FOR REMOTE ACCESS DEVICE**			
16.01	Manufacturer		Poynting or equivalent	
16.02	Model		Omni 280 or equivalent	
16.03	Cable Length	*m*	min 2	
17	**SCADA SOFTWARE**			
17.01	SCADA software		Inductive Automation Ignition or equivalent	
17.02	Number of Tags	*No.*	Unlimited	
17.03	Clients	*No.*	Unlimited	
17.04	Additional Modules			
17.05	Reporting	*Yes / No*	Yes	
17.06	Alarming Notification	*Yes / No*	Yes	
17.07	SMS notification	*Yes / No*	Yes	
17.08	Enterprise Administration	*Yes / No*	Yes	
17.09	Web Development Module	*Yes / No*	Yes	
17.10	MQTT Modules	*Yes / No*	Yes	
18	**HISTORIAN**			
18.01	Historian Software		Canary Labs or equivalent	
18.02	Number of Tags	*No.*	As per Contractor's design	
19	**MQTT BROKER**			
19.01	MQTT Broker software			
19.02	Clustered	*Yes / No*	Yes	
19.03	Sparkplug B enabled	*Yes / No*	Yes	
19.04	Licensing	*Open source / Enterprise*	Enterprise	
20	**DATA MODELLING AND BUSINESS INTELLIGENCE ANALYTICS**			
20.01	Data Modelling and Business Intelligence Analytics Software			
20.02	Number of Tags or license			
21	**SUPPLEMENTARY DETAILS**			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

Name (Print): ***Signature:***

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DATA SHEET No. DST-II-0004: INSTRUMENTATION

CLIENT N°.	PAGE
ZUTARI N°. 1001757	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B – FOR APPROVAL; C – FOR KNOWLEDGE; D – FOR QUOTATION; E – FOR CONSTRUCTION; F – AS PURCHASED; G – AS BUILT; H - CANCELLED

Rev.	TI	Descriptrion	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-II-0004: INSTRUMENTATION	KF	CA	RDP		06/12/2023

Instructions on Filling Out This Form

I - Potential Suppliers should fill out the Offered Column

II - The explanatory notes at the end of the Data Sheet are to be filled out by the Issuer and not by Suppliers.

Supplier: **Quantity:**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**IO-LINK MASTER**			
1.01	Manufacturer		IFM or equivalent	
1.02	Model		Dataline or equivalent	
1.03	Number of Class A ports	No.	min 8	
1.04	Communication Protocol		Industrial Ethernet	
1.05	Surge Protection Required	Yes / No	Yes	
1.06	Protection Rating	IP	IP66K	
1.07	Ring Protocol		RSTP	
2	**INTRINSICALLY SAFE AREA ZONE BARRIER (ANALOGUE SIGNALS)**			
2.01	Manufacturer			
2.02	Model			
2.03	Location of Sensor / Transmitter		Zone 0	
2.04	Safe Area Output Signal Range	mA	4 - 20	
2.05	Hazardous Area Input Signal Range	mA	0 - 24 mA (16.5 V @ 20mA)	
3	**INTRINSICALLY SAFE AREA ZONE BARRIER (DIGITAL SIGNALS)**			
3.01	Manufacturer			
3.02	Model			
3.03	Number of Channels	No.	min. 2	
3.04	Control Voltage	V	20 - 35 Vdc	
3.05	Location of Switches / Proximity Detector		Zone 0	
3.06	Applied Voltage to Sensor	V	7 - 9 Vdc	
3.07	Relay Output Contact		NO / NC	
4	**ULTRASONIC LEVEL TRANSMITTER**			
4.01	Manufacturer			
4.02	Transmitter Model			
4.03	Number of Relay outputs	No.	min 2	
4.04	Detection Range	m	Various	
4.05	Communication Protocol		IO-Link or 4-20 mA or Industrial Internet	
4.06	Surge Protection Required	Yes / No	Yes	
4.07	Local Indication Required	Yes / No	Yes	
4.08	IP Rating	IP	IP66	
5	**ULTRASONIC LEVEL SENSOR WITH IO LINK**			
5.01	Manufacturer			
5.02	Sensor Model			
5.03	Detection Range	m	Various	
5.04	Communication Protocol		IO-Link	
5.05	Surge Protection Required	Yes / No	Yes	
5.06	Local Indication Required	Yes / No	Yes	
5.07	IP Rating	IP	IP66	
5.08	Minimum accuracy	mm	3	
6	**ULTRASONIC LEVEL SENSOR FOR INSTRINSICALLY SAFE AREA**			
6.01	Manufacturer			
6.02	Sensor Model			
6.03	Detection Range	m	Various	
6.04	Communication Protocol		4-20 mA	
6.05	Surge Protection Required	Yes / No	Yes	
6.06	Local Indication Required	Yes / No	Yes	
6.07	IP Rating	IP	IP66	
6.08	Minimum accuracy	mm	3	
6.09	Instrinsically Safe	Yes / No	Yes	
7	**ULTRASONIC LEVEL SENSOR WITH 4-20mA**			
7.01	Manufacturer			
7.02	Sensor Model			
7.03	Number of Relay outputs	No.	min 2	
7.04	Detection Range	m	Various	
7.05	Communication Protocol		4-20 mA	
7.06	Surge Protection Required	Yes / No	Yes	
7.07	Local Indication Required	Yes / No	Yes on Transmitter	
7.08	IP Rating	IP	IP66	
7.09	Minimum accuracy	mm	3	
8	**RADAR LEVEL TRANSMITTER**			
8.01	Manufacturer			
8.02	Transmitter Model			
8.03	Number of Relay outputs	No.	min 2	
8.04	Detection Range	m	Various	
8.05	Communication Protocol		IO-Link or 4-20 mA or Industrial Internet	
8.06	Surge Protection Required	Yes / No	Yes	
8.07	Local Indication Required	Yes / No	Yes	
8.08	IP Rating	IP	IP66	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
9	**RADAR LEVEL METER WITH IO LINK**			
9.01	Manufacturer			
9.02	Sensor Model			
9.03	Transmitter Model			
9.04	Detection Range	*m*	Various	
9.05	Communication Protocol		IO-Link	
9.06	Surge Protection Required	*Yes / No*	Yes	
9.07	Local Indication Required	*Yes / No*	Yes	
9.08	IP Rating	*IP*	IP66	
9.09	Minimum accuracy	*mm*	3	
10	**RADAR LEVEL SENSOR FOR INSTRINSICALLY SAFE AREA**			
10.01	Manufacturer			
10.02	Sensor Model			
10.03	Detection Range	*m*	Various	
10.04	Communication Protocol		4-20 mA	
10.05	Surge Protection Required	*Yes / No*	Yes	
10.06	Local Indication Required	*Yes / No*	Yes	
10.07	IP Rating	*IP*	IP65	
10.08	Minimum accuracy	*mm*	3	
10.09	Instrinsically Safe	*Yes / No*	Yes	
11	**RADAR LEVEL SENSOR WITH 4-20mA**			
11.01	Manufacturer			
11.02	Sensor Model			
11.03	Detection Range	*m*	Various	
11.04	Communication Protocol		4-20 mA	
11.05	Surge Protection Required	*Yes / No*	Yes	
11.06	Local Indication Required	*Yes / No*	Yes on Transmitter	
11.07	IP Rating	*IP*	IP66	
11.08	Minimum accuracy	*mm*	3	
12	**ELECTROMAGNETIC FLOW TRANSMETER**			
12.01	Manufacturer			
12.02	Model			
12.03	Flow range	*m³/hr*	Various	
12.04	Number of Relay outputs	*No.*	min 2	
12.05	Communication Protocol		Industrial Ethernet	
12.06	Additional Protocol		IO-Link or 4-20 mA	
12.07	Surge Protection Required	*Yes / No*	Yes	
12.08	Local Indication Required	*Yes / No*	Yes	
12.09	IP Rating	*IP*	IP65	
12.10	Minimum accuracy	*%*	0.5	
13	**ELECTROMAGNETIC FLOW SENSOR WITH IO LINK**			
13.01	Manufacturer			
13.02	Model			
13.03	Flange Size	*mm / DN*	Same as Pipe Diameter	
13.04	Flow range	*m³/hr*	Various	
13.05	PN Rating		Same as Pipe pressure rating	
13.06	Communication Protocol		IO-Link	
13.07	Surge Protection Required	*Yes / No*	Yes	
13.08	Local Indication Required	*Yes / No*	Yes	
13.09	IP Rating	*IP*	IP65	
13.10	Minimum accuracy	*%*	0.5	
14	**ELECTROMAGNETIC FLOW SENSOR FOR INSTRINSICALLY SAFE AREA**			
14.01	Manufacturer			
14.02	Model			
14.03	Flange Size	*mm / DN*	Same as Pipe Diameter	
14.04	Flow range	*m³/hr*	Various	
14.05	PN Rating		Same as Pipe pressure rating	
14.06	Communication Protocol		IO-Link	
14.07	Surge Protection Required	*Yes / No*	Yes	
14.08	Local Indication Required	*Yes / No*	Yes	
14.09	IP Rating	*IP*	IP65	
14.10	Minimum accuracy	*%*	0.5	
14.11	Instrinsically Safe	*Yes / No*	Yes	
15	**ELECTROMAGNETIC FLOW SENSOR WITH 4-20mA**			
15.01	Manufacturer			
15.02	Model			
15.03	Flange Size	*mm / DN*	Same as Pipe Diameter	
15.04	Flow range	*m³/hr*	Various	
15.05	PN Rating		Same as Pipe pressure rating	
15.06	Communication Protocol		4-20mA	
15.07	Surge Protection Required	*Yes / No*	Yes	
15.08	Local Indication Required	*Yes / No*	Yes	
15.09	IP Rating	*IP*	IP65	
15.10	Minimum accuracy	*%*	0.5	
16	**HARDNESS ANALYSER**			
16.01	Manufacturer		Endress+Hauser or equivalent	
16.02	Sensor Model		Liquiline System CA80HA or equivalent	
16.03	Transmitter Model			
16.04	Number of Relay outputs	*No.*	min 2	
16.05	Detection Range		Various	
16.06	Communication Protocol		Industrial Ethernet	
16.07	Surge Protection Required	*Yes / No*	Yes	
16.08	Local Indication Required	*Yes / No*	Yes	
16.09	IP Rating	*IP*	IP65	
16.10	Minimum accuracy	*%*	1	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
17	RESIDUAL CHLORINE ANALYSER			
17.01	Manufacturer			
17.02	Sensor Model			
17.03	Transmitter Model			
17.04	Number of Relay outputs	No.	min 2	
17.05	Detection Range	mg/l	Various	
17.06	Communication Protocol		Industrial Ethernet	
17.07	Surge Protection Required	Yes / No	Yes	
17.08	Local Indication Required	Yes / No	Yes	
17.09	IP Rating	IP	IP65	
17.10	Minimum accuracy	mg/l	0.01	
18	PRESSURE TRANSMITTER			
18.01	Manufacturer			
18.02	Sensor Model			
18.03	Transmitter Model			
18.04	Detection Range	kPa	Various	
18.05	Number of Relay outputs	No.	min 2	
18.06	Communication Protocol		IO-Link or 4-20 mA	
18.07	Surge Protection Required	Yes / No	Yes	
18.08	Local Indication Required	Yes / No	No	
18.09	IP Rating	IP	IP65	
18.10	Minimum accuracy	%	0.5	
19	TEMPERATURE TRANSMITTER			
19.01	Manufacturer			
19.02	Sensor Model			
19.03	Transmitter Model			
19.04	Detection Range	Degrees °C	Various	
19.05	Number of Relay outputs	No.	min 2	
19.06	Process Connection		As indicated on the P&ID	
19.07	Communication Protocol		IO-Link or 4-20 mA	
19.08	Surge Protection Required	Yes / No	Yes	
19.09	Local Indication Required	Yes / No	Yes	
19.10	IP Rating	IP	IP65	
19.11	Minimum accuracy	%	0.3	
20	TEMPERATURE TRANSMITTER FOR INTRISICALLY SAFE AREA			
20.01	Manufacturer			
20.02	Sensor Model			
20.03	Transmitter Model			
20.04	Detection Range	Degrees °C	Various	
20.05	Number of Relay outputs	No.	min 2	
20.06	Process Connection		As indicated on the P&ID	
20.07	Communication Protocol		4-20 mA	
20.08	Surge Protection Required	Yes / No	Yes	
20.09	Local Indication Required	Yes / No	Yes	
20.10	IP Rating	IP	IP65	
20.11	Minimum accuracy	%	0.3	
20.12	Instrinsically Safe	Yes / No	Yes	
21	HYDROGEN ANALISER TRANSMITTER			
21.01	Manufacturer			
21.02	Sensor Model			
21.03	Transmitter Model			
21.04	Detection Range	ppm	0 to 1000	
21.05	Number of Relay outputs	No.	min 2	
21.06	Communication Protocol		4-20 mA	
21.07	Additional Protocol		Industrial Ethernet	
21.08	Surge Protection Required	Yes / No	Yes	
21.09	Local Indication Required	Yes / No	Yes	
21.10	IP Rating	IP	IP65	
21.11	Minimum accuracy	%	0.5	
21.12	Instrinsically Safe	Yes / No	Yes	
22	VIBRATION SENSORS (IF REQUIRED)			
22.01	Manufacturer			
22.02	Sensor Model			
22.03	Transmitter Model			
22.04	Type		Piezoelectric Accelerometer	
22.05	Detection Range	m/s	Various	
22.06	Process connection		As per Equipment Requirement	
22.07	Communication Protocol		IO-Link or 4-20 mA	
22.08	Surge Protection Required	Yes / No	Yes	
22.09	No. Axis		3 (x,y,z)	
22.10	IP Rating	IP	IP65	
22.11	Minimum accuracy	%	2	
23	LEVEL SWITCHES WITH IO LINK			
23.01	Manufacturer			
23.02	Model			
23.03	Type		Point level	
23.04	Communication Protocol		IO-Link	
23.05	IP Rating	IP	IP65	
24	LEVEL SWITCHES FOR INSTRINSICALLY SAFE AREA			
24.01	Manufacturer			
24.02	Model			
24.03	Type		Point level	
24.04	Communication Protocol		Digital IO	
24.05	IP Rating	IP	IP65	
24.06	Instrinsically Safe	Yes / No	Yes	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
25	POSITION SWITCHES WITH IO LINK			
25.01	Manufacturer			
25.02	Model			
25.03	Type		Inductive Proxy	
25.04	Communication Protocol		IO-Link	
25.05	IP Rating	IP	IP65	
26	POSITION SWITCHES FOR INSTRINSICALLY SAFE AREA			
26.01	Manufacturer			
26.02	Model			
26.03	Type		Inductive Proxy	
26.04	Communication Protocol		Digital IO	
26.05	IP Rating	IP	IP65	
26.06	Instrinsically Safe	Yes / No	Yes	
27	PRESSURE SWITCHES			
27.01	Manufacturer			
27.02	Model			
27.03	Type			
27.04	Communication Protocol		IO-Link or Digital IO	
27.05	IP Rating	IP	IP65	
28	FLOW SWITCHES			
28.01	Manufacturer			
28.02	Model			
28.03	Type			
28.04	Communication Protocol		IO-Link or Digital IO	
28.05	IP Rating	IP	IP65	
29	FLOW SWITCHES FOR INSTRINSICALLY SAFE AREA			
29.01	Manufacturer			
29.02	Model			
29.03	Type			
29.04	Communication Protocol		IO-Link or Digital IO	
29.05	IP Rating	IP	IP65	
29.06	Instrinsically Safe	Yes / No	Yes	
30	AUDIO VISUAL SIREN			
30.01	Manufacturer			
30.02	Model			
30.03	Audio Output at 1 m	dBA	100	
30.04	Power supply	dBA	24 V DC	
30.05	Communication Protocol		IO-Link or Digital IO	
30.06	IP Rating	B	IP65	
31	AUDIO VISUAL SIREN FOR INSTRINSICALLY SAFE AREA			
31.01	Manufacturer			
31.02	Model			
31.03	Audio Output at 1 m	dBA	100	
31.04	Power supply	dBA	24 V DC	
31.05	Communication Protocol		IO-Link or Digital IO	
31.06	IP Rating	B	IP65	
31.07	Instrinsically Safe	Yes / No	Yes	
32	SURGE PROTECTION			
32.01	Instrument Power Supply Circuits - Manufacturer			
32.02	Instrument Power Supply Circuits - Model			
32.03	Instrument Signal Loop Circuits - Manufacturer			
32.04	Instrument Signal Loop Circuits - Model			
32.05	Instrument Transducer Loop Circuits - Manufacturer			
32.06	Instrument Transducer Loop Circuits - Model			
33	INSTRUMENT REMOTE JUNCTION BOXES (IF REQUIRED)			
33.01	Manufacturer			
33.02	Material of Construction	1.6 mm Mild Steel / 2.0 mm Mild Steel / Electro Galvanized / Stainless Steel / 3CR12 / Fibre Glass	3CR12	
33.03	Epoxy Powder Coated	Yes / No	Yes	
33.04	Colour		B26 Electric Orange	
33.05	IP Rating (Indoor)	IP	IP65	
33.06	IP Rating (Outdoor)	IP	IP65	
34	LOCAL CONTROL PANELS (IF REQUIRED)			
34.01	Manufacturer			
34.02	Material of Construction	1.6 mm Mild Steel / 2.0 mm Mild Steel / Electro Galvanized / Stainless Steel / 3CR12 / Fibre Glass	3CR12	
34.03	Epoxy Powder Coated	Yes / No	Yes	
34.04	Colour		B26 Electric Orange	
34.05	IP Rating (Indoor)	IP	IP65	
34.06	IP Rating (Outdoor)	IP	IP65	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
35	CONDITION MONITORING SYSTEM (IF REQUIRED)			
35.01	Manufacturer		IFM or equivalent	
35.02	Sensor Model		VSE or equivalent	
35.03	Transmitter Model			
35.04	Number of instrument ports	No.	min 4	
35.05	Instrument Interface		IO-Link or 4-20 mA	
35.06	Communication Protocol		Industrial Ethernet	
35.07	Surge Protection Required	Yes / No	Yes	
35.08	Local Indication Required	Yes / No	Yes	
35.09	Conformally Coated	Yes / No	Yes	
35.10	Management Software Required	Yes / No	Yes	
36	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EL-0005: BUILDING SERVICES FIBRE	CLIENT Nº.	PAGE
	ZUTARI Nº. 1001757	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0005: BUILDING SERVICES FIBRE	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**FIBRE OPTIC CABLE**			
1.01	Manufacturer			
1.02	Transceiver Type		Single Mode	
1.03	Cable Type		OS2	
1.04	Typical wavelength	nm	1310	
1.05	Number of cores	No.	12	
1.06	Connector Type		Duplex	
1.07	Termination Type		LC	
1.08	Splice Type		APC	
1.09	No Polish Adaptor	Yes/No	Yes	
1.10	Armoured	Yes/No	Yes	
1.11	Armouring Type		SWA	
2	**NETWORK FIBRE PATCH PANEL**			
2.01	Manufacturer			
2.02	Type		LC-APC	
2.03	Number of ports	No.	24	
2.04	Casing		Rack Mounted	
3	**PERIMETER FIBRE ENCLOSURE PATCH PANEL**			
3.01	Manufacturer			
3.02	Model			
3.03	Type		LC-APC	
3.04	Number of ports	No.	8	
3.05	Casing		DIN Rail	
4	**PANEL PATCH CABLES**			
4.01	Manufacturer			
4.02	Type		LC-LC	
4.03	Transceiver Type		Single Mode	
4.04	Cable Type		OS2	
4.05	Typical wavelength	nm	1310	
4.06	Number of cores	No.	2	
4.07	Connector Type		Duplex	
4.08	Splice Type		APC	
4.09	No Polish Adaptor	Yes/No	Yes	
4.10	Ruggedised protection	Yes/No	No	
5	**EXTERNAL PATCH CABLES**			
5.01	Manufacturer			
5.02	Type		LC-LC	
5.03	Transceiver Type		Single Mode	
5.04	Cable Type		OS2	
5.05	Typical wavelength	nm	1310	
5.06	Number of cores	No.	2	
5.07	Connector Type		Duplex	
5.08	Splice Type		APC	
5.09	No Polish Adaptor	Yes/No	Yes	
5.10	Ruggedised protection	Yes/No	Yes	
6	**SUPPLEMENTARY DETAILS**			

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DATA SHEET No. DST-EL-0006: BUILDING SERVICES NETWORK

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0006: BUILDING SERVICES NETWORK	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**NETWORK SWITCH**			
1.01	Manufacturer		Cisco or equivalent	
1.02	Model			
1.03	Minimum number of fibre optic (SFP) ports	No.	2	
1.04	Number of Ethernet ports	No.	As required by Contractor's design	
1.05	Minimum uplink/backbone network speed	Gbps	1	
1.06	PoE+ Capability	Yes/No	Yes	
2	**NETWORK ACCESS POINT (IF REQUIRED)**			
2.01	Manufacturer		Cisco or equivalent	
2.02	Model			
2.03	Wi-Fi 6 (802.11ax)	Yes/No	Yes	
2.04	Installation		Ceiling	
2.05	Minimum uplink network speed	Gbps	1	
2.06	PoE+ Capability	Yes/No	Yes	
3	**SMALL FORM FACTOR PLUGGABLE (SFP)**			
3.01	Manufacturer		Cisco or equivalent	
3.02	Transceiver Type		Single mode	
3.03	Connector Type		LC	
3.04	Minimum number of fibre optic ports	Gbps	1	
4	**CAT CABLES**			
4.01	Manufacturer			
4.02	Type		CAT6	
4.03	Armouring Type		SWA	
5	**CAT PATCH PANEL**			
5.01	Manufacturer			
5.02	Model			
5.03	Type		CAT6	
5.04	Number of ports	No.	24	
5.05	Casing		Rack mounted	
5.06	Size		1U	
5.07	Material		Electrostatic powder-coated steel	
5.08	Colour		Black	
6	**CABLE MANAGEMENT PANEL**			
6.01	Manufacturer			
6.02	Model			
6.03	Number of rings	No.	24	
6.04	Casing		19" Rack mountable	
6.05	Size		1U	
6.06	Colour		Black	
7	**SERVER ROOM NETWORK ENCLOSURE**			
7.01	Manufacturer			
7.02	Type		19" Rack	
7.03	Size	U	42	
7.04	Depth	mm	1000	
7.05	Installation		Floor standing	
7.06	Loading Capacity	kg	800	
7.07	IP rating		IP10	
7.08	Forced ventilation (fans)	No/Yes	Yes	
7.09	Material		3CR12 or Aluzinc	
7.10	Coating		Powder coated	
7.11	Colour		Black	
7.12	Locking, removable, reversible front and rear doors	Yes/No	Yes	
7.13	Locking, removable side panels	Yes/No	Yes	
7.14	DIN rail mount kit	Yes/No	Yes	
7.15	Internal Power Rail	Yes/No	Yes	
8	**BUILDING NETWORK ENCLOSURE**			
8.01	Manufacturer			
8.02	Type		19" Rack	
8.03	Size	U	15U	
8.04	Depth	mm	550	
8.05	Installation		Wall mounted	
8.06	Frame type		90° Swing frame	
8.07	Loading Capacity	kg	60	
8.08	IP rating	No.	IP20	
8.09	Forced ventilation (fans)	No/Yes	Yes	
8.10	Material		3CR12 or Aluzinc	
8.11	Coating		Powder coated	
8.12	Colour		Black	
8.13	Lockable	Yes/No	Yes	
8.14	DIN rail mount kit	Yes/No	Yes	
8.15	Internal Power Rail	Yes/No	Yes	
9	**INDUSTRIAL NETWORK ENCLOSURE**			

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
9.01	Manufacturer			
9.02	Type		19" Rack	
9.03	Size	U	12U	
9.04	Depth	mm	550	
9.05	Installation		Wall mounted	
9.06	Loading Capacity	kg	40	
9.07	IP rating	No.	IP53	
9.08	Forced ventilation (fans)	No/Yes	Yes	
9.09	Dust filters	No/Yes	Yes	
9.10	Material		3CR12 or Aluzinc	
9.11	Coating		Powder Coated	
9.12	Colour		Orange	
9.13	Lockable	Yes/No	Yes	
9.14	DIN rail mount kit	Yes/No	Yes	
9.15	Internal Power Rail	Yes/No	Yes	
10	**OUTDOOR NETWORK ENCLOSURE**			
10.01	Manufacturer			
10.02	Type		19" Rack	
10.03	Size	U	12U	
10.04	Minimum Depth	mm	550	
10.05	Installation		Wall mounted	
10.06	IP rating	No.	IP65	
10.07	Forced ventilation (fans)	No/Yes	Yes	
10.08	Dust filters	No/Yes	Yes	
10.09	Material		3CR12 or Aluzinc	
10.10	Coating		Powder Coated	
10.11	Colour		Orange	
10.12	Lockable	Yes/No	Yes	
10.13	DIN rail mount kit	Yes/No	Yes	
10.14	Internal Power Rail	Yes/No	Yes	
11	**UPS**			
11.01	Manufacturer		As per CCT Standard Specification	
11.02	Model			
11.03	Type		Double conversion	
11.04	Casing Mounting		19" Rack mounted	
11.05	Input Voltage	Vac	230	
11.06	Rated Power	VA	As per drawing	
11.07	Battery Type		Lithium-ion	
11.08	Battery Minimum Capacity	VAh	300	
11.09	Extension Battery	Yes/No	Yes, as per drawing	
11.10	Extension Battery Minimum Capacity	VAh	1000	
11.11	Minimum Back-up Time	Minutes	30	
11.12	Network Card	Yes/No	No	
11.13	Service Bypass Panel	Yes/No	Yes, as per drawing	
12	**SUPPLEMENTARY DETAILS**			

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DATA SHEET No. DST-EL-0007: FIRE DETECTION AND SUPPRESSION (FDAS) SYSTEM

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T0	D	DATA SHEET No. DST-EL-0007: FIRE DETECTION AND SUPPRESSION (FDAS) SYSTEM	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**SYSTEM MANAGEMENT SOFTWARE**			
1.01	Manufacturer		Aritech/Carrier or equivalent	
1.02	Product code		Advisor Integrated Security Management Software Business Edition, ATS8609	
1.03	Number of panels		3	
1.04	Spare panel connection capacity	%	20	
2	**FIRE CONTROL PANEL**			
2.01	Manufacturer		Ziton or equivalent	
2.02	Type		Addressable Fire Panel with User Interface - 2 Loop	
2.03	Model		ZP2-F2-99	
2.04	Supply voltage	*Vac*	230	
2.05	Addressable Panel	*Yes/No*	Yes	
2.06	Minimum Zone capacity	*No.*	128	
2.07	Minimum Number of loops	*No.*	2	
2.08	Maximum cable length per loop (at maximum device capacity)	*m*	3500	
2.09	Minimum number of relays	*No.*	2	
2.10	Battery back up	*Yes/No*	Yes	
2.11	Battery Capacity	Ah	2 x 18Ah	
2.12	Ingress Protection	IP	30	
3	**OPTICAL SMOKE DETECTOR**			
3.01	Manufacturer		Ziton or equivalent	
3.02	Model		ZP730-2P	
3.03	Addressable device	*Yes/No*	Yes	
3.04	Device colour		Polar white	
3.05	Alarm indicator colour		Red	
3.06	EN54-7 compliant	*Yes/No*	Yes	
4	**HEAT DETECTOR (IF REQUIRED)**			
4.01	Manufacturer		Ziton or equivalent	
4.02	Model		ZP720-3P	
4.03	Detection Principle		Thermistor	
4.04	Addressable device	*Yes/No*	Yes	
4.05	Device colour		Polar white	
4.06	Alarm indicator colour		Red	
4.07	EN54-5 compliant	*Yes/No*	Yes	
5	**DUAL OPTICAL & HEAT DETECTOR (IF REQUIRED)**			
5.01	Manufacturer		Ziton or equivalent	
5.02	Model		ZP732-2P	
5.03	Detection Principle		Photo electric light scatter and heat	
5.04	Addressable device	*Yes/No*	Yes	
5.05	Device colour		Polar white	
5.06	Alarm indicator colour		Red	
5.07	EN54-5/7 compliant	*Yes/No*	Yes	
6	**OPTICAL/HEAT MULTISENSOR DETECTOR (IF REQUIRED)**			
6.01	Manufacturer		Ziton or equivalent	
6.02	Model		ZX832-3P	
6.03	Detection Methodology		Fuzzy logic multi-criteria sensing	
6.04	Addressable device	*Yes/No*	Yes	
6.05	Device colour		Polar white	
6.06	Alarm indicator colour		Red	
6.07	EN54-5/7 compliant	*Yes/No*	Yes	
7	**REMOTE INDICATOR**			
7.01	Manufacturer		Apollo Minidisc or equivalent	
7.02	Model		AI671	
7.03	Compatible with addressable device	*Yes/No*	Yes	
7.04	Device colour		White	
7.05	Alarm indicator colour		Red	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
8	**EMERGENCY RED BREAKGLASS UNITS**			
8.01	Manufacturer		Ziton or equivalent	
8.02	Models		ZP785 & ZP887	
8.03	Addressable device	*Yes/No*	Yes	
8.04	Colour		Red	
8.05	Mounting		Surface	
8.06	Resettable	*Yes/No*	Yes	
8.07	IP Ratings	*IP*	24 & 67	
8.08	EN54-11 compliant	*Yes/No*	Yes	
9	**HORN SOUNDER/INDICATOR**			
9.01	Manufacturer		Ziton or equivalent	
9.02	Model		ZP755HAV-2R / ZPW767R	
9.03	Addressable device	*Yes/No*	Yes	
9.04	Device colour		Red	
9.05	Alarm indicator colour		Red	
9.06	IP Ratings	*IP*	21 & 66	
9.07	EN54-3/23 compliant	*Yes/No*	Yes	
10	**BASE SOUNDER/INDICATOR (IF REQUIRED)**			
10.01	Manufacturer		Ziton or equivalent	
10.02	Model		178001	
10.03	Addressable device	*Yes/No*	Yes	
10.04	Device colour		Red	
10.05	Alarm indicator colour		Red	
11	**REFLECTIVE BEAM DETECTOR**			
11.01	Manufacturer		Carrier or equivalent	
11.02	Type		FD810R-N	
11.03	Range	m	50 to 100	
11.04	Detector heads	*No.*	2	
11.05	Device colour		Grey-black	
11.06	Alarm indicator colour		Red	
11.07	IP Rating	*IP*	54	
11.08	EN54-12 compliant	*Yes/No*	Yes	
12	**DETECTION EQUIPMENT DC POWER SUPPLY**			
12.01	Manufacturer			
12.02	Type			
12.03	Input Voltage	Vac	230	
12.04	Output Voltage	Vdc	24	
12.05	Backup Battery	Yes/No	Yes	
12.06	Battery Capacity	Ah	2 x 7.2Ah	
12.07	Endsoure Material		3CR12	
12.08	Minimum IP Rating	*IP*	65	
12.09	EN54 / SANS 50054-4compliant	*Yes/No*	Yes	
13	**DIGITAL LIENAR HEAT DETECTOR (IF REQUIRED)**			
13.01	Manufacturer		Carrier or equivalent	
13.02	Model		AD68SS-0100	
13.03	Cable Type		Alarmline II 68°C with SS over PVC Sheath	
13.04	Maximum Length	m	3000	
13.05	Securing and mounting clips material		Stainless steel	
14	**ASPIRATED DETECTOR (IF REQUIRED)**			
14.01	Manufacturer		Edwards (Carrier) or equivalent	
14.02	Model		FHSD8330 / FHSD8310	
14.03	Type		ModuLaser	
14.04	Input Voltage	V	24	
14.05	EN54-20 compliant	*Yes/No*	Yes	
15	**ASPIRATED PIPING (IF REQUIRED)**			
15.01	Manufacturer		Carrier or equivalent	
15.02	Type		Acrylonitrile Butadiene Styrene (ABS)	
15.03	EN 61386-1 compliant	*Yes/No*	Yes	
16	**SMOKE IMAGE DEDECTOR (IF REQUIRED)**			
16.01	Manufacturer		Xtralis or equivalent	
16.02	Type		OSID	
16.03	Range	m	200	
16.04	FOV	H x V (°)	80 x 48	
16.05	Minimum detection range	m	6	
16.06	Maximum detection range	m	68	
16.07	Image lense type	°	90	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
17	**SYSTEM MANAGEMENT COMPUTER WORKSTATION**			
17.01	Manufacturer			
17.02	Model			
17.03	Type		All-in-One PC	
17.04	CPU		Intel® Core™, Core i5-13500T	
17.05	Operating System		Windows 11 Pro	
17.06	RAM	GB	16 GB DDR4 SDRAM	
17.07	Hard Drive Storage	GB	512, SSD	
17.08	Display Type		Non-touch	
17.09	Minimum Number of RJ45 Ethernet Ports	No.	1	
17.10	Colour		Black	
17.11	Minimum Number HDMI Ports	No.	1	
17.12	Wall Mounting Frame Included	Yes/No	No	
18	**SYSTEM MANAGEMENT SCREEN**			
18.01	Manufacturer			
18.02	Model			
18.03	Mounting		Wall	
18.04	Size	Inch	50	
18.05	Resolution (Horiz x Vert)	pixles	3840X2160	
18.06	Image refresh frequency	Hz	60	
18.07	Response Time	ms	8	
18.08	HDMI inputs	No.	3	
19	**SUPPLEMENTARY DETAILS**			

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DATA SHEET No. DST-EL-0008: CLOSED CIRCUIT TELEVISION (CCTV)

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T0	D	DATA SHEET No. DST-EL-0008: CLOSED CIRCUIT TELEVISION (CCTV)	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**THERMAL CAMERAS (PERIMETER FENCE) TYPE A, B & C**			
1.01	Manufacturer		Avigilon or equivalent	
1.02	Model		As per drawing	
1.03	Type	IP/Analogue	IP	
1.04	Motion & Object detection	Yes/No	Yes	
1.05	Vandal proof	Yes/No	Yes, IK10	
1.06	Ingress Protection (including any additional housing required)	IP	IP66	
1.07	Lens		As per drawing	
1.08	Angle of View		As per drawing	
1.09	Minimum frame rate	fps	5	
1.10	Securing and mounting brackets material		Stainless steel	
2	**OUTDOOR BULLET CAMERAS TYPE E**			
2.01	Manufacturer		Avigilon or equivalent	
2.02	Model		As per drawing	
2.03	Type	IP/Analogue	IP	
2.04	Infrared	Yes/No	Yes	
2.05	Motion detection	Yes/No	Yes	
2.06	Resolution	MP	>2MP	
2.07	Vandal proof	Yes/No	Yes	
2.08	Ingress Protection (Housing)	IP	IP66 and IP67, weatherproof	
2.09	Lens		As per drawing	
2.10	Angle of View		As per drawing	
2.11	Minimum frame rate	fps	20	
2.12	Securing and mounting brackets material		Stainless steel	
3	**PTZ CAMERA TYPE F**			
3.01	Manufacturer		Avigilon or equivalent	
3.02	Model		As per drawing	
3.03	Type	IP/Analogue	IP	
3.04	Infrared	Yes/No	Yes	
3.05	Motion detection	Yes/No	Yes	
3.06	Zoom	°	x36	
3.07	Pan travel range:	°	360 cont.	
3.08	Tilt angle	°	-20 to 90	
3.09	Motion tracking	Yes/No	Yes	
3.10	Resolution	MP	>4MP	
3.11	Vandal proof	Yes/No	Yes, IK10	
3.12	Ingress Protection (Housing)	IP	IP66	
3.13	Lens		As per drawing	
3.14	Angle of View		As per drawing	
3.15	Minimum frame rate	fps	20	
3.16	Securing and mounting brackets material		Stainless steel	
4	**INDOOR DOME CAMERAS TYPE D**			
4.01	Manufacturer		Avigilon or equivalent	
4.02	Model		As per drawing	
4.03	Type	IP/Analogue	IP	
4.04	Infrared	Yes/No	Yes	
4.05	Motion detection	Yes/No	Yes	
4.06	Resolution	MP	>2MP	
4.07	Vandal proof	Yes/No	Yes, IK10	
4.08	Ingress Protection (Housing)	IP	IP66 and IP67, weatherproof	
4.09	Lens		As per drawing	
4.10	Angle of View		As per drawing	
4.11	Minimum frame rate	fps	20	

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[redacted]

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
5	**INDOOR DOME CAMERAS TYPE G**			
5.01	Manufacturer		Avigilon or equivalent	
5.02	Model		As per drawing	
5.03	Type	*IP/Analogue*	IP	
5.04	Infrared	*Yes/No*	Yes	
5.05	Motion detection	*Yes/No*	Yes	
5.06	Resolution	*MP*	>2MP	
5.07	Vandal proof	*Yes/No*	Yes, IK10	
5.08	Ingress Protection (Housing)	*IP*	No	
5.09	Lens		As per drawing	
5.10	Angle of View		As per drawing	
5.11	Minimum frame rate	*fps*	20	
6	**FISHEYE CAMERAS TYPE H (IF REQUIRED)**			
6.01	Manufacturer		Avigilon or equivalent	
6.02	Model		As per drawing	
6.03	Type	*IP/Analogue*	IP	
6.04	Infrared	*Yes/No*	Yes	
6.05	Motion detection	*Yes/No*	Yes	
6.06	Horizontal Angle of View	°	180	
6.07	Field of View	°	360	
6.08	Motion tracking	*Yes/No*	Yes	
6.09	Resolution	*MP*	>8MP	
6.10	Vandal proof	*Yes/No*	Yes, IK10	
6.11	Ingress Protection (Housing)	*IP*	IP66 and IP67	
6.12	Lens		As per drawing	
6.13	Angle of View		As per drawing	
6.14	Minimum frame rate	*fps*	20	
7	**TIME LAPSE CAMERAS (IF REQUIRED)**			
7.01	Manufacturer		Brinno or equivalent	
7.02	Model		BCC2000 or equivalent	
7.03	Battery Life		sampling rate: 1 sample every 24 hrs (battery will last 248.8 days)	
7.04	Power Source		Battery only or Battery and grid Power	
7.05	Minimum Field of View	°	112	
7.06	Memory Storage		microSD / SDHC / SDXC Card (minimum 8 GB)	
7.07	Splashproof		IPX4	
7.08	Compression		AVI (1280x720 resolution)	
7.09	Securing and mounting brackets material		Stainless steel	
8	**CCTV INTERCOM**			
8.01	Manufacturer		Avigilon or equivalent	
8.02	Model		3.0C-H4VI-RO1-IR or equivalent	
8.03	Type	*IP/Analogue*	IP	
8.04	Infrared	*Yes/No*	Yes	
8.05	Motion detection	*Yes/No*	Yes	
8.06	Resolution	*MP*	>3MP	
8.07	Vandal proof	*Yes/No*	Yes, IK10	
8.08	Ingress Protection (Housing)	*IP*	IP66	
8.09	Angle of View	°	170x120	
8.10	Minimum frame rate	*fps*	20	
8.11	Audio Streaming		Two-way, Full Duplex	
8.12	Securing and mounting brackets material		Stainless steel	
9	**CCTV SERVER C/W SOFTWARE**			
9.01	Manufacturer		Avigilon or equivalent	
9.02	Model		NVR5-STD-32TB	
9.03	Processor		1 × Intel 8-core Xeon	
9.04	RAM	*GB*	2 × 8 GB DDR4	
9.05	Operating System Hard Drive Configuration	*GB*	2 × 240 GB M.2 SSD Drives	
9.06	Operating System Hard Drive Type		RAID 1	
9.07	Recording Rate	*Mbps*	800	
9.08	Expandable storage	*Yes/No*	Yes	
9.09	Minimum Number of 1GB RJ45 Ethernet ports	*No.*	2	
9.10	Casing		Rack Mounted	
9.11	Operating System		Microsoft Windows Server 2019 - 16 core	
9.12	CCTV software		Avigilon Control Center	
9.13	Version		ACC 7	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
10	**OPERATOR COMPUTER WORKSTATION**			
10.01	Manufacturer		Avigilon or equivalent	
10.02	Model		RM 6-WKS-2/4MN	
10.03	CPU		Intel Core i3 (10th Gen), Intel Core i5 1(11th Gen)	
10.04	Operating System		Microsoft Windows 10 IoT Enterprise LTSB (2019)	
10.05	RAM	GB	8 GB DDR4 RAM, 32 GB DDR4 RAM	
10.06	Hard Drive Storage	GB	256 GB M.2 SSD + 500 GB HDD	
10.07	Minimum Number of RJ45 Ethernet ports	No.	2	
10.08	Tower Form Factor		Small	
10.09	Wall Mounting Frame Included	Yes/No	Yes	
11	**DISPLAYS**			
11.01	Manufacturer		DELL or equivalent	
11.02	Model		E2421HN, C5519Q	
11.03	Type		LED	
11.04	Size		24", 55"	
11.05	Wall mounting brackets included	Yes/No	Yes	
12	**POWER OVER ETHERNET SWITCH**			
12.01	Manufacturer		MOXA or equivalent	
12.02	Model		As per drawing	
12.03	Minimum Nnmber of SFP ports	No.	2	
12.04	Minimum uplink/backbone network speed	Gbps	1	
12.05	Minimum Nnmber of camera RJ45 Ethernet ports	No.	4	
12.06	Minimum camera RJ45 ethernet port speed	Mbps	100	
12.07	Casing		DIN Rail	
13	**SMALL FORM FACTOR PLUGGABLE (SFP)**			
13.01	Manufacturer		MOXA or equivalent	
13.02	Model		As per drawing	
13.03	Connetor Type		LC	
13.04	Minimum network speed	Gbps	1	
14	**DC POWER SUPPLY (PS5 & PS10)**			
14.01	Manufacturer		Phoenix Contact or equivalent	
14.02	Model		As per drawing	
14.03	Type		Switch Mode	
14.04	Casing Mounting		DIN Rail	
14.05	Input Voltage	Vac	100-240	
14.06	Output Voltage	Vdc	48	
15	**CAT PATCH PANEL**			
15.01	Manufacturer			
15.02	Model			
15.03	Type		CAT 5e	
15.04	Number of ports	No.	24	
15.05	Casing		Rack mounted	
15.06	Cable securing accessories including	Yes/No	Yes	
16	**CAT CABLE**			
16.01	Manufacturer			
16.02	Type		CAT 5e	
17	**IP HORN SPEAKER (IF REQUIRED)**			
17.01	Manufacturer		Avigilon or equivalent	
17.02	Model		IP-A1SC15 or equivalent	
17.03	PoE	Yes/No	Yes	
17.04	IP rating	IP	66	
17.05	Mounting bracket material		Stainless steel	
17.06	Rear Cover	Yes/No	Yes	
18	**CCTV UTILITY BOX/UTILITY**			
18.01	Manufacturer		Allbro or equivalent	
18.02	Type		Allbrox/Cabinet	
18.03	Model/Size		As per drawing	
18.04	Installation		Pole or Wall Mounted	
18.05	Window	Yes/No	No	
18.06	IP rating		IP66	
18.07	Forced ventilation (fans)	Yes/No	No	
18.08	Material		SMC	
18.09	Colour		Orange	
18.10	Lockable	Yes/No	Yes	
18.11	Backplate		Yes, SMC	

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	DESCRIPTION	UNIT	SPECIFIED	OFFERED
19	SUPPLEMENTARY DETAILS			

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DATA SHEET No. DST-EL-0009: ACCESS CONTROL SYSTEM	CLIENT Nº.	PAGE
	ZUTARI Nº. 1001757	REV. T0

TI: TYPE OF ISSUE — A - PRELIMINARY; B - FOR APPROVAL; C - FOR KNOWLEDGE; D - FOR QUOTATION; E - FOR CONSTRUCTION; F - AS PURCHASED; G - AS BUILT; H - CANCELLED

Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0009: ACCESS CONTROL SYSTEM	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**MAIN CONTROLLER**			
1.01	Manufacturer		Paxton or equivalent	
1.02	Type		Net2 Plus or equivalent	
1.03	Model		TDS-1042-AE	
1.04	Capacity	*Profiles.*	50000	
1.05	Number of events that can be retained	*No.*	2500+	
1.06	Monitoring and alert	*Yes/No*	Yes	
1.07	Readers	*No*	4	
1.08	Power Supply Type		PoE+ AT Type 2	
1.09	Back-up power	*Yes/No*	Yes, via switch UPS	
1.10	Standalone logic operation	*Yes/No*	Yes	
1.11	Cabinet Material		Plastic	
2	**SOFTWARE**			
2.01	Name		Paxton or equivalent	
2.02	Model		Net2 Lite or equivalent	
3	**TAG READER**			
3.01	Manufacturer		Paxton or equivalent	
3.02	Type		P50 or equivalent	
3.03	Ingress Protection (indoor)	*IP*	IPX7	
3.04	Vandal Resistance		Medium	
3.05	Mounting		Surface	
4	**EXIT BUTTON**			
4.01	Manufacturer		Paxton or equivalent	
4.02	Type		Marine exit button or equivalent	
4.03	Model		TDS-1033-2A	
5	**ACCESS TAG**			
5.01	Manufacturer		Paxton or equivalent	
5.02	Type		Net2 proximity keyfobs or equivalent	
5.03	Model		TDS-1077-AE	
6	**DESKTOP TAG READER**			
6.01	Manufacturer		Paxton or equivalent	
6.02	Type		USB	
6.03	Model		TDS1034 -AE	
7	**ACCESS MANAGEMENT COMPUTER WORKSTATION**			
7.01	Manufacturer			
7.02	Model			
7.03	Type		All-in-One PC	
7.04	CPU		Intel® Core™, Core i5-13500T	
7.05	Operating System		Windows 11 Pro	
7.06	RAM	*GB*	16 GB DDR4 SDRAM	
7.07	Hard Drive Storage	*GB*	512, SSD	
7.08	Display Type		Non-touch	
7.09	Minimum Number of RJ45 Ethernet ports	*No.*	1	
7.10	Colour		Black	
7.11	Minimum Number HDMI Ports	*No.*	1	
7.12	Wall Mounting Frame Included	*Yes/No*	No	
8	**EMERGENCY BREAKGLASS UNIT**			
8.01	Manufacturer		Ziton or equivalent	
8.02	Model		DMN700G or equivalent	
8.03	Colour		Green	
8.04	Mounting		Surface	
8.05	IP Rating		IP24	
9	**DOORS AND WINDOWS**			
9.01	Push/Pull Striker Lock			
9.02	Manufacturer		Abloy or equivalent	
9.03	Type		EL 404 or equivalent	
9.04	Fail unlock operation	*Yes/No*	Yes	
9.05	Compatible with all access control systems	*Yes/No*	Yes	
10	**Magnetic Lock for Doors**			
10.01	Manufacturer		Fortis or equivalent	
10.02	Fail unlock operation	*Yes/No*	Yes	
10.03	Minimum holding force	*kg*	500	
10.04	Installation type (door compatibility)		As per drawing	

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To [redacted]

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
11	**LONG RANGE HANDS FREE RECIEVER**			
11.01	Manufacturer		Paxton or equivalent	
11.02	Type		Net2 Proximity Longe Range Receiver 313-110 or equivalent	
11.03	Model		TDS-1010	
12	**SUPPLEMENTARY DETAILS**			

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DATA SHEET No. DST-EL-0010: ENTRANCE GATE SYSTEM	CLIENT Nº.	PAGE
	ZUTARI Nº. 1001757	REV. T0

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Rev.	TI	Description	By	Ckd	APP.	Aut.	Date
T0	D	DATA SHEET No. DST-EL-0010: ENTRANCE GATE SYSTEM	KF	CR	RDP		13/12/2023

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	**GATE MOTOR**			
1.01	Manufacturer		Centurion or equivalent	
1.02	Model		As per Contractor's Design	
1.03	Minimum operations per day	*No.*	750	
1.04	Infrared Safety Beams/ Collision Detection	Yes/No	Yes	
1.05	IP rating		IP54	
1.06	Back-up batteries	Yes/No	Yes	
1.07	Motor Cage	*Yes/No*	Yes	
2	**REMOTE CONTROL**			
2.01	Manufacturer		Centurion or equivalent	
2.02	Model		Nova or equivalent	
2.03	Min. Buttons	*No.*	1	
2.04	Frequency	*MHz*	433	
3	**REMOTE CONTROL RECEIVER**			
3.01	Manufacturer		Centurion or equivalent	
3.02	Model		Nova Helix or equivalent	
3.03	Min. Buttons	*No.*	1	
3.04	Frequency	*MHz*	433	
4	**TRAFFIC BARRIER (IF REQUIRED)**			
4.01	Manufacturer		Centurion or equivalent	
4.02	Model		SECTOR II	
4.03	Pole length	*m*	3	
4.04	Infrared Safety Beams	Yes/No	Yes	
4.05	Housing Material	*Grade*	SS 316	
4.06	Max. Daily Operations	*No.*	3000	
4.07	Catchpost	*Yes/No*	Yes	
4.08	Backup Memory Module	*Yes/No*	Yes	
4.09	Back-up batteries	Yes/No	Yes	
4.10	Jack Knife Assembly	Yes/No	Yes	
4.11	Receiver code storage capacity	No.	Minimum 300 transmitter buttons	
5	**GOOSENECK**			
5.01	Manufacturer			
5.02	Model			
5.03	Material	*Grade*	SS 316	
6	**SUPPLEMENTARY DETAILS**			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

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3.7.10 CONSTRUCTION PHASE ENVIRONMENTAL MANAGEMENT PROGRAMME

The Construction Phase Environmental Management Programme (cEMP) is included immediately hereafter, comprising 101 pages.

The tendered rates for Environmental Management shall ensure full compliance with this specification.

[redacted]

Construction Phase Environmental Management Programme (cEMP) for the Northern Area Bulk Water Augmentation Scheme: Muldersvlei Bulk Water Treatment Facility, Reservoir and Associated Infrastructure

Sixth Final

March 2023

Environmental Management & Sustainability Consultant

[redacted]

[redacted]

Construction Phase Environmental Management Programme (cEMP) for the Northern Area Bulk Water Augmentation Scheme: Muldersvlei Bulk Water Treatment Facility, Reservoir and Associated Infrastructure

Prepared for:

[redacted]

Attention: [redacted]

Prepared by:

[redacted]

Part 2 Amendment Mitigations included by [redacted]

Environmental Management & Sustainability Consultant

[redacted]

[redacted]

Abbreviations and Definitions

cEMP	Construction Phase Environmental Management Programme
CoCT	City of Cape Town
Construction Phase	This is the phase during which physical construction activities take place. It is preceded by the detailed design phase and succeeded by the operational phase.
DEADP	Western Cape Provincial Department of Environmental Affairs and Development Planning
Design Phase	This is the phase during which the detailed design of the WTP and pipelines takes place. It includes detailed landscape and architectural designing as well as layout and routing of the pipelines. It starts before the construction phase but may continue even after construction activities have commenced. For the purposes of this document they are regarded as discrete and separate phases.
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011
EMP	Environmental Management Programme
MS	Method Statement
NABWAS	Northern Area Bulk Water Augmentation Scheme
NEMA	National Environmental Management Act (No 107 of 1998)
oEMP	Operational Phase Environmental Management Programme
Operational Phase	The operational phase succeeds the construction phase and commences when water treatment at the WTP or storage of potable water at the bulk reservoir starts. There may still be some construction taking place around the facility which will still be covered by the construction phase so the oEMP may commence before the cEMP has been completely phased out.
WTP	Water Treatment Plant

To [redacted]

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Environmental Specification 6: Responsibilities and functions of the Restoration Ecologist
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1. Introduction

1.1 Background to this management programme

This document details the draft Construction Phase Environmental Management Programme (cEMP) and accompanies the application for Environmental Authorisation for the development of the Northern Area Bulk Water Augmentation Scheme: Muldersvlei Bulk Water Treatment Facility, Reservoir and Associated Infrastructure (NABWAS). It is based on the assumption that the preferred alternative and associated mitigation measures as detailed in the Environmental Impact Assessment Report (EIR) would be approved *in toto* by the Western Cape Provincial Department of Environmental Affairs and Development Planning (DEADP). It also made use of standard clauses found in other Environmental Authorisations for the delineation of roles and responsibilities under the assumption that they too will form an explicit part of the Authorisation. It is intended that a final version will be submitted for approval by DEADP containing additional details once the record of decision has been issued.

Since it is entirely possible that additional conditions may be required of the applicant by DEADP, and that some recommended mitigation measures may be deemed unnecessary, the first task in the implementation of this cEMP will be to update section 3 (below) to accurately reflect the conditions of approval. However, this document details the manner in which the conditions of authorisation and environmental best practice will be applied to this development by the City of Cape Town. Since it is unlikely that anything contained in the Environmental Authorisation will change the contents of sections 1 and 2, these two sections shall not be changed or amended unless specifically required by DEADP as part of the Authorisation process. Specifications for the amendment of the specifications in section 3 are detailed in that section.

This document has been compiled by [redacted] on instructions from, and using information supplied by Chand Environmental Consulting. It has been amended to incorporate responses to stakeholder comments and queries and an adjustment to the preferred option made in June 2012. [redacted] has more than 15 years experience in environmental management, environmental auditing and systems design. He has audited operations as diverse as mining concerns to sweet factories. This has resulted in the development of a keen sense of the components of practical and implementable management plans. His recent experience in a auditing a number of large construction activities has resulted in the development of an approach to environmental management plans which focus more on who performs the tasks and with what desired outcome than on providing details on how the tasks much be achieved. Furthermore, this experience has resulted in a focus on recognising existing organisational structures and using them for environmental management rather than inventing new ones which would necessarily be add-ons. His skills and experience are therefore well suited to the drafting of this cEMP. His curriculum vitae is available on request.

1.2 Structure and function of this Environmental Management Programme

This cEMP primarily focuses on specifying desired outcomes of environmental management activities and the organisational structures and procedures to produce and check such outcomes during the detailed design and construction phases. The practical details of how such outcomes are achieved are left to the engineers and other contractors involved. They are required to develop Method Statements (MS) detailing how the outcomes will be achieved before commencing construction activities. This approach is deemed preferable since the

[redacted]

engineers and other contractors are more familiar with approaches and techniques involved and how they will affect costing for the implementation of the requirements of this draft cEMP. It is therefore logical to require them to provide the details rather than to prescribe them inthe sections below.

The document is organised in three discrete sections:

- **Section One:** details the background to the draft cEMP, the construction activities that will take place and an indication of how these activities could affect the surrounding environment based upon a synthesis of specialist investigations detailed in the EIR compiled by Chand Environmental Consulting.
- **Section Two:** details the organisational structures and responsibilities for implementing, checking and rectifying the activities required to mitigate any negative impacts resulting from construction activities.
- **Section Three:** details environmental protection specifications for the most likely construction activities. These will form the bases for Method Statements provided by the contractors. This list is NOT exhaustive and provision is made for the Engineer and/or ECO to develop additional specifications and call for further Method Statements as required.

The final cEMP is to be included in all contract documentation. Compliance with the provisions of that cEMP is mandatory for all parties involved in the construction of the Water Treatment Works and associated infrastructure including the pipelines.

1.3 Scope

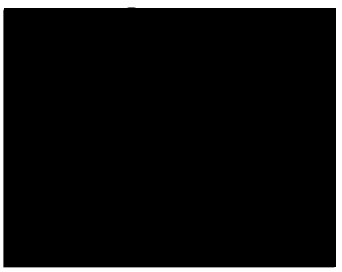
This cEMP provides environmental specifications for the implementation of mitigation measures specified in the Environmental Impact Assessment Report (EIR) for the Design and Construction Phases of the construction of the Water Treatment Plant, associated facilities and the pipelines as approved. Environmental specifications for the Operational Phase are contained in a separate volume. The mandate for the development and limits of these environmental specifications are derived from the Environmental Authorisation issued in terms of the National Environmental Management Act (No 107 of 1998) (NEMA) and other environmental legislation. As such, the mandate of the cEMP does not extend beyond environmental management. While there is some overlap with Health and safety management plans, this cEMP is not intended to provide health and safety specifications. The management of the overlap between the two disciplines is detailed in section 2.2.

1.3.1 Description of Activities

The activities which may affect the environment and are the subject of this cEMP relate to the construction of the following facilities as detailed in the EIR.

The Muldersvlei component of the NABWAS comprises a Water Treatment Plant, a reservoir and a system of pipelines carrying raw water to and treated water from the WTP. The following description provides context to the Environmental Management Programme. Final details of orientation and location of the various components will result from the detailed design phase.

The WTP/reservoir complex will be between 25 and 32 ha in extent, the exact boundaries of which will be finalised during the detail design phase. Agricultural activities will be able to continue directly beyond the boundaries of the site.



The WTP will have a capacity of 500 Mℓ/day, with a storage capacity of 300 Mℓ in the reservoir. This Reservoir will be a rectangular excavation and embankment-type which is concrete lined and is fully enclosed.

The major components of the WTP/ reservoir complex include the following:

- Lime silos (each 11.5 m high (approximately 7 m above ground level and the tallest structures on the site);
- Sludge tanks (approximately 8.7 m high and 30 m diameter, projecting above ground, approximately 1 500 m^2 in extent);
- The inlet building (approximately 8.6 m high above ground level);
- Double-storeyed administration buildings (approximately 8 m high and 900 m^2 in extent);
- Workshop buildings (approximately 6 m high);
- The reservoir (approximately 31 500 m^2 in extent and largely set into the hillside slope);
- Filter buildings (approximately 4 m high and 1 000 m^2 in extent);
- Flammable store;
- Disinfection building comprising on-site sodium hypochlorite generation units and storage tanks;
- Filter beds (approximately 4000 m^2 in extent); and
- Settling tanks (approximately 14 800 m^2 in extent).

External areas would either be covered in grass or asphalt hardstanding.

Ancillary services for the combined WTP and reservoir site will include:

- internal access roads,
- domestic water supply,
- domestic waste removal,
- sewage treatment and effluent disposal,
- stormwater drainage,
- telecommunications,
- electricity supply and
- lighting.

On-site generation of sodium hypochlorite is proposed, for use in disinfection. This will eliminate the need for chlorine gas to be stored on site. This also negates the facility being declared a major hazardous installation. This process involves using electrolysis to convert ordinary salt dissolved in water, to produce sodium hypochlorite. The sodium hypochlorite solution is dosed directly into the product water stream, where the free chlorine produced acts as a disinfectant. Hydrogen gas produced in the process is safely vented into the atmosphere.

Electricity will be supplied by on-site turbines with an alternative supply from Eskom, with a backup diesel generator for emergencies.

Sewage will be treated with a commercial sewage treatment package plant to specifications of the General Authorisation provided for under the National Water Act, 1998 (Act No. 36 of 1998). The maximum capacity of the plant will be approximately 5 m^3/day. The treated effluent will be irrigated onto landscaped areas located around the WTP facility in summer, but in winter is likely to be discharged to the nearest watercourse, located to the south west of the facility. The treated effluent will be treated to the general effluent standards as determined by the Department of Water Affairs (as prescribed within GG No 26187 GN 399 of 26 March 2004) and should therefore not pose a problem in terms of odour and groundwater contamination. In addition, the quality of the effluent discharged will be regularly monitored by the City of Cape Town to ensure compliance

Potable water supply will be obtained on site from the WTP.



Domestic waste will be disposed of at an appropriately licensed landfill.

Tarred access roads will be constructed from existing farm roads (where practically possible) which will have a 20 m wide road reserve with a 9.5 m wide paved surface. Where the road is located on a private property, the land required for the 20 m reserve will be purchased by the CoCT from the relevant landowner.

The premises will have access control at the entrance and 24 hour patrols inside the perimeter security fence.

The total length of the proposed pipeline from the Dasbos Pump Station at the Berg River Dam, to the Dasbos outlet and on to the planned transfer reservoir at Spes Bona, just north of Durbanville, is approximately 40 km with pipeline sizes ranging from 1 500 mm to 2 000 mm in diameter, depending on the final design and possible agricultural demand. The area to be disturbed along the pipeline route will be limited to a width of 27 m. A typical excavation trench would have an estimated top width of 9.4 m and a depth of approximately 3.2 m. These dimensions will vary with pipe depth below ground level. The areas inside the 27 m zone which are not being excavated will be used as working space for construction machinery and for temporary storage of construction materials. A permanent servitude, which is approximately 15 m wide, will be required for the pipelines. A schematic indication of the main proposed pipeline corridor between the Berg River Dam and the Spes Bona Reservoir is indicated in Figure 1 below. The details of orientation will result from the detailed design phase.

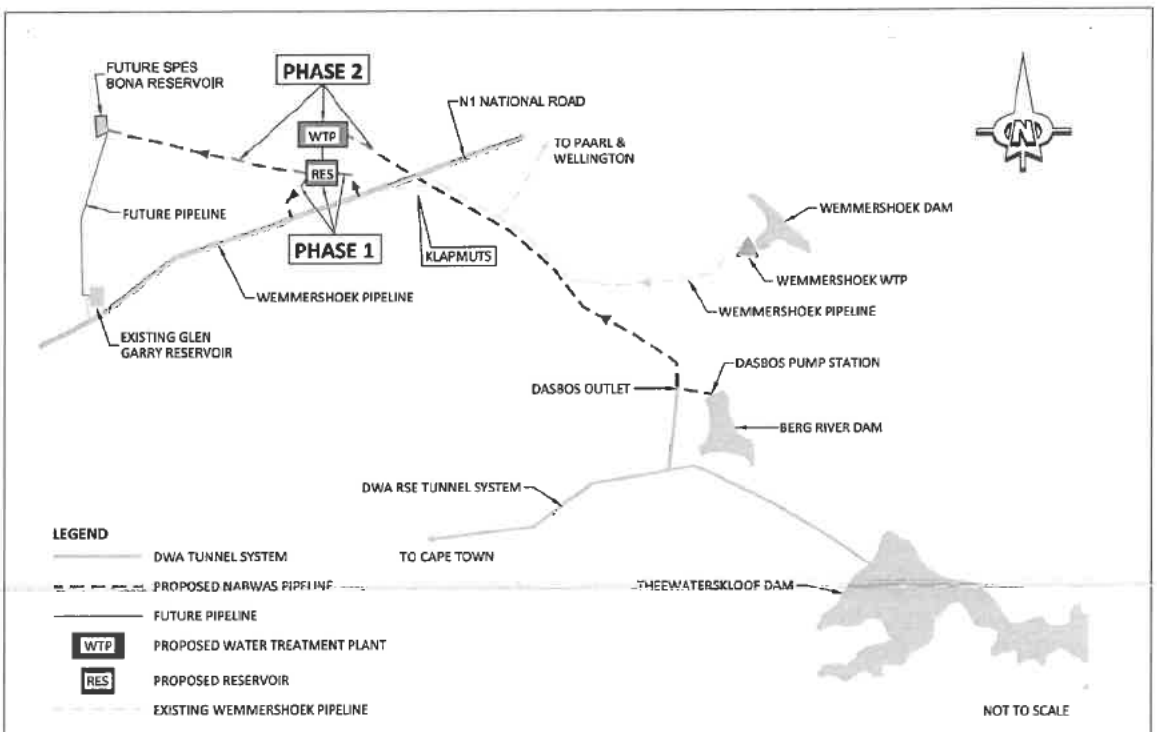


Figure 1: A schematic diagram of the proposed pipeline routes from the Dasbos Pump Station to the Spes Bona Reservoir

1.3.2 Affected environment

The table below summarises the potential impacts of activities which must be addressed during the design and construction phases. The specialist reports in the EIR provided more

detail but this table provides context to the specifications which follow in this cEMP. (Impacts associated with the operational phase are dealt with in a separate volume).

Table 1: Summary of impacts in affected environments

Receiving Environment	Risk/ Potential Impacts
Freshwater rivers and streams, wetlands and riparian vegetation	• Disruption of freshwater and riparian ecology through alteration of normal functioning of the ecosystems resulting from: o Contamination of surface water with silt or spilled chemical pollutants o Contamination through accidental release of sewage from portable toilets o Disruption of stream flow through diversions or other physical obstructions such as litter o Removal of or damage to riparian vegetation making stream banks vulnerable to erosion o Erosion of stream beds and banks from constructions activities
Ground water systems	• Contamination of the soil and ground water with chemical contaminants
Endangered terrestrial vegetation	• Disruption of endangered terrestrial ecosystems through alteration of normal functioning of the systems resulting from: o Removal of vegetation for construction of facilities and associated services such as roads o Damage to vegetation by heavy plant o Smothering of terrestrial vegetation with dust o Endangering terrestrial vegetation through contamination of the ground water system
Agricultural land and potential	• Disruption of agricultural activities through: o Loss of agricultural land through expropriation o Damage to agricultural land by heavy plant and equipment o Smothering of crops with dust
Surrounding human communities	• Disruption to normal traffic flow through road closures • Influx of contract workers and job seekers resulting in pressure on local housing and services and posing security problems • Possible security risks resulting from influx of workers and prospective workers • Increased ambient noise levels • Elevated dust levels • Disruption of sense of place resulting from construction activities
Visual landscape (including heritage landscape)	• Disruption of visual landscapes and potentially the heritage of the area through the construction of buildings or removal of vegetation and other landscape elements
Archaeological environment	• Disruption of archaeological artefacts during construction and as a result of placement of infrastructure

A summary of the mitigation measures recommended in the Second Revised Draft EIR and which will be implemented by this and the operational phase EMP is contained in Annexure 1.

1.3.3 Applicable legislation

The impacts detailed in the previous sub-section are governed by legislation which is used to set performance criteria in the specifications which follow. Please note that this is not intended to comprise a comprehensive legal review; merely a list of the legislation associated with the identified impacts below. This list does not remove the responsibility of all parties concerned from complying with other legislation not listed below.

Table 2: Summary of applicable legislation

Impact	Applicable legislation
General threat to environmental quality	• National Environmental Management Act (No 107 of 1998) (s28(1) • CoCT By-law: Environmental Health
Protection of water resources including prevention of pollution of Water and diversion of flows	• National Water Act (No 36 of 1998) (s19), (s3(3)) • CoCT By-law: Storm water management

[redacted]

Impact	Applicable legislation
Management of waste including discharge to a natural watercourse	• National Environmental Management Act (No 108 of 1998) s28 • National Environmental Management: Waste Act (No 59 of 2008) (chapter 4) • National Water Act (No 36 of 41998) (GA 3.7) • CoCT By-law: Integrated Waste Management • CoCT By-law: Waste Water
Noise generation	• Environment Conservation Act (No 73 of 1989) (Regulation 25) • National Environmental Management: Air Quality Act (No 39 of 2004) s34 • CoCT By-law: Relating to Streets, Public Places and the Prevention of Noise Nuisances
Pollution prevention and safe handling of hazardous and flammable substances and equipment	• Occupational Health and Safety Act (No 85 of 1993) (s 9(1) • Hazardous Substances Act (No 15 of 1973(• Hazardous Substances Regulations (August 1995) • CoCT By-law: Community Fire Safety
Dust and smoke	• National Environmental Management: Air Quality Act (No 39 of 2004) (s 27, 32, 34, 35) • CoCT By-law: Air Pollution Control
Protection of heritage resources	• National Heritage Resources Act (No 25 of 1999) (s44(1))
Endorsement of this cEMP	• National Environmental Management Act (No 107 of 1998) (s24(e))
Prevention of veld fires	• National Veld and Forest Act (No 101 of 1998 as amended)
Control of invasive alien plant species	• Conservation of Agricultural Resources Act (No 43 of 1983)

1.3.4 Legal Status

This draft cEMP is an intrinsic part of the suite of conditions of approval of the WTP and associated infrastructure. As such, compliance with the specifications is mandatory by all parties concerned.It must be included with, and form an explicit component to all contracts associated with this development. Changes to the specifications may only take place with the express, written consent of the competent authority: the Western Cape Provincial Department of Environmental Affairs and Development Planning. The varying responsibilities in this regard are detailed in the following section.

The draft version of this cEMP, as it has been written prior to commencement of the detailed design and construction phases, will be reviewed and revised during detailed design. Any changes will be made with the written consent of the Department of Environmental Affairs and Development Planning.

[redacted]

2. Implementation of the EMP

2.1 Organisational structure

The sub-sections that follow detail the responsibilities and lines of reporting for the key role-players in the design and construction phases. As a result of a meeting held with staff of the Bulk Water Branch on 5th October 2011, it is understood that CoCT intends using different contractors for different elements of the construction, but with a single overarching Engineer to oversee and project manage the works on behalf of the CoCT. The Engineer may be a CoCT employee, or may be a consulting engineer appointed by the City. This will be decided upon during preliminary detailed design. In the organograms below, this appointee is termed "Engineer" and any other specialists appointed by the Engineer are referred to as "Contractors". Since the responsibilities attendant on these appointments do not differ between disciplines, no distinction is drawn between a landscape architect or a civils contractor, or indeed any other discipline. There may also be sub-contractors to the Contractors, and since the same obligations and responsibilities apply and so will not be repeated. The only exception to this is the direct appointment of the Environmental Control Officer (ECO) by CoCT. The reason for this is that the ECO is required to oversee and report on compliance by the Engineer as an independent third party. Direct appointment by the City reduces the potential for bias on the part of the ECO towards the source of contract payment thus introducing a more rigorous impartiality.

2.1.1 Structure and Responsibility

Box 1 provides an overview of the responsibilities of the Applicant (in this case CoCT) and the ECO.

Box 1: Excerpts from various Environmental Authorisations (EAs) on the roles of the ECO and Applicant

- Authorisation of the activity is subject to the conditions contained in this authorisation, which form part of the environmental authorisation and are binding on the holder of the authorisation.
- The holder of the authorisation shall be responsible for ensuring compliance with the conditions contained in this environmental authorisation. This includes any person acting on the holder's behalf, including but not limited to, an agent, servant, contractor, sub-contractor, consultant or person rendering a service to the holder of the authorisation.
- The holder of this authorisation must appoint a suitably qualified and experienced Environmental Site Manager/ Environmental Control Officer ("ECO") for the construction phase of the development, before commencement of any land clearing or construction activities, to ensure that the mitigation/rehabilitation measures and recommendations referred to in this authorisation are implemented and to ensure compliance with the provisions of the EMP.

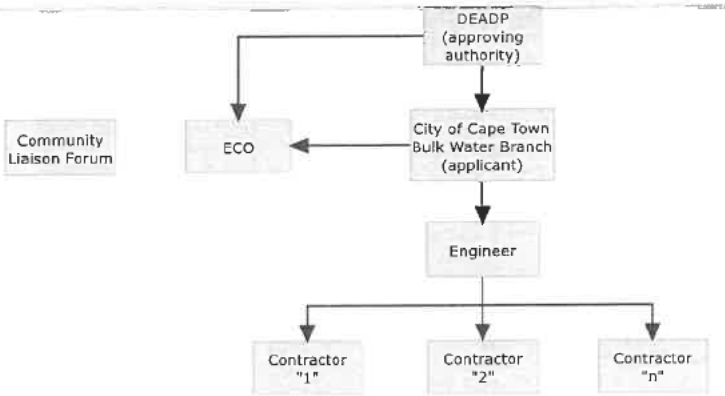


Figure 2: Lines of responsibility for the implementation of this cEMP

From the excerpt in Box 1 it is clear that ultimately, full responsibility for compliance with the conditions of authorisation (implementation of this cEMP being one of them) rests with CoCT. This responsibility is imposed upon

CoCT by DEADP (Figure 2). Responsibility for complying with the conditions of authorisation is conferred through contractual agreement onto the Engineer and from the Engineer to Contractors of various descriptions, again via contractual agreement. Thus each contractor is accountable to the Engineer for compliance and the Engineer is accountable to CoCT for compliance. Thus non-compliance at any level below CoCT requires corrective action on the part of the next tier up. Similarly, non-compliance on the part of CoCT requires action by DEADP.

The ECO is directly accountable to the applicant: CoCT and to DEADP as a consequence of the imposition of responsibility in the EA for the activities detailed in this cEMP.

In response to recommendations in the Second Revised Draft EIR, the establishment of a voluntary Community Liaison Forum is likely to be required as a condition of authorisation. Since this Forum has no decision-making function and does not itself undertake any construction activities, there is no direct line of responsibility in Figure 2 since only limited responsibilities are imposed by DEADP on the Forum and these revolve primarily on reporting which will be dealt with in the next section.

Details of the responsibilities and actions required of each of these role-players are presented in section 3 below. However, an overview of the range of responsibilities and how they will link with those in the operational phase have summarised in Table 3 below.

Table 3: Summary of responsibilities for the implementation of this cEMP

Phase of development	Design			Construction			Operational
	Start	Mid	End	Start	Mid	End	Start
City of Cape Town							
Appoint Engineer(s)	x						
Appoint ECO	x						
Participate in detailed design	x	x	x				
Commission traffic management plan			x				
Commission landscape architect			x				
Notify DEADP of commencement			x				
Finalise and approve penalty system for the cEMP			x				
Submit version 1 of the cEMP to DEADP			x				
Establish Community Liaison Forum			x				
Manage Community Liaison Forum				x	x	x	
Manage Engineer and ECO contracts	x	x	x	x	x	x	
Take any actions required to ensure compliance	x	x	x	x	x	x	x
Appoint operational staff						x	
Accept handover from Engineer (contractors) and ECO						x	
Commission WTP and pipelines							x
Approve version 1 of oEMP							x
Take responsibility for ongoing management and compliance							x
Consulting Engineer							
Accept appointment	x						
Finalise detailed design	x	x	x				
Appoint contractor(s)			x				
Approve the Contractor(s) Waste Management Plan prior to the commencement of construction activities			x				

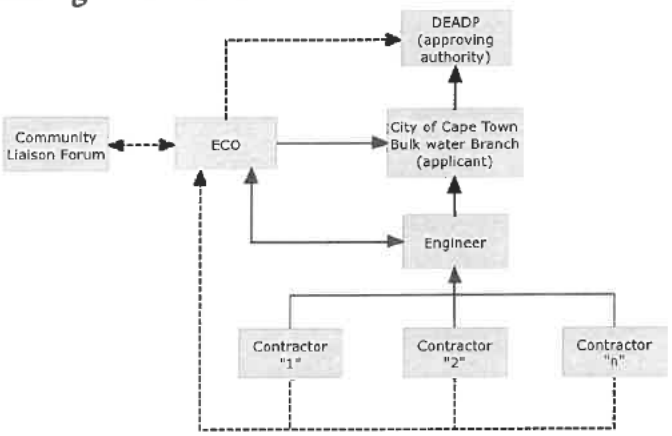
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Phase of development	Design			Construction			Operational
	Start	Mid	End	Start	Mid	End	Start
Approve site establishment and maintenance MS prior to establishment			x				
Approve construction activities MS prior to commencement of construction activities			x				
Manage compliance by contractors				x	x	x	
Hand over to City of Cape Town operational staff						x	
Environmental Control Officer (ECO)							
Accept appointment	x						
Provide input to detailed design	x	x					
Provide input to structure and siting of construction camp(s)			x				
Revise draft cEMP to incorporate conditions of approval			x				
Provide input to traffic management plan			x				
Provide input to landscape plan			x				
Provide input to Contract(s) Waste Manage Plans			x				
Provide input to site establishment and maintenance MS			x				
Provide input to construction activities MS			x	x	x	x	
Conduct induction training				x	x	x	
Review MS developed by the Contractor(s)				x	x	x	
Monitor construction compliance with cEMP				x	x	x	
Report to CoCT and the Engineer on compliance during construction				x	x	x	
Design of Rules of Engagement for Community Liaison Forum		x	x				
Receive and respond to community and stakeholder inputs/ feedback				x	x	x	
Compile and submit closure inspection and compliance report						x	
Finalise and customise draft oEMP into version 1.							x
Obtain approval for version 1 of oEMP							x
Notify DEADP of changes to oEMP							x
Handover Community Liaison Forum to operational staff						x	
Transfer documentation to operational staff						x	
Transfer environmental management to operational staff						x	
Community Liaison Forum							
Establishment			x				
Inception				x			
Engage in information sharing with ECO and construction team				x	x	x	
Act as a conduit for stakeholder and community feedback				x	x	x	x
Monitor construction activities				x	x	x	
Monitor operational activities							x
Environmental Responsible Staff Member							
Accept appointment							x
Assume functions of environmental management							x
Assume management of Community Liaison Forum							x
Ensure that contents of oEMP are included in Event Management System and Risk Register as appropriate							x

Phase of development	Design			Construction			Operational
	Start	Mid	End	Start	Mid	End	Start
Implement the requirements of the oEMP							x

2.1.2 Communication and Reporting Structures

Figure 3: Lines of reporting for this cEMP



The lines of reporting compliance are depicted in Figure 3. Contractors are required to report environmental non-compliance directly to the Engineer as and when it becomes apparent. However, it is the explicit function of the ECO in the role of facilitator and monitor to gather information on compliance as well as non-compliance by the Contractors and a regular basis and report to the Engineer and CoCT directly for action. These reports are then submitted to DEADP as specified in the EA.

Finally, the ECO provides feedback on compliance at the Community Liaison Forum meetings and provides feedback on progress on responses to any negative or positive feedback from stakeholders.

More details on these lines of reporting and the nature of the reporting are contained in section 3.

2.1.3 Community Engagement

Engagement with stakeholders and especially the surrounding community is essential. In this development road closures and other traffic obstructions may occur, about which the stakeholders will need prior notice. There is also a need for a portal to accept and process feedback from stakeholders. To this end the Community Liaison Forum will be established. The draft rules of engagement and responsibilities are detailed in section 3.

2.1.4 Review and Maintenance of the EMP

This draft cEMP is a living document and as such will require modification or amendment to suit changing circumstances. The procedure for making amendments or changes while ensuring that the integrity of the cEMP is maintained is detailed in section 3.

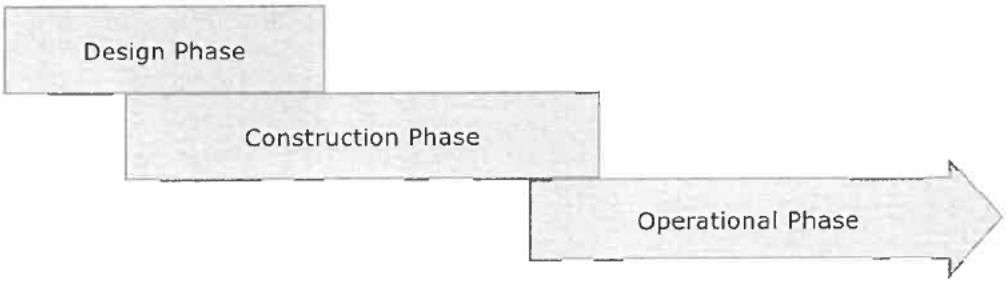
2.2 Links to other management plans

This cEMP is designed to manage environmental consequences of activities taking place during the design and construction phases of the development. However, it does not stand in isolation. It necessarily links with other management plans during the construction phase and the Operational Phase Environmental Management Programme. For the purposes of this draft cEMP and the subsequent draft oEMP the following definitions of the three phases of development are used.

Table 4: Definitions of the three phases of development for the purposes of this cEMP

Design Phase	This is the phase during which the detailed design of the WTP and pipelines takes place. It includes detailed landscape and architectural designing as well as layout and routing of the pipelines. It starts before the construction phase but may continue even after construction activities have commenced. There may thus be a functional overlap in schedule between the two phases. However, for the purposes of this document they are regarded as discrete and separate phases. Since there is no conflict between the activities and responsibilities during the two phases, this overlap is not considered to be an impediment to effective implementation.
Construction Phase	This is the phase during which physical construction activities take place. It is preceded by the detailed design phase and succeeded by the operational phase. However, as noted in the previous cell some detailed design may continue into the construction phase. Furthermore, some construction may continue after the WTP has become operational resulting in some overlap between this phase and the operational phase. Since implementation of the operational phase is the responsibility of the CoCT and not the Engineer or ECO, there is no conflict as result of the two phases running concurrently.
Operational Phase	The operational phase succeeds the construction phase and commences when water treatment at the WTP starts. There may still be some construction taking place around the facility which will still be covered by the construction phase so the oEMP may commence before the cEMP has been completely phased out.

The possible overlap between the phases is depicted in the schematic below. The Scheme will be implemented in components, so the phases in Table 4 will be implemented for each component. The implementation of the components will overlap.



Details of the linkages with other management plans are presented in Table 5 below.

Table 5: Description of linkages with other management plans

Name of Management Plan	Nature of linkage
Traffic	A Traffic Management Plan is recommended in the EIR since there will be numerous disruptions to road and possibly rail traffic that will need to be planned to minimise disruption of surrounding communities. Should this be a condition of authorisation, the Traffic Management Plan will be compiled during the design phase. The ECO is required to liaise with the Traffic Engineer and firstly ensure that the mitigation measures recommended in the EIR are implemented and secondly to ensure that any specific actions required in other Method Statements are included in amended Method Statements and implemented.
Landscaping	Similarly a landscape plan for the WTP premises needs to be reviewed by the ECO. The ECO is then required to monitor the contractors' activities and identify actions taking place during construction that could impair or prevent effective implementation of the landscape plan- e.g. spoiling of topsoil. Any such actions will be reported to the Contractor and/ or Engineer for appropriate action.

[redacted]

Name of Management Plan	Nature of linkage
Rehabilitation	The same philosophy applies to the development of a restoration and rehabilitation plan for areas which are disturbed during construction of the pipelines. This is to be reviewed by the ECO who in turn must identify any actions taking place during construction that could affect the implementation of the rehabilitation plan and report any such actions to the contractor and/ or Engineer for appropriate response.
Health & Safety	The distinction between environmental matters and health & safety matters is not always clear. In order to avoid duplication or omission of significant issues, the procedure for developing Method Statements detailed in section 3 requires collaboration and joint sign-off between the ECO and Health & Safety agent.
Operational Environmental Management Programme	The cEMP deals with activities during the construction phase but must transfer responsibility to the environmentally responsible person for the operational phase. Section 3 contains specifications for this handover.

Details of the specifications follow. Each individual specification will need to be checked and confirmed or amended in the final cEMP before implementation to reflect the contents of the EA and how they will be implemented as appropriate. The draft specifications that follow contain the minimum requirements for the specifications. Compliance requires that at least the details presented below are complied with but this does not prevent additional elements being added. A standard format has been used for all specifications. However not all cells are applicable in all cases. Where the cells are not applicable they are noted as such.

[redacted]

3. Environmental Management Specifications

This section provides specifications for the following:

1. Actions to be taken during the design phase
2. Responsibilities and function of the CoCT
3. Responsibilities and function of the Engineer
4. Responsibilities and function of the Contractor
5. Responsibilities and function of the ECO
6. Responsibilities and function of the Restoration Ecologist
7. Responsibilities and function of the Landscape Architect
8. Responsibilities and function of the Traffic Engineer
9. Responsibilities and function of the external auditor
10. Establishment and functions of the Community Liaison Forum
11. Complaints register
12. Development of Method Statements
13. cEMP amendment and change
14. Incident management
15. Emergency preparedness and response
16. Training and induction
17. Monitoring, checking and auditing
18. Records and record keeping
19. Reporting
20. Enforcement
21. Waste management
22. Site camp establishment and maintenance
23. Construction activities
24. Temporary site closure
25. Site closure and rehabilitation
26. Handover to operational staff



Environmental Specification 1: Actions to be taken during the detailed design Phase

Version No.	draft	Date of Approval	

1. Background

The assessment of possible impacts and recommendation of mitigation measures conducted during the EIA dealt with numerous permutations of design. In fact some the mitigations measures require specific design considerations. For this reason, the input of the ECO is required during the Detailed Design Phase to provide input to and report on the successful implementation of recommended design changes in accordance with the conditions of authorisation.

2. Objectives

- To ensure that where possible and practicable, recommended mitigations measures are incorporated into the detailed design.
- To ensure that there is an impartial report on the implementation of the recommended mitigation measures by the ECO.

3. Specifications

The following actions shall take place in the detailed design phase and must be completed before construction may commence:

- The detailed designs of all structures shall be finalised. These shall be designed to:
  - Maximise the use of recycled or reused article;
  - Maximise the use of renewable resources and minimise the use of non-renewable resources;
  - Maximise the use of energy and water efficient devices;
  - Minimise the amount of maintenance required on the buildings and avoid the use of polluting or hazardous substances in the finishing surface and coatings;
  - Facilitate final decommissioning and re-use or recycling of the resulting break-down materials;
  - Ensure that in the event of total power failure, no pollutants can discharge to the environment; and,
  - Ensure that no more than 35 m^3 treatment residue is held on site at any one time.
  - Contingency plans must be developed to remove the waste in the event of failure of the waste disposal company to provide removal services.
- In addition to any other specialists, CoCT shall appoint:
  - An ECO;
  - Landscape Architect;
  - Restoration Ecologist; and,
  - Traffic Engineer.
- The draft cEMP must be updated to include any additional conditions of authorisation or accommodate any changes in construction methods resulting from the detailed design phase, approved by CoCT and submitted to DEADP.
- This draft version of the cEMP must include details of the penalty system to be implemented which includes:
  - the magnitude and nature of penalties for various infractions;
  - how the penalties will be levied;
  - which "green" charity or cause will be the beneficiary of the penalties; and,
  - how the penalties will be paid to the beneficiary.
- Changes to the designs can take place once construction has commenced but they should have the input of the ECO to ensure that the mitigation measures are not compromised and that any changes required are made to environmental specifications.

[redacted]

- The Rules of Engagement for the Community Liaison Forum shall be developed by the CoCT and the Forum established.
- The final route, layout and construction methods of the pipelines and WTP shall be determined in collaboration with the ECO to ensure that all recommended mitigation measures have been included as detailed below.
- The cost of implementing the cEMP and general environmental protection must be estimated to be included in the tender specifications for the Contractors.
- The registration of the servitude for the pipelines shall include provision for CoCT to have rights and responsibilities for the control of invasive plant species.

Summary of recommended mitigation measures from the Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011

Note: the recommended mitigation measures detailed below have been paraphrased from the EIR. Where the original recommended mitigation measure is impractical, conflicts with other recommendations or is not sufficiently stringent, it has been changed. The original recommendations are presented verbatim in Annexure 1.

- The pipeline design shall be:
  - Designed to minimise vertical and horizontal footprint (as shallow and narrow as possible).
  - Aligned to avoid wetlands and rivers - especially for sites listed to be of moderate to high conservation importance. Where this is impossible artificial stabilisation using structures such as gabions to be kept to a minimum.
  - Aligned to avoid crossing roads or railway lines or make use of existing crossings.
  - Ensure that the bedding medium does not form a preferential drainage line.
  - Commented upon by the freshwater ecologist prior to finalisation.
- A post construction rehabilitation plan shall be developed in collaboration with a restoration ecologist and approved prior to the commencement of construction. This plan must highlight and minimise t any construction activities which could limit rehabilitation success. Such activities must be avoided where possible. The restoration ecologist is to be appointed by the CoCT.
- Compensation for expropriated land and lost production shall be finalised prior to construction.
- The pipeline route should:
  - Be above the valley floor .
  - Be separated from public scenic road edges by vineyards or other relevant planted agricultural land.
  - Avoid running alongside scenic drive edges.
  - Avoid crossing tree-lined main approach avenues.
  - Be set back a minimum 5 m from tree canopy drip lines where running parallel with, and adjacent to, belts of trees.
  - Be separated from private roads by planted tree.
  - Be set back a minimum 10 m from the edge of a river or watercourse
  - Be laid below watercourse and stream beds.
  - Run close to and preferably on the southern side of the (disused) railway embankment running along the valley.
  - Follow existing vineyard and other agricultural boundaries wherever possible, particularly where farm service roads are already in existence.
  - In order to prevent any impingement upon the County Fair Farm the following route shall be used:

[redacted]



Figure 4: Pipeline route to be followed

- Avoid bisecting or encroaching on vineyards and tunnel farming infrastructure.
- Avoid the use of obtrusive service structures.

- The WTP and associated infrastructure design shall:
  - Minimise the footprint.
- The visual impact of the WTP infrastructure shall be mitigated by:
  - Blending and varying colours and textures to fit in with the existing environment.
  - Grading earth embankments within the perimeter fence to the proposed reservoir into the natural contours.
  - Landscaping the WTP premises to blend with the surrounding environment.
  - Ensuring that only essential security lighting is used and that it faces away from the perimeter.
  - Employing sustainable design elements such as:
    - Using renewable and natural materials and elements where possible, as well as recycled and reconstituted materials.
    - Using locally produced, as opposed to imported materials.
  - Planning construction and finishing to limit repainting/re-finishing intervals; and replacement and repair costs.

- Construction of the pipelines shall:
  - Be planned in collaboration with a restoration ecologist to ensure that activities do not occur during construction which will limit post-construction rehabilitation. The restoration ecologist shall be appointed by the CoCT.
  - Limit stream flow disruption. Temporary diversions to be designed to flush sediment accumulations. Crossings to occur in late summer or when the streams are dry whenever possible. Bank erosion must be prevented. All diversions to be removed once construction has been completed. Post-construction rehabilitation to be signed-off by the ECO.
- Soil disturbance shall be kept to a minimum.
  - Removal of vegetation shall be kept to a minimum
  - Exposed soil shall be protected from erosion.
  - Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
  - Exposed soil shall be revegetated as soon as construction has ceased.
  - Post-construction rehabilitation to be signed-off by the ECO.
- Rare and endangered plants are to be fostered.
  - Ecologically sensitive areas shall be demarcated and maintained as no-go zones.
  - All invasive aliens to be removed within the servitude of the pipeline where indigenous vegetation or riparian areas are affected.
  - A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring.
  - A nursery is to be established on-site to care for the rescued plants.
  - The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed.
  - Post-construction rehabilitation to be signed-off by the restoration ecologist.
- Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation.
  - Topsoil stockpiles to be protected against wind and rain dispersal.
  - Any topsoil run-off to be trapped and re-stockpiled.
  - No stockpile run-off may be permitted to enter any watercourse.
- Watercourses shall be protected from contamination.
  - All building materials should be stored away (at least 100 m) from aquatic ecosystems or outside 100 yr floodline, but within the 27 m construction footprint and the areas bunded appropriately such that there will be no runoff to watercourses.

[redacted]

- If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse.
- Vehicle and plant washing shall take place at least 50 m from watercourses the wash bay shall be constructed in such a way that waste water is contained within bunds and preventing from contaminating soil or any adjacent water bodies and any effluent water contained and treated prior to discharge to the watercourse.
- No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses.

- Measures to reduce dust production and dispersal shall be included in a method statement submitted by the contractor.
- The burial/cemetery site on the Farm Simonsvlei alongside the Klapmuts Road is a no-go area and shall be demarcated as such.
- Should any unmarked human remains be disturbed, exposed or uncovered during excavations and earthworks for the proposed project, these shall be reported to the South African Heritage Resources Agency and not be disturbed or removed without official approval.
- The existing water pipeline to County Fair must not be damaged during construction. In the event that any damage does occur, County Fair is to be notified immediately and repairs effected without delay.

- Construction of the WTP shall:
  - Be planned in collaboration with a restoration ecologist to ensure that activities do not occur during construction which will limit post-construction rehabilitation.
  - Take place in the dry season to minimise impacts of blasting and bulk earth moving.
  - Limit stream flow disruption. Temporary diversions to be designed to flush sediment accumulations. Crossings to occur in late summer or when the streams are dry. Bank erosion must be prevented. All diversions to be removed once construction has been completed. Post-construction rehabilitation to be signed-off by the restoration ecologist.
- Soil disturbance shall be kept to a minimum.
  - Removal of vegetation shall be kept to a minimum.
  - Exposed soil shall be protected from erosion.
  - Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
  - Exposed soil shall be revegetated in a phased manner so that rehabilitation commences in each area as construction in that area is completed.
  - Post-construction rehabilitation to be signed-off by the restoration ecologist.
- Rare and endangered plants are to be fostered.
  - Ecologically sensitive areas shall be demarcated and maintained as no-go zones.
  - All invasive aliens to be removed within the servitude of the pipeline where indigenous vegetation or riparian areas are affected.
  - A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring (at least twenty plants of the rare Athanasia capitata associated with Area BA4 would have to be relocated).
  - A nursery is to be established to care for the rescued plants.
  - The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed.
  - Post-construction rehabilitation to be signed-off by ECO.
- Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation.
  - Topsoil stockpiles to be protected against wind and rain dispersal. (Note potable water may not be used for this purpose)
  - Any topsoil run-off to be trapped and re-stockpiled.
  - No stockpile run-off may be permitted to enter any watercourse.
- Watercourses shall be protected from contamination:
  - All building materials should be stored away (at least 50 m) from aquatic ecosystems and the areas bunded appropriately such that there will be no runoff to watercourses.
  - If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse.
  - Vehicle and plant washing shall take place at least 50 m from watercourses and any effluent water contained and treated prior to discharge to the watercourse.
  - No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses.
- Measures to reduce dust production and dispersal shall be included in a method statement submitted by the contractor. Use of potable water for dust suppression is not permitted.
- Local labour to be used wherever practical.
- The burial/cemetery site on the Farm Simonsvlei alongside the Klapmuts Road is a no-go area and shall be demarcated as such.
- Should any unmarked human remains be disturbed, exposed or uncovered during excavations and earthworks for the proposed project, these shall be reported to the South African Heritage Resources Agency and not be disturbed or removed without official approval.
- The access road to the WTP shall be constructed within the development corridor of the pipeline from the reservoir to the Wemmershoek pipeline in order to maintain access to the dam for farm animals and avoid the Renosterveld remnant.

4. Performance Criteria

- Compliance with this environmental specification will require each of the above recommendations to be addressed and noted as either incorporated into detailed designs or rejected and the reason provided.
- Compliance requires the implementation of these recommendations during construction.

- Compliance also requires that the ECO monitor implementation of this specification during construction.

5. Responsibilities

- The CoCT is responsible for appointing the relevant parties for the detailed design phase and ensuring that the recommendations for mitigation are evaluated and incorporated or rejected accordingly.
- The ECO is responsible for providing input to the final design and reporting on the incorporation of the recommendation mitigation measures.
- DEADP is responsible for ensuring that this step is included in the detailed design phase.
- The Engineer is responsible for ensuring that the incorporated mitigation measures are implemented during construction.
- The ECO is responsible for monitoring such implementation.
- The ECO is responsible for notifying CoCT of any breaches detected.
- The ECO is responsible for informing DEADP of any breaches detected to which the CoCT has not responded.
- The external auditor is responsible for verifying that the ECO took all actions for which he/she is responsible and reporting any breaches as required.
- DEADP is responsible for taking any action required in the event of non-compliance by CoCT with this specification. Report of such a breach can arise from the ECO, the external auditor or any other third party such as a member of the Community Liaison Forum.

6. Monitoring and reporting

- The ECO shall compile a report detailing each of the above specifications and how they were addressed prior to construction. It is acknowledged that not all recommended mitigation measures may be possible. The report must detail the reasons they were not possible. This report shall be available for the first external audit and presented to the Community Liaison Forum.
- The external auditor shall verify the actions of the ECO and report accordingly.
- This report shall be reviewed by the external auditor and submitted to DEADP as evidence of compliance.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 1
to
Environmental Specification 26 inclusive.

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure of the Contractors to implement this specification and the adopted mitigation measures without due cause shall comprise a breach which may attract a penalty of between R500 to R2 000 per day until the mitigation measures as adopted are implemented.

[redacted]

Environmental Specification 2: Responsibilities and functions of CoCT

Version No.	draft	Date of Approval	

1. Background

There are numerous responsibilities incumbent upon the CoCT arising from the recommendations in the EIR and from the conditions of authorisation. This environmental specification provides a checklist to ensure that each function is completed. While the responsibilities with CoCT the actual execution of the functions can be delegated.

2. Objectives

- To ensure that all functions required of the CoCT are executed in accordance with the EA.

3. Specifications

The functions of the CoCT during the detailed design phase are:

- Appoint an ECO;
- Appoint external auditor
- Appoint a landscape architect;
- Appoint a traffic engineer;
- Appoint a restoration ecologist;
- Ensure that each of the above specialists completes their assigned tasks prior to construction commencing;
- Ensure that detailed designs incorporate all recommended mitigations possible;
- Fulfil the administration notification requirements of the EA;
- Approve the amended cEMP;
- Monitor compliance with the EA and cEMP;
- Develop rules of engagement for the Community Liaison Forum and manage the Forum once established; and,
- Take actions required in the event of non-compliance.

The functions of the CoCT during the construction phase are:

- Monitor compliance with the EA and cEMP through the ECO and external auditor; and,
- Take actions required in the event of non-compliance.

4. Performance Criteria

- Compliance with this environmental specification will require each of the above requirements to be addressed and noted as either incorporated into detailed designs or rejected and the reason provided for any breach.

5. Responsibilities

- CoCT is responsible for fulfilling the items in this specification and for ensuring that the details are implemented by the Engineer and for taking any action required in the event of a breach by the Engineer.
- The ECO is responsible for monitoring the implementation of this specification by the Contractor and reporting any non-compliance initially to CoCT but in the event of no action resulting; to DEADP for action.
- DEADP is responsible for ensuring that CoCT complies with this specification and taking any action required in the event of a breach.

6. Monitoring and reporting

- The ECO shall monitor compliance with this environmental specification and report any non-compliances for attention CoCT. If this is not resolved the non-compliance shall be reported to DEADP.
- The action of CoCT and the ECO shall be reviewed by the external auditor.

7. Related documents

The following documents relate to this environmental specification:

[redacted]

Environmental Specification 1 to Environmental Specification 26 inclusive.
8. Breach • Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below. • Failure of the Engineer to ensure that the Contractors implement the adopted mitigation measures comprises a breach and may attract a penalty of between R500 to R2 000 per day until the specification is incorporated as designed.

[redacted]

Environmental Specification 3: Responsibilities and functions of the Engineer

Version No.	draft	Date of Approval	

1. Background

The Engineer is the "agent" of CoCT and as such is responsible for ensuring that the responsibilities of the CoCT are duly executed in the design and construction phases

2. Objectives

- To provide a checklist of responsibilities and functions of the Engineer in terms of the EA.

3. Specifications

The Engineer shall:

- Ensure that all contracts with Contractors contain the cEMP and that adherence to the cEMP is explicitly made mandatory in all contract documents;
- Require the contractors to provide Method Statements as required by the environmental specifications and as recommended by the ECO during construction;
- Ensure that all Method Statements are jointly signed off by the ECO and the Health & Safety Agent to ensure that they do not conflict and that there is no duplication or omission of essential instructions. It is therefore important that all MS are integrated documents including aspects of environmental management, Health & Safety Management and quality management;
- Review, comment on and approve or reject the submitted Method Statements;
- Receive Contractor(s) Waste Management Plans and in collaboration with the ECO and ensure that they comply to the environmental specification, if not amendments shall be completed prior to any construction work commencing;
- Receive Contractor(s) Site Establishment and Maintenance Method Statement and in collaboration with the ECO ensure that they comply to the environmental specification, if not amendments shall be completed prior to any construction work commencing;
- Receive Contractor(s) Construction Activities Method Statement and in collaboration with the ECO ensure that they comply to the environmental specification, if not amendments shall be completed prior to any construction work commencing;
- Ensure that all contractors adhere to the cEMP;
- Receive and review compliance reports from the ECO;
- Receive and respond to external audit reports;
- Take appropriate and speedy action in the event of non-compliance including issuing of penalties;
- Plan for and respond to any incidents or emergencies; and,
- Provide compliance reports to the CoCT and DEADP as per the conditions of authorisation.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.

5. Responsibilities

- The Engineer is responsible for ensuring the implementation of the above specifications by the Contract(s).
- The Contractor(s) are responsible for implementing the above specifications where appropriate.
- The ECO shall monitor the execution of the above responsibilities and implementation thereof and report to CoCT.

[redacted]

6. Monitoring and reporting

- The ECO shall monitor the execution of the above functions and responsibilities and report any noncompliance to CoCT for action.
- The ECO shall monitor implementation of the specifications as appropriate.
- The external auditor shall review and comment on the ECO reports on compliance.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 1
to
Environmental Specification 26 inclusive.

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made.

[redacted]

Environmental Specification 4: Responsibilities and functions of the Contractor(s)

Version No.	draft	Date of Approval	

1. Background

The Contractor has numerous responsibilities and functions which include implementing the adopted mitigation measures and the conditions of authorisation which must be implemented effectively, if the environmental protection required of the development is to be achieved. Since the Contractor(s) will be performing the physical work involved in construction, it is critical that their roles in environmental management be clearly defined.

2. Objectives

- To ensure that the Contractors have a clear understanding of responsibilities and functions in environmental management during the construction phase.

3. Specifications

The Contractor(s) shall:

- Sign acceptance and adherence to the cEMP as part of the contract with the Engineer;
- Comply with all aspects of the cEMP in the execution of his designated construction activities;
- Submit Method Statements required by the Engineer;
- Amend Method Statements as required by the Engineer;
- Compile a Waste Management Plan to the satisfaction of the ECO, Health & Safety Agent and Engineer prior to commencing any construction activities;
- Compile a Site Establishment and Maintenance Method Statement to the satisfaction of the ECO, Health & Safety Agent and Engineer prior to establishing any site camps;
- Compile a Construction Activities Method Statement to the satisfaction of the ECO, Health & Safety Agent and Engineer prior to commencing any construction activities;
- Ensure that all employees adhere to the approved Waste Management Plan, Site Establishment and Maintenance Management Plan and all Method Statements and reasonable instruction from the ECO;
- Ensure that all employees and subcontractors comply with all aspects of the cEMP;
- Respond to any reports of non-compliances from the ECO without delay; and,
- Respond to any incidents immediately as per the relevant environmental specification.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.

5. Responsibilities

- The Contractor(s) is responsible for ensuring the complete execution of the above functions and the implementation of the cEMP and related Method Statement and management plans.
- The Engineer shall review the performance of the contractor(s) and be held responsible for the execution of the above responsibilities and functions by the Contractor(s).

6. Monitoring and reporting

- The ECO shall monitor the execution of the above functions and responsibilities and report any noncompliance to CoCT for action.
- The external auditor shall review the ECO monitoring reports.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 1

to
Environmental Specification 26 inclusive.

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor(s) to implement the above specifications or any aspects of the cEMP and/or Method Statements and/or Management plans comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of the Engineer and ECO.

[redacted]

Environmental Specification 5: Responsibilities and functions of the ECO

Version No.	draft	Date of Approval	

1. Background

The ECO is intended to be an impartial third party who facilitates and monitors compliance with the cEMP, EA and environmental best practice. The ECO shall also act as a resource providing suggested advice and technical input as required for implementation of sound environmental practices. This function is pivotal to the successful protection of the environmental during the construction phase and the successful post-construction rehabilitation. The construction activities are likely to be phased with construction occurring at more than one site at a time. The ECO is required to monitor compliance at all construction sites. If the Contractors choose to appoint their own environmental staff members (who can be termed Environmental Site Officers (ESO), Environmental Officers (EO) or Designated Environmental Officers (DEO) as preferred by the Contractor(s) this does not detract from the primary responsibility of the ECO appointed by CoCT to oversee and facilitate compliance.

2. Objectives

- To provide a checklist of responsibilities and functions to guide the ECO in the protection of the environmental and implementation of mitigation measures.

3. Specifications

The ECO shall:

- Be appointed at the start of the detailed design phase and continue operating until the last elements of the construction phase (including rehabilitation) have been signed off. (The retention of the ECO's services for the notification phase is at the discretion of the CoCT and would be determined by the number of outstanding issues remaining at the end of construction. The issue of a closure certification (Environmental Specification 25) should obviate the need for this extension to the contract of the ECO.
- Compile a checklist detailing actions and outcomes that must be fulfilled by the Contractor in order to be complaint with the cEMP and associated documents and the Environmental Authorisation. This checklist will form the basis of the regular compliance monitoring by the ECO. This checklist must be updated if any Method Statements or designs change. This checklist must include all conditions of authorisation and all specifications included in this cEMP.
- Provide input to the detailed design and layout of the pipelines and WTP.
- Provide input to the siting and establishment of the site camp(s) within the specified and approved 27 wide development envelope or within the perimeter fence of the WTP. No materials storage or other activities may take place outside of the specified areas without LUPO approval.
- Review and comment on the Contractor(s) Waste Management Plans.
- Review and comment on the Contractor(s) site establishment and maintenance Method Statement.
- Review and comment on the Contractor(s) construction activities Method Statement.
- Compile a report detailing compliance with the mitigation measures detailed in Environmental Specification 1.
- Provide inputs to and ensure that requirements of the landscape architect, traffic engineer, and restoration ecologist are incorporated into the cEMP and Method Statements as required.
- Conduct weekly compliance site inspection monitoring at each centre of construction against the checklist comprising:
  - Physical inspection of the sites and operations;
  - Compiling and referencing a photographic record of all observations;

[redacted]

- Reporting any non-compliances to the CoCT in writing immediately;
- Monitor progress with response to the report of non-compliance to ensure that response is within the specified time frame; and,
- Recommend that the Engineer imposes a penalty if the corrective is either not taken or not taken within the time frame specified.

- Attend technical site meetings (and any other site meetings at the request of the Contractor) and report on compliance and response to any non-compliances identified.
- Maintain a complete set of records and reports on all facets of compliance with the EA and this cEMP in an ordered and accessible manner.
- Maintain a complaints and response register.
- Report any significant non-compliance to the Engineer and CoCT.
- Recommend a work stoppage to the Client in the event of serious and potentially damaging non-compliance.
- Recommend penalties to the Engineer to address repeated or persistent non-conformance.
- Participate in the investigation and sign-off of incident investigations.
- Compile and submit monthly compliance reports to the Engineer and CoCT.
- Review and comment on Method Statements and management plans submitted by the contractors in collaboration with the Health & Safety Agent to ensure that there is no conflict or omission of duties.
- Update compliance checklists if any Method Statements change or if there are amendments to the cEMP.
- Call for any additional Method Statements the local circumstances may require.
- Attend all meetings of the Community Liaison Forum.
- Co-operate with the external auditor and provide information as requested.
- Ensure that induction training is conducted on all sites by the Contractor(s) and that a training register is maintained to ensure that only trained staff are permitted on site.
- Sign-off on the implementation of the rehabilitation plans
- Sign off on the implementation of the landscaping plan;
- Complete environmental closure inspection reports as each facet of construction is completed (see Environmental Specification 25).
- Update and finalise the oEMP for handover.
- Handover all documentation to operational staff of the NABWAS WTP at the end of his/her contract.

Minimum criteria for the selection of the ECO

- Minimum of a tertiary degree in environmental management or appropriately related field;
- Demonstrated experience in compiling and reviewing EMPs;
- At least 5 years experience as an ECO; and,
- At least 2 years experience with design phase applications of environmental management.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.

5. Responsibilities

- The ECO is responsible for implementing the above specification.
- CoCT is responsible for ensuring that the ECO fulfils these duties effectively.
- The external auditor shall review the performance of the ECO and submit a report to DEADP accordingly.

6. Monitoring and reporting

- The Engineer may report any non-compliance by the ECO to CoCT but since there

[redacted]

Environmental Specification 6: Responsibilities and functions of the Restoration Ecologist

Version No.	draft	Date of Approval	

1. Background

Rehabilitation of the areas disturbed by construction requires a number of actions prior to, during and after construction to be successful. These must be also planned in advance to ensure that nothing occurs during construction that would limit or hamper the post-construction rehabilitation.

2. Objectives

- To provide a checklist of responsibilities for the restoration ecologist.

3. Specifications

The Restoration Ecologist shall:

- Be appointed in the design phase;
- Complete a restoration plan detailing:
  - How the mitigation measures detailed in the EIR and presented in the cell below will be accommodated;
  - pre-construction search and rescue efforts;
  - nursery or propagation operations;
  - specifications for topsoil removal and storage during construction;
  - specifications for activities or actions which MUST take place to facilitate post-construction efforts as well as those which must NOT occur
  - post-construction rehabilitation plans (including maintenance of invasive plant species removal program within the pipeline servitudes); and
  - maintenance and monitoring plans for the operational phase.
- Ensure that appropriate provisions to cater for these specifications have been included in the cEMP and Method Statements as appropriate.
- Provide detailed inputs to the oEMP for maintenance of the rehabilitated areas.
- Manage the nursery during the construction phase.
- Monitor the compliance with specifications during the construction phase.
- Rehabilitate the disturbed areas once construction has ceased in accordance with the plan.
- Handover rehabilitated areas to the operational staff for maintenance.

Summary of recommended mitigation measures from the Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011

- A post construction rehabilitation plan shall be developed in collaboration with a restoration ecologist and approved prior to the commencement of construction. This plan must highlight and minimise t any construction activities which could limit rehabilitation success. Such activities must be avoided where possible.
- Rare and endangered plants are to be fostered.
  - Ecologically sensitive areas shall be demarcated and maintained as no-go zones.
  - All invasive aliens to be removed within the servitude of the pipeline where indigenous vegetation or riparian areas are affected .
  - A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring.
  - A nursery is to be established to care for the rescued plants.
  - The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed.
  - Post-construction rehabilitation to be signed-off by the ECO.
- Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation.
  - Topsoil stockpiles to be protected against wind and rain dispersal.
  - Any topsoil run-off to be trapped and re-stockpiled.
  - No stockpile run-off may be permitted to enter any watercourse.
- Soil disturbance shall be kept to a minimum.
  - Removal of vegetation shall be kept to a minimum.
  - Exposed soil shall be protected from erosion.
  - Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
  - Exposed soil shall be revegetated as soon as construction has ceased.
  - Post-construction rehabilitation to be signed-off by the restoration ecologist.

[redacted]

is not direct line of responsibility this is regarded as voluntary function.

- The external auditor shall review the execution of the above functions and responsibilities at the frequency required by the EA and report any noncompliance to CoCT for action.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 1
to
Environmental Specification 26 inclusive.

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.

[redacted]

- Watercourses shall be protected from contamination:
  - All building materials should be stored away (at least 100 m) from aquatic ecosystems and the areas bunded appropriately such that there will be no runoff to watercourses.
  - If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse.
  - Vehicle and plant washing shall take place at least 50 m from watercourses the wash bay shall be constructed in such a way that waste water is contained within bunds and preventing from contaminating soil or any adjacent water bodies and any effluent water contained and treated prior to discharge to the watercourse.
  - No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses.
- Post-construction rehabilitation to be signed-off by the restoration ecologist.

4. Performance Criteria

Compliance with this specification shall be:

- the execution of the above listed functions
- the successful rehabilitation of the disturbed areas outside the perimeter fence of the WTP.

5. Responsibilities

- The ECO shall review the performance of the restoration ecologist and submit a report to CoCT accordingly.
- The Contractor(s) is responsible for implementing any actions specified in the rehabilitation plan.
- The Engineer is responsible for ensuring that the Contractor(s) complies with any instruction contained in the rehabilitation plan and for taking any actions required in the event of non-compliance.
- The ECO is responsible for monitoring compliance with the specifications above and in the rehabilitation plan by the Contractor(s) and reporting any non-compliance to the Engineer and CoCT.
- The restoration ecologist is responsible for monitoring compliance with the specifications of the rehabilitation plan during construction and amending instructions as required.
- The restoration ecologist is responsible for implementing the rehabilitation plan.
- The ECO is responsible for signing off on the rehabilitation plan.

6. Monitoring and reporting

- The ECO shall incorporate all requirements of the restoration ecologist in the cEMP, method statement and compliance checklist as appropriate
- The ECO shall review the execution of the above functions and responsibilities at regular intervals and report any noncompliance to CoCT for action.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to implement the above specifications comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.

[redacted]

Environmental Specification 7: Responsibilities and functions of the Landscape Architect

Version No.	draft	Date of Approval	

1. Background

Landscaping of the WTP premises is a requirement for the mitigation of negative impacts on the visual and heritage environments. A landscape architect is required to give input to the design or the structures as well as the layout and landscaping of the premises to reduce visual impact.

2. Objectives

- To provide a checklist of responsibilities for the landscape architect.

3. Specifications

The Landscape Architect shall:

- Be appointed in the design phase;
- Complete a landscape plan detailing:
  - How the mitigation measures detailed in the EIR and presented in the cell below will be accommodated;
  - specifications for activities or actions which MUST take place to facilitate post-construction efforts as well as those which must NOT occur;
  - post-construction landscaping plans; and,
  - maintenance and monitoring plans for the operational phase.
- Ensure that appropriate provisions to cater for these specifications have been included in the cEMP and Method Statements as appropriate;
- Provide detailed inputs to the oEMP for maintenance of the landscaped areas;
- Monitor the compliance with specifications during the construction phase;
- Landscape the WTP premises once construction has ceased in accordance with the plan; and,
- Handover landscaped areas to the operational staff for maintenance.

Summary of recommended mitigation measures from the Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011

- The WTP and associated infrastructure design shall:
  - Minimise the footprint.
- The visual impact of the WTP infrastructure shall be mitigated by:
  - Blending and varying colours and textures to fit in with the existing environment.
  - Grading earth embankments to the proposed reservoir into the natural contours.
  - Landscaping the WTP premises to blend with the surrounding environment.
  - Ensuring that only essential security lighting is used and that it faces away from the perimeter.
  - Employing sustainable design elements such as:
    - Using renewable and natural materials and elements where possible, as well as recycled and reconstituted materials.
    - Using locally produced, as opposed to imported materials.
    - Planning construction and finishing to limit repainting/re-finishing intervals; and replacement and repair costs.

4. Performance Criteria

Compliance with this specification shall be:

- the execution of the above listed functions
- the successful rehabilitation of the disturbed areas inside the perimeter fence of the WTP.

5. Responsibilities

- The ECO shall review the performance of the landscape architect and submit a report to CoCT accordingly.
- The Contractor(s) is responsible for implementing any actions specified in the landscape plan.
- The Engineer is responsible for ensuring that the Contractor(s) complies with any instruction contained in the landscape plan and for taking any actions required in the event of non-compliance.

[redacted]

- The ECO is responsible for monitoring compliance with the specifications above and in the landscape plan by the Contractor(s) and reporting any non-compliance to the Engineer and CoCT.
- The landscape architect is responsible for monitoring compliance with the specifications of the landscape plan during construction and amending instructions as required.
- The landscape architect is responsible for implementing the landscape plan.
- The ECO is responsible for signing off on the landscape plan.

6. Monitoring and reporting

- The ECO shall incorporate all requirements of the landscape architect in the cEMP, method statement and compliance checklist as appropriate
- The ECO shall review the execution of the above functions and responsibilities at regular intervals and report any noncompliance to CoCT for action.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to implement the above specifications comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by the Engineer to take action against the Contractor(s) when in breach of the above specifications comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by the landscape architect to implement the above specifications and complete rehabilitation of the areas inside the WTP perimeter fence comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by CoCT to take action against the Engineer to ensure compliance shall require action on the part of DEADP in accordance with co-operative governance but still upholding the conditions of authorisation.

Environmental Specification 8: Responsibilities and functions of the Traffic Engineer

Version No.	draft	Date of Approval	

1. Background

Where pipelines need to cross-existing roads and highways, interruptions to traffic flow can be anticipated. In order to ensure compliance with legislative conditions and to minimise the impact on surrounding communities the appointment of a traffic engineer has been recommended as a mitigation measure.

2. Objectives

- To provide a checklist of responsibilities for the traffic engineer.

3. Specifications

The Traffic Engineer shall:

- Be appointed in the design phase;
- Complete a construction phase traffic management plan detailing:
  - How the mitigation measures detailed in the EIR and presented in the cell below will be accommodated;
  - specifications for activities or actions which must take place during construction to notify surrounding communities and minimise risk of danger and disruption; and,
  - comply with legislative requirements.
- Ensure that appropriate provisions to cater for these specifications have been included in the cEMP and Method Statements as appropriates
- Monitor the compliance with specifications during the construction phase.

Summary of recommended mitigation measures from the Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011

Where pipelines need to cross-existing roads and highways, interruptions to traffic flow can be anticipated.

(a) Impact on National Roads

The proposed pipeline routes cross the N1 in a number of locations and connections need to be made to the Wemmershoek pipeline, which is located in the median of the N1, in the Muldersvlei area. The N1 is under the control of the South African National Road Agency Ltd (SANRAL). The SANRAL has indicated that open trench excavation across the N1 is not allowed and therefore pipe jacking would have to be utilised. However, where connections need to be made to the existing Wemmershoek pipeline, it is expected that some encroachment onto the roadway is unavoidable.

(b) Impact on Provincial Roads

Apart from the N1, all of the other pipeline crossings across major access roads would be across roads under the jurisdiction of the Roads Infrastructure Branch of the Provincial Department of Transport and Public Works. This Department has indicated that through-traffic must be provided as far as possible on all paved roads. One-way traffic is, however, allowed on gravel roads.

(c) Impact on Railway lines

All railway lines would have to be crossed by means of pipe jacking, unless permission is obtained from Spoornet at the detail design stage to use open cut excavation in the case of disused railway lines.

- Traffic accommodation measures would need to be formulated during the detail design stage of the project and in consultation with traffic law enforcement. This should form part of a traffic management plan to be included for this phase of the development.
- The requirements of SANRAL, the Department of Transport and Public Works and Spoornet must be satisfied.
- Appropriate signage will need to be erected to warn road users where traffic interruptions are to take place and speed control measures will need to be enforced where appropriate.

Increased traffic on farm roads

There will be more traffic on farm roads associated with the construction activities, however, the implementation of speed control measures and other safety controls such as flag men on site will mitigate impacts to acceptable levels.



4. Performance Criteria

Compliance with this specification shall be:

- the execution of the above listed functions
- the implementation of the traffic management plan.

5. Responsibilities

- The ECO shall review the performance of the traffic engineer and submit a report to CoCT accordingly.
- The Contractor(s) is responsible for implementing any actions specified in the landscape plan.
- The Engineer is responsible for ensuring that the Contractor(s) complies with any instruction contained in the traffic management plan and for taking any actions required in the event of non-compliance.
- The ECO is responsible for monitoring compliance with the specifications above and in the traffic management plan by the Contractor(s) and reporting any non-compliance to the Engineer and CoCT.
- The traffic engineer is responsible for monitoring compliance with the specifications of the traffic management plan during construction and amending instructions as required.
- The traffic engineer is responsible for addressing any complaints regarding notification processes obtained from stakeholders.

6. Monitoring and reporting

- The ECO shall incorporate all requirements of the traffic engineer in the cEMP, method statement and compliance checklist as appropriate
- The ECO shall review the execution of the above functions and responsibilities at regular intervals and report any noncompliance to CoCT for action.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to implement the above specifications comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by the Engineer to take action against the Contractor(s) when in breach of the above specifications comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by CoCT to take action against the Engineer to ensure compliance shall require action on the part of DEADP in accordance with co-operative governance but still upholding the conditions of authorisation.

[redacted]

Environmental Specification 9: Responsibilities and functions of the external auditor

Version No.	draft	Date of Approval	

1. Background

The Environmental Authorisation frequently specifies the need for external audits in addition to checking by the ECO and the frequency thereof. Due to the complexity of the activities in this construction, the inclusion of this condition in the authorisation is recommended. In anticipation of this requirement the following specification is issued.

2. Objectives

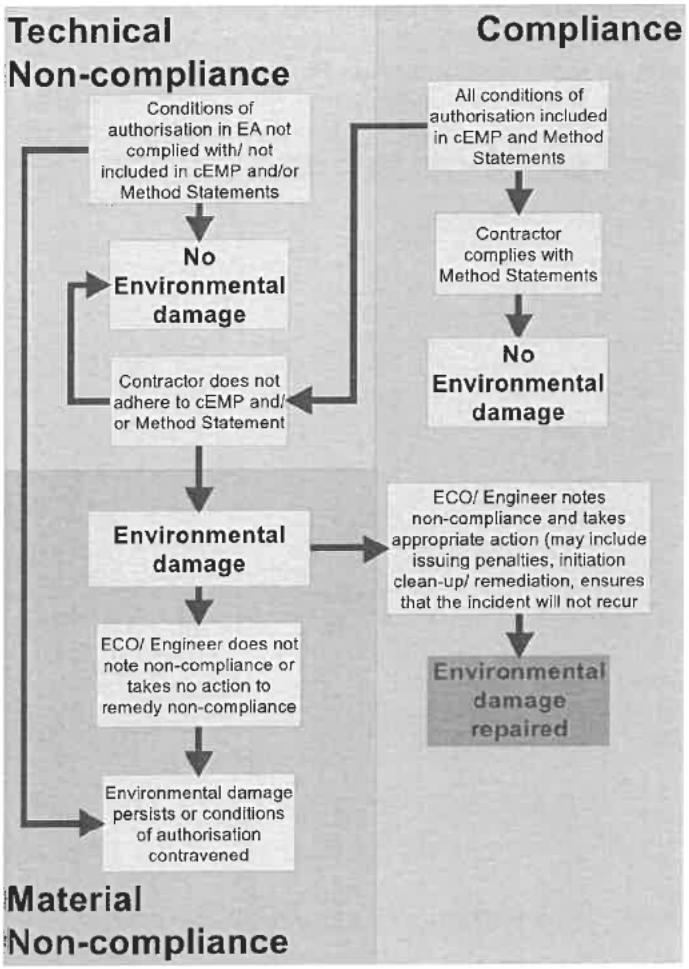
- To provide a checklist of responsibilities for the external auditor.

3. Specifications

- The external auditor shall review all documentation and records held by the ECO on a six monthly basis during construction.
- Conduct physical site inspections.
- Compile a report detailing:
  - Documentation reviewed;
  - Details of compliance and non-compliance using the definitions of compliance detailed below;
  - An assessment of the efficiency and or effectiveness of the ECO;
  - An assessment of the record and document keeping of the ECO;
  - An assessment of the effectiveness of the cEMP;
  - Any recommendations for improvement; and,
  - An overall statement of compliance.
- Submit the audit report to the CoCT which will then be copied to DEADP.

[redacted]

When auditing compliance, it is useful to distinguish between difference types of non-compliance as this will inform the degree of severity/ materiality of the finding. The figure below illustrates two types of non-compliance.



In discussing the figure, it is useful to first discuss the nature of **compliance**. Clearly, if the conditions of the Environmental Authorisation are fully incorporated into the EMPs and Method Statements and no environmental damage results, a finding of **compliance** is the logical outcome.

However, if all the conditions of the Record of Decision are fully incorporated into the EMPs and Method Statements but the contractor fails to implement them BUT the ECO notes the failure to comply and takes remedial action and no environmental damage results, the finding is also of **compliance**. In this instance, whilst the contractor was non-compliant, the ECO was fully compliant in taking remedial action so the end result complied with the intent of the Environmental Authorisation from an audit perspective.

In considering **non-compliance** then; if not all of the conditions of the Environmental Authorisation are incorporated into either the EMP or the Method Statements a finding of **non-compliance** is obvious. However, as already noted, this has far less significance than if there had been environmental damage, so there needs to be a way of distinguishing between the two types of non-compliance.

For this reason it is convenient, for the purposes of this audit report, to distinguish between **Technical non-compliance** and **Material non-compliance**. The former deals with non-compliances which **do not** result in environmental damage and are largely administrative in nature and the latter deals with non-compliances that **do** result in environmental damage and are therefore of much greater significance. The latter, which result in environmental damage and therefore contravene environmental legislation require immediate attention.

4. Performance Criteria

- Compliance with this specification shall be external audits covering the above details at frequency specified by the EA.

5. Responsibilities

- CoCT shall appoint the auditor at the frequency specified in the EA.
- The external auditor shall review all documentation and conduct all activities specified above.
- The ECO shall co-operate with the external auditor, provide a guided site tour and supply all documentation required.

6. Monitoring and reporting

- The Engineer shall respond to any recommendations by the external auditor.
- The ECO shall amend the cEMP and/or any other documentation as recommended by the external auditor in collaboration with CoCT.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5

[redacted]

- Environmental Specification 18
- Environmental Specification 19

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to take actions recommended by the external and endorsed by CoCT comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.

[redacted]

Environmental Specification 10: Establishment and functions of the Community Liaison Forum

Version No.	draft	Date of Approval	

1. Background

The EIR recommends the establishment of a Community Liaison Forum to act as an information portal between the contractors and the surrounding communities. Since the Forum has no decision-making or voting functions it does not have a constitution but rather its operations and activities are guided by "rules of engagement".

2. Objectives

- To provide a checklist of responsibilities and functions of the Community Liaison Forum.

3. Specifications

CoCT shall:

- Develop the rules of engagement of the Community Liaison Forum;
- Establish the Community Liaison Forum comprising representatives of community and stakeholder groups; and,
- Provide secretariat functions and logistics such as venue and refreshments or the Community Liaison Forum meetings.

The Community Liaison Forum shall:

- Comprise of representatives of stakeholder or community groups only- individuals may not be members;
- Have no decision-making or veto powers;
- Meet monthly or as specified in the EA;
- Be attended by the ECO;
- Elect its own chairperson;
- Adopt its rules of engagement;
- Keep accurate minutes of the meetings;
- Be entitled to receive updates on construction progress, road closures and any other information that the ECO may feel necessary;
- Provide complaints to the ECO and or Engineer and expect report-back on the response or remedial action as appropriate; and,
- Perform a monitoring function on behalf of the community during the construction and then again during the operational phase. The rules of engagement shall reflect the different functions of these two phases of operation.

4. Performance Criteria

- Compliance with this specification shall be the establishment and regular meeting of the Community Liaison Forum.

5. Responsibilities

- The external auditor shall review the performance of the Community Liaison Forum and report to the CoCT.
- The ECO shall be responsible for arranging meetings and organising venues but is NOT responsible for the chairing of the meeting or of the functioning of the Community Liaison Forum.
- CoCT shall be responsible for ensuring that the ECO fulfils the functions described above and in the specification dealing with the functions and responsibilities of the ECO in this regard.

6. Monitoring and reporting

- The ECO shall monitor the Community Liaison meetings.
- The external auditor shall review the role and functioning of the ECO in the Community Liaison Forum and responses to queries or complaints.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 1
- Environmental Specification 2
- Environmental Specification 5
- Environmental Specification 11

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to take actions specified above comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.

[redacted]

Environmental Specification 11: Complaints register			
Version No.	**draft**	**Date of Approval**	

1. Background

The construction of both the pipelines and the WTP will take place adjacent to and within existing communities. While the cEMP and other management plans are designed to minimise the negative impact on the surrounding communities, such impacts may occur through incorrect mitigation measures, mistakes or non-compliance with mitigation measures. A system to receive, analyse and respond to community members is critical as a community liaison function but also to receive feedback on the effectiveness of measures which were designed to limit such disturbances so that they can be improved.

2. Objectives

- To provide a checklist of the components of a complaints management system.

3. Specifications

The Engineer and ECO shall:

- Assign a contact details for complaints receipt;
- Publicise the numbers in local media and at the Community Liaison Forum;
- Maintain a register of all complaints received detailing:
  - Date and time of complaint;
  - Name of complainant;
  - Name of recipient of complaint;
  - Nature of complaint;
  - Name of the responsible person to whom the complaint was referred;
  - Date of referral;
  - Details of resulting action;
  - Date of resulting action; and,
  - Date of feedback to complainant.
- Ensure that all complaints received are processed and responded to within 24 hours. Where remedial action will take longer than 24 hrs the complainant shall be notified of the time anticipated before final resolution and then notified once the remedial action is completed.
- Report on complaints and complaint trends at the site meetings and in the monthly ECO reports.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.
- Compliance shall constitute responses to all complaints with 24 hrs of receipt.

5. Responsibilities

- CoCT shall co-ordinate and maintain the register and ensure that response is received to any complaints within the specified time.
- The Contractor(s) shall respond to complaints as they are received.
- The ECO shall ensure that is amendments are required to the cEMP and/or any other documentation to adequately respond to the complaints raised and prevent recurrence, that this is effected in a timely fashion.

6. Monitoring and reporting

- The ECO shall monitor the complaints to ensure that they are responded to by the responsible party within the time specified.
- The external auditor shall review the functioning of the complaints register and the performance of the ECO in the management of complaints.

7. Related documents

The following documents relate to this environmental specification:
Environmental Specification 5



8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to take actions specified above comprises a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected to the satisfaction of CoCT.
- Failure by the Contractor to respond to a complaint within the specified time shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected.

[redacted]

Environmental Specification 12: Development of Method Statements			
Version No.	draft	Date of Approval	

1. Background

The environmental specifications contained in this cEMP prescribe what must be achieved by the contractors and other parties involved in the design and construction of the WTP and pipeworks. The contractors are required to provide details on how this will be achieved based upon their experience and local conditions and resources.

2. Objectives

- To provide an initial checklist of activities which require Method Statements and a pro-forma for Method Statements.
- To ensure that that activities comply with legislation and do not *inter alia*:
  - Contaminate soil, surface or ground water;
  - Unnecessarily divert or otherwise interfere with stream flows or water courses;
  - Impact on indigenous vegetation without reason;
  - Impact on surrounding communities more than necessary;
  - Have a footprint any larger than absolutely necessary; and,
  - Generate excessive waste.

3. Specifications

- The Contract(s) shall as a minimum, provide the Engineer with Method Statements for:
  a. Incident management;
  b. Waste management;
  c. Site camp establishment and maintenance; and,
  d. Construction activities which may impact on the environment.
- Each method statement shall detail:
  - the title of the method statement, version number and date;
  - what work is to be done- e.g. cement batching;
  - where the work is to be done;
  - when the work is to be done;
  - what potential impacts are to be avoided;
  - what actions will be taken to avoid the environmental impacts;
  - who will be responsible for taking and checking these actions; and,
  - the measure used to assess the success of the method statement.
- The method statement is to be submitted to both the ECO and Health & Safety Agent by the Engineer to ensure that both sets of requirements are met and there is no conflict or omission.
- Where different Method Statements are required for the same work (each cement mixing) at different locations (WTP as opposed to on a stream bank) as dictated by local conditions- the distinctions in site application are to be made clear and both Method Statements are to be held by the ECO.
- The method statement shall be amended in response to recommendations by either the ECO and Health & Safety Agent and Site Agent. Each MS must fully integrate all aspects of management: environment, health & safety, quality etc.
- The effectiveness of the method statement is to be monitored by the ECO- in the event of it not being fully effective the ECO shall recommend changes which will then be incorporated into a revised method statement.
- The requirements of the method statement shall be included in the ECOs monitoring checklist.
- A complete set of current Method Statements is to be held by the ECO at all times.

4. Performance Criteria

Compliance with this specification shall be:

- The generation of a full set of approved Method Statements
- The implementation of the Method Statements

[redacted]

- Prevention of environmental damage through the effective planning of activities as expressed in the Method Statements.

5. Responsibilities

- The Contractor(s) shall generate and implement the Method Statements
- The ECO and Health & Safety Agent shall review and comment on the Method Statements submitted by the Contractor(s) as required.
- The ECO shall review the performance of the Method Statements and report any failures or recommendations to the Engineer for action by the Contractor.

6. Monitoring and reporting

- The ECO shall monitor the execution of the above functions and responsibilities and report any noncompliance to CoCT for action.
- The external auditor shall review and comment on the Method Statements, their implementation and effectiveness.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5
- Environmental Specification 9
- Environmental Specification 21
- Environmental Specification 22
- Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to generate, amend or implement the required Method Statements shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the implementation is effected.

[redacted]

Environmental Specification 13: Maintenance and amendment of the cEMP

Version No.	draft	Date of Approval	

1. Background

The cEMP is a living document and once approved by DEADP is still be able to change to suit changing local conditions in order to be effective.

2. Objectives

- To provide a procedure to guide amendment and modification of the cEMP without resulting in loss of integrity or having different versions in circulation.

3. Specifications

The ECO shall:

- On appointment, revise the draft cEMP to include all conditions detailed in the EA and change all version numbers to version 1 and date the specifications accordingly;
- Separate each environmental specification into individual files which reflect the name of the environmental specification and version number to facilitate amendment of individual specifications;
- Issue version 1 on behalf of the CoCT to the Engineer and all contractors as part of the contract specifications;
- Maintain a register of all Environmental Specifications and their version number;
- Amend individual environmental specifications as required by:
    - Collaborating with the Health & Safety Agent;
    - Amending the environmental specification and changing the version number and date accordingly;
    - Submitting the amended version to CoCT for approval by DEADP;
    - Registering the amended version in the register;
    - Notifying all parties and the next site meeting of the amended version and distributing the new version as needed;
    - Request that the old version be destroyed by all holders of the version; and,
    - Notify DEADP of the amendment.

4. Performance Criteria

Compliance with this specification shall be:

- the execution of the above listed functions
- removal of old versions of the environmental specifications and replacement with the new versions
- the maintenance of a register which reflects the removal and replacement with an amended version.

5. Responsibilities

- The CoCT is responsible for the development and maintenance of the cEMP and all its revisions.
- The Contractor(s) is responsible for implementing the cEMP and its revisions.

6. Monitoring and reporting

- The ECO shall monitor the execution of the above functions and responsibilities and report any noncompliance to CoCT for action.
- External auditor shall review the performance of the ECO and report on compliance to CoCT.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 1
- Environmental Specification 5
- Environmental Specification 12
- Environmental Specification 18

[redacted]

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to amend the cEMP in response to changing conditions or at the reasonable request of the Contractor(s) or Engineer and with the approval of CoCT shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the amendments are incorporated and the cEMP updated.

[redacted]

Environmental Specification 14: Incident management

Version No.	draft	Date of Approval	

1. Background

Even with the best planning in the world, mistakes or unexpected events can occur. An incident management procedure ensures that any such event is responded to appropriately and quickly but more importantly that the event is analysed to determine its root causes so that procedures can be changed to reduce the likelihood of recurrence.

2. Objectives

- To identify and investigate significant incidents in sufficient time to prevent persistent or cumulative environmental damage and through reviewing and improving existing management instructions ensure thatthe incident does not recur.

Definitions

A significant environmental incident is any inadvertent occurrence (including sabotage):

1. in which the performance criteria specified in any environmental specification or method statement have been inadvertently contravened, or
2. any environmental facet (air, water, soil) has been endangered or degraded through a spill or similar event.

This will include but is not limited to:

- spills of any liquid or solid onto the exposed soil, into the storm water drain or sewer or any natural watercourse
- an accidental release of any gaseous substance to atmosphere

Note: This definition is different from the definition of a significant incident defined in terms of section 30(1)(a) of NEMA as an unexpected sudden occurrence, including a major emission, fire or explosion leading to **serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.** The incidents dealt with by this procedure are localised and do not require the intervention of the Department of Water and the Environment. If the incident is deemed significant in terms of this legislation the procedure is overruled and the procedure legislated by the Department shall be assumed.

3. Specifications

1. Any incident occurring in any working area of the NABWAS development will be reported to the contractor responsible for the area and the Engineer immediately.
2. Upon receiving a report of an incident, the contractor shall take any action required to prevent the impact of the incident from spreading.
3. Once the incident area has been stabilised, the contractor shall complete the incident investigation form in Annexure 2. This shall include a full investigation into the causes of the incident and how a recurrence can be avoided.
4. Once the form has been completed it shall be submitted to the Engineer for review within one day of the incident.
5. The ECO shall review the incident reporting form.

Note: In the event of a significant incident which is defined in terms of section 30(1)(a) of NEMA as an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the incident shall be reported to the National Department of Water and the Environment and an appropriate incident form completed and submitted to the regional office or as instructed by the competent official.

6. The Engineer shall sign- off that the incident has been investigated and signed off to his/her satisfaction.
7. The ECO shall report the incident at the site meeting and in the monthly compliance report.

4. Performance Criteria

- All incidents are fully documented and reviewed.
- Management instructions have been amended in response to incident investigation.
- The incident is not repeated.

5. Responsibilities

- The Contractor(s) is responsible for ensuring that all staff respond to all incidents in accordance with this environmental specification.
- The ECO shall review the incident reports and response.
- The contractor is responsible for implementing any changes to procedures required to prevent a recurrence of the incident.
- The ECO is required to amend the cEMP or environmental specifications to incorporate such changes as required.

6. Monitoring and reporting

- The ECO shall monitor the execution of the above functions and responsibilities and report any noncompliance to CoCT for action.
- The external auditor shall review and comment on the functioning and implementation of the incident management environmental specification.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 1
- Environmental Specification 6
- Environmental Specification 7
- Environmental Specification 8
- Environmental Specification 12
- Environmental Specification 15
- Environmental Specification 16
- Environmental Specification 21
- Environmental Specification 22
- Environmental Specification 23
- Environmental Specification 24

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to respond to incidents in accordance with this environmental specification shall constitute a breach and may attract a penalty of between R500 to R2 000 per incident.

[redacted]

- The Principal Agent and ECO shall be contacted and shall further ensure that,
- The source of the spillage shall be isolated.
- The spillage shall be contained using sand berms, sandbags, pre-made booms, and sawdust or other absorbent materials.
- Cordon off and ensure safety of the spillage area.
- A specialist cleanup/remediation service provider shall be contracted if required.
- Mop up/remediate the spillage site.

- The source of localised flood damage caused by the Contractor's activities on site e.g. due to heavy rains or blockages in the natural water courses shall be addressed immediately.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.

5. Responsibilities

- Engineer shall review the emergency preparedness and response plan and report to the CoCT.
- The external auditor shall verify that this function was performed.

6. Monitoring and reporting

- The ECO shall monitor the emergency response drills according to the plan to determine whether environmental protection is adequate.
- The external auditor shall checks that such drills have taken place and that the ECO has fulfilled the review function

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made.

Environmental Specification 15: Emergency preparedness and response

Version No.	draft	Date of Approval	

1. Background

Emergency preparedness and response differs from incident management in the magnitude of the incident and the risk to the environment and human lives. This environmental specification draws attention to environmentally related aspects of such response but does not attempt to prescribe the contents of the comprehensive emergency response plan required by the OHSAct.

2. Objectives

- To provide a checklist of environmental aspects to be considered in the development of a comprehensive emergency response plan.

3. Specifications

- The Contractor shall develop an emergency response plan for the construction activities.
- The ECO shall review and determine whether:
  - environmental consequences (such as pollution of any environmental medium) of emergency response are adequately addressed in the emergency plan;
  - risks from environmental media are considered where appropriate (i.e. flooding of a river washing hazardous chemicals downstream); and,
  - nature of operations and the position of equipment and chemicals reflects the provisions made in the plan – e.g. hazardous chemicals stored above the flood line.

Minimum Requirements (Courtesy of Ecosense CC)

- The Contractor shall take all reasonable and active steps to avoid increasing the risk of fire through their activities on Site. The Contractor shall ensure that the basic fire-fighting equipment is available on site. The Contractor shall supply the Site with adequate tested and approved fire fighting equipment. All "hot" work areas (e.g. welding, gas cutting or cutting of metal) must have fire extinguishers readily at hand. No open fires are allowed to be made anywhere on site or in the precinct. The disposal of any material by burning on site is prohibited. The Contractor shall be liable for all costs incurred by organisations sub-contracted to extinguish all fires started by any person(s) under their control. The Contractor shall be liable for all costs incurred to repair burnt areas. A Fire Protection, Response and Evacuation Plan is to be prepared by the Contractor. This plan is to be conveyed to all staff on the Site. This shall identify:
  - a Fire Officer for the Site (this is usually the H&S officer)
  - all potential fire hazards,
  - fire fighting equipment to be provided on site
  - procedure in case of a fire
  - a fire evacuation route and plan
  - emergency contact numbers
- Key staff members will be trained to deal with the control of fire fighting equipment on site and to assist with evacuations as required. All staff is to be familiar with the position of fire control equipment on site and response and evacuation procedures. This should be covered in the Contractor's H&S inductions for all new site staff. In the case of a fire occurring on site, the following actions are to be taken immediately:
  - Contact Local Fire Department.
  - Warn neighbouring buildings of potential danger.
  - Take whatever practical measures are required to bring the fire under control, prior to the fire department arriving on site, without
- The emergency procedure and evacuation plan including telephone numbers of emergency services, including the local fire fighting service, police and ambulance as well as contact details for site management shall be posted noticeably at the Site office. The Contractor's safety officer is to present emergency procedures during the mandatory Health and Safety Induction presented to all new site staff. The Contractor shall ensure that his employees are aware of the procedure to be followed in the event of a fire.
- The site shall have a supply of absorbent material readily available to absorb any emergency hydrocarbon (fuel/oil) spills, and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to absorb / deal with a minimum of 200 litres of hydrocarbon liquid spill. Treatment and remediation of spill areas shall be undertaken to the satisfaction of the Principal Agent and ECO.
- In the case of a potentially hazardous chemical spill (hydrocarbon based or otherwise):

[redacted]

Environmental Specification 16: Induction and Training

Version No.	draft	Date of Approval	

1. Background

Implementation of the cEMP can only be effective if all personnel are appropriately trained.

2. Objectives

- To provide a checklist of training and induction requirements.

3. Specifications

The ECO shall check that the Contractor(s):

- have developed training and induction program which covers aspects of general environmental management and best practice as well as the specifics of the cEMP;
- implement the training and induction programmes;
- ensure that no personnel are permitted to work on site without having first completed the induction training;
- maintain a register of personnel trained; and,
- provide refresher training after temporary closure during builder's holidays.

4. Performance Criteria

- All personnel, visitors and consultants working on site have attended an induction and training course; and,
- The training register is up-to-date and accurate.

5. Responsibilities

- Contractor shall provide the training and maintain the training register.
- The Contractor shall prohibit any personnel form working on site without having first completed the induction training.
- The Contractor shall ensure that only trained personnel are permitted access to the site and any construction areas..

6. Monitoring and reporting

- The ECO shall monitor the activities on site to determine whether the induction training is adequate. If not, the program is to be revised and all personnel retrained.
- The ECO shall report on training conducted in the monthly compliance reports and at weekly site meetings.
- The external auditor shall review the register and conduct random checks of personnel on site to ensure that all have received induction training.

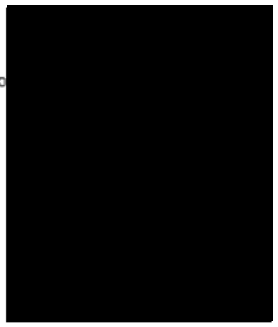
7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5
- Environmental Specification 6
- Environmental Specification 7
- Environmental Specification 8
- Environmental Specification 12
- Environmental Specification 13
- Environmental Specification 14
- Environmental Specification 15
- Environmental Specification 21
- Environmental Specification 22
- Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to provide the requisite training detailed in this environmental specification without due reason shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the training has been



provided.

- Failure by the Contractor to limit site access to trained personnel shall constitute a breach and may attract a penalty of between R500 to R2 000 per person found on site without specified training.

[redacted]

Environmental Specification 17: Monitoring checking and auditing			
Version No.	**draft**	**Date of Approval**	

1. Background

The effectiveness of planned environmental protection measures can only be determined through implementation and an analysis of the outcomes of the implementation. For this reason monitoring, checking and auditing of the results if the implementation of these specifications and the cEMP as a whole are a critical part of the cEMP.

2. Objectives

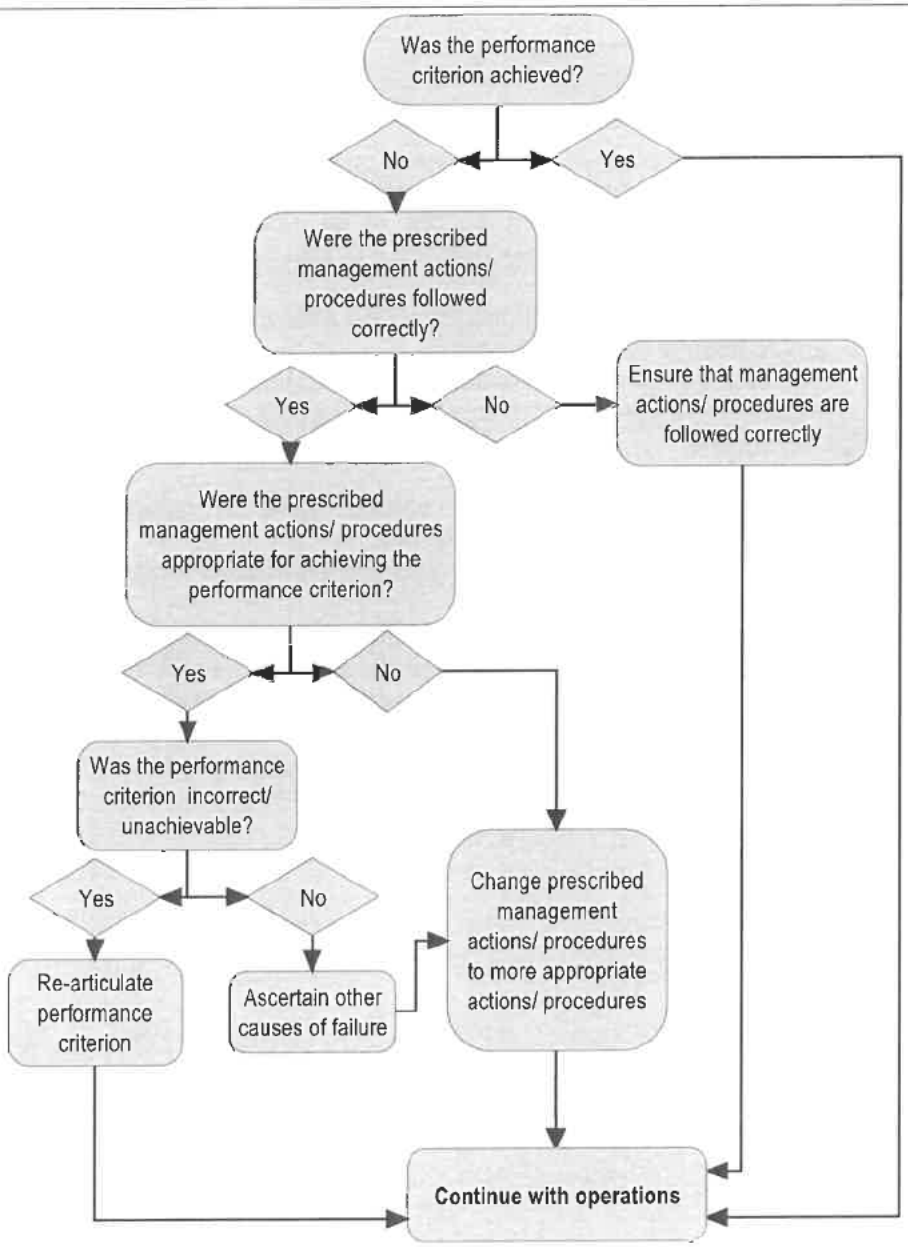
- To provide for the monitoring, checking and auditing of the implementation of the environmental specifications; and,
- To provide for improvement of environmental specifications and Method Statements if their performance is below specifications.

3. Specifications

The ECO shall:

- monitor all operations on a weekly basis to determine if the prescribed environmental protection is achieved;
- review audit reports to identify deficiencies in environmental management during construction;
- employ the decision tree overleaf if performance does not meet specifications;
- suggest amendments to environmental specifications or methods statements to the Engineer if required as a result of the analysis (or comment on a similar suggestion by the Contractor); and,
- report any such action to CoCT, the Engineer and Contractor(s), at the site meetings and in the monthly compliance report.

[redacted]



4. Performance Criteria

- Environmental compliance is monitored weekly.
- Any discrepancies are analysed for root cases.
- Any required changes to specifications or method statement are implemented.

5. Responsibilities

- The ECO is responsible for conducting all monitoring and analyses.

6. Monitoring and reporting

- The external auditor shall check that such checking has been conducted and that any discrepancies have been adequately analysed.

7. Related documents

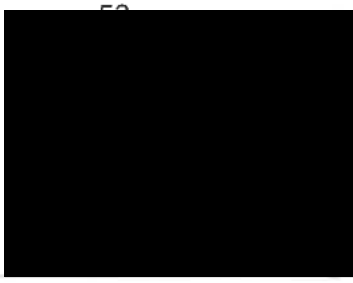
The following documents relate to this environmental specification:

- Environmental Specification 5
- Environmental Specification 9

[redacted]

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to conduct monitoring in accordance with this specification without due reason shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the training has been provided.



Environmental Specification 18: Records and record-keeping			
Version No.	**draft**	**Date of Approval**	

1. Background

The ECO is the facilitator and monitor of environmental compliance. This record of compliance has to be available to any third party and especially to the external auditor. A coherent filing system is essential especially as this development involves public funds and all aspects of it may be subject to scrutiny.

2. Objectives

- To provide a comprehensive and coherent procedure for record keeping by the ECO.

3. Specifications

- The ECO shall file and index the following (note this list is not limited to the items below):
  - Environmental Authorisation;
  - The most recent cEMP;
  - The most recent Method Statements;
  - Register of updates to the cEMP and Method Statements;
  - Traffic management plan;
  - Rehabilitation plan;
  - Landscape plan;
  - Reports on the incorporation of mitigation recommendations into the detailed design;
  - Weekly compliance monitoring checklists;
  - Photographic evidence detailing the site, and date and subject matter;
  - Copies of incident investigations;
  - Minutes of site meetings;
  - Monthly compliance reports;
  - External audit reports;
  - Temporary closure certificates;
  - Final environmental closure reports;
  - Training records;
  - Complaints register; and,
  - Any other correspondence.
- The ECO shall hand the complete filing system to the operational staff before completing his/her contractual obligations.
- The records must be kept for five years for audit purposes.

4. Performance Criteria

- All the above documents are in place, in order and current.

5. Responsibilities

- The ECO is responsible for the establishment and maintenance of the filing system.

6. Monitoring and reporting

- The external auditor shall report on the filing system and report any noncompliance to CoCT for action.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to maintain the filing system in accordance with this specification without due reason shall constitute a breach and may attract a penalty

[redacted]

	of between R500 to R2 000 per day until the system has been implemented or updated.

[redacted]

Environmental Specification 19: Reporting			
Version No.	**draft**	**Date of Approval**	

1. Background

The ECO and CoCT both have reporting responsibilities in terms of the EA and this cEMP. It is important that the reporting schedule and content is maintained to demonstrate compliance.

2. Objectives

- To provide a checklist of reporting requirements.

3. Specifications

The ECO shall:

- Compile a report on compliance with the design phase specifications;
- Complete temporary and final closure inspection reports;
- Compile weekly monitoring checklists; and
- Compile monthly compliance reports and submit them to the CoCT;

The CoCT shall:

- submit compliance reports to DEADP at the frequency specified in the EA; and.
- submit external audit reports to DEADP at the frequency specified in the EA.

The external auditor shall compile audit reports at the frequency specified in the EA.

4. Performance Criteria

- Compliance with this specification shall be the execution of the above listed functions.

5. Responsibilities

- As above

6. Monitoring and reporting

- The external auditor shall monitor the execution of the above specifications and report any noncompliance to CoCT for action.

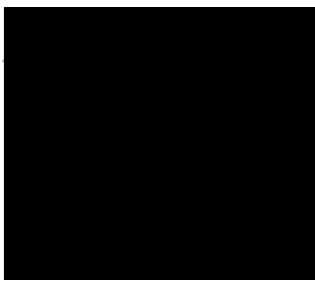
7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 1
- Environmental Specification 5
- Environmental Specification 9
- Environmental Specification 17
- Environmental Specification 18

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to report according of the above specification without due reason shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until the reports have been submitted.



Environmental Specification 20: Enforcement

Version No.	draft	Date of Approval	

1. Background

The specifications detailed it this draft cEMP are intended to ensure that the negative impacts of the construction works are not realised on the environment. Failure to implement them can result in environmental damage which then also conflicts with the conditions of authorisation prohibiting such damage. Where this is a result of negligence or repetition of actions know to result in damage a punitive system will be the last resort to ensure compliance.

2. Objectives

- To provide a mechanism to ensure compliance in the face of negligence or repetition of actions which endanger the environment.

3. Specifications

Where the Contractor causes any damage to the environment or repeatedly fails to comply with any of the environmental specifications contained within this cEMP, a penalty may be payable

- The Contractor is deemed NOT to have complied with this Specification if:
  - there is evidence of repeated contravention of a specific Environmental Specification in the cEMP;
  - environmental damage results from negligence;
  - the Contractor fails to comply with corrective or other instructions issued by the Engineer or ECO within a specified time period;
  - the Contractor fails to respond to complaints from the public to the satisfaction of the ECO.
- Penalties shall be issued per incident for the Contractor' s responsibility at the discretion of the Engineer in consultation with the ECO using amounts specified in the environmental specifications as a guideline. Where there is a range in the value the final amount will be determined by the severity of the incident. For each subsequent similar offence committed by the same team or individual, the penalty shall be doubled in value to a maximum value of R20 000.
- The amount of the penalty shall be determined by the Engineer, in consultation with the ECO. The Engineer shall inform the Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract.
- Where the penalty is levied against the Engineer, CoCT shall withhold this amount from the monies due to the Engineer.
- Payment of any penalties in terms of the contract shall not absolve the offender from being liable from prosecution in terms of any environmental law applicable to the environmental damage caused.
- All monies collected through penalties shall be held by the CoCT and be accounted for. A summary page is to be included with the monthly payment certificates as a record of penalties issued to date. Penalty funds shall be allocated to the beneficiary selected by the CoCT and Engineer during the design phase. Payment of all penalties to this beneficiary must be confirmed by the ECO prior to environmental closure being granted for the project.

4. Performance Criteria

- Penalties are issued promptly for any infractions detailed above.
- Penalties are paid promptly and a record of kept of transfer of funds to the selected beneficiary.

5. Responsibilities

- The Engineer shall ensure that any issued penalties are paid.
- The Contractor shall pay all penalties issued
- The ECO shall be responsible for monitoring and reporting regarding compliance

[redacted]

with these specifications.
6. Monitoring and reporting • The ECO shall detail all recommended and issued penalties in the monthly environmental compliance report • The Engineer shall account for all penalties issued and paid and present these as part of the site meeting minutes. • The external auditor shall review penalties levied and paid to the beneficiary.
7. Related documents The following documents relate to this environmental specification: Environmental Specification 1 To Environmental Specification 26
8. Breach Not applicable

[redacted]

Environmental Specification 21: Waste management

Version No.	draft	Date of Approval	

1. Background

The National Environmental Management: Waste Act (No 59 of 2008) and the CoCT By-law: Integrated Waste Management require that waste is approached in a hierarchical manner starting with waste minimisation through re-use, recycling and only a final resort disposal. This environmental specification provides guidance on how that will be achieved in this project.

Examples of waste generated in the site camp:

- Packaging
- Food containers
- Food waste
- Human waste
- Cleaning waste
- Paper and spent stationery and office consumables such as toners cartridges
- Waste from the camp buildings themselves during camp break-down
- etc.

Examples of waste generated during construction:

- Packaging
- Food waste
- Human waste
- Shuttering/shoring
- Electrical waste
- Chemical waste
- Waste water
- Cement and concrete waste
- Spent paint tins and paint residues
- Oils and greases from heavy plant
- etc

2. Objectives

- To minimise the amount of water produced
- Comply with waste management legislation in all facets of waste management
- To manage waste in such a manner as to prevent *inter alia*:
  - Spillage onto and contamination of soil, surface or ground water;
  - Dispersal by wind or animals;
  - Generation of nuisances such as odour or vermin;
  - Cross contamination preventing potentially re-usable or recyclable materials from being re-used or recycled;
  - Formation of leachates through the accumulations of rainwater in containers; and,
  - Misidentification through incorrect or inadequate labelling.

3. Specifications

The Contractor(s) shall compile a Waste Management Plan for the approval of the Engineer with input from the ECO and Health & Safety Agent which details for both the site camp(s) & offices and all construction areas:

- What wastes are anticipated to be generated;
- How waste generation will be minimised through planning and preferential procurement;
- How waste will be classified, labelled and stored;

[redacted]

- How many skips/ and or bins will be provided and in which locations on site;
- How waste will be collected and stored to ensure that:
  - cross-contamination;
  - wind or rain dispersal;
  - ingress of rain water;
  - pollution of soil, ground water or any streams or watercourse is prevented.
- Which waste will be re-used or recycled and the avenues for such actions (including written agreements with impoverished settlements if shoring boards etc are to be made available for their use);
- What hazardous waste will be produced and how this will be labelled, stored and disposed of;
- Which waste will be disposed of and to which landfill using which mechanisms; and,
- The establishment and maintenance of the waste register.

The Contractor(s) shall maintain a waste register which shall detail:

- Nature and volumes of all wastes produced; and,
- Disposal routes and mechanism with receipts of delivery and/or safe disposal.

Minimum Requirements (Courtesy of Ecosense CC)

Waste shall be managed in the following order (as is required by the NEM Waste Act):

1. **Waste Elimination**: Eliminate waste generation through efficient procurement, reduction in wasteful corrections due to poorly supervised work etc.
2. **Waste Reduction**: Good storage and management of materials to avoid unnecessary breakage/contamination
3. **Waste Re-use on site**: Reclaiming of materials otherwise considered as waste e.g. whole bricks and shutter ply out of the rubble stockpile.
4. **Waste Recycling/Recovery off-site** (records required for verification).
5. **Waste Disposal** to a **licensed** landfill site (records required for verification) after separation into general versus hazardous waste categories.

The Waste Management Plan entails the following:

1. The contractor shall complete a **Waste Register** which details each waste anticipated to be produced during the project, anticipated quantities, the waste's classification (hazardous and SABS class or non hazardous), the disposal method and any special precautions or legislative requirements for each waste type. This shall be reviewed a minimum of every 6 months to remain up to date.
2. Specific details as to the destination of each waste type including contact details.
3. Details of the system of sorting employed on site including separating hazardous from non hazardous wastes, separating recyclable from no recyclable wastes and sorting out re-useable materials, and providing labelled bins for these different waste types.
4. Sets up a **Waste Manifest** system which details the weight of all wastes leaving the facility, the date on which they left, the date on which they were received by the disposal/recycling/recovery facility and proof of correct disposal by the facility (safe disposal certificate for hazardous waste and receipts for other waste types).

- The contractor is to keep all working areas and the site in general in a neat and tidy condition at all times, including neat and safe stacking and storage of materials and equipment, and management of waste materials at appropriate intervals. Refer also to Section 25 ("Housekeeping on Construction Sites") of the Construction Regulations (18 July 2003) of the Occupational Health and Safety Act. The Contractor shall provide labourers to clean up refuse in the Contractor's camp and working areas daily. Litter and waste materials (excluding rubble and hazardous waste materials) shall be disposed of into bins. Bins shall be provided at all eating areas. The separation and recovery of recyclable materials is required and shall be detailed in the Contractor's Waste Management plan. The Contractor shall provide sufficient bins on Site to store the waste produced on a daily basis. Bins shall not be allowed to become overfull. The waste may be temporarily stored on Site in a central fenced waste area e.g. with ready fence panels or a waste skip with a shade cloth/netting roof cover where there is a risk of wind dispersal of litter across the site, and which the ECO has approved. All waste storage areas shall be maintained to prevent these from becoming a breeding ground for pests or otherwise posing a health nuisance. The Contractor shall remove refuse collected from Site at least once a month. Refuse must be disposed of at a licensed landfill site or reputable recycling depot. The Contractor shall ensure that waste litter is not deposited by employees anywhere on the site except in refuse bins.
- Petroleum, chemical, harmful and hazardous waste is to be temporarily stored in a sealed drum/s in a specifically designated area in the site camp. This waste shall be disposed of at a licensed hazardous waste disposal site. Storage and disposal etc is also controlled through other relevant legislation, which must be complied with e.g. Hazardous Substances Act (No. 15 of 1973) and Occupational Health & Safety Act.
- The Contractor shall provide labourers to clean up the Contractor's camp and working areas of rubble generated in the course

[redacted]

of construction work at least once a week. Clean* rubble shall be temporarily stockpiled in a waste skip or a central stockpile/s and shall be crushed on site for re-use or if this is not feasible removed from site to a licensed crusher or landfill site as soon as it constitutes a practical load for removal (maximum 10 m^3) and before temporary closure of the site. No plastics, shrink-wrap, paint buckets or any other debris that does not constitute clean building rubble, shall be stored at such stockpile sites.

- Wherever possible and practical, waste materials generated by construction shall be recycled for example:
  - Paper / cardboard (e.g. significant quantities are generated during the fit-out phase)
  - Metals
  - Glass
  - Plastic (specific types only)
  - Salvageable trees and other plant material transplanted elsewhere.
  - Organic waste (e.g. cleared vegetation) to a green waste depot that produces compost
  - Whole bricks and crushed rubble for base course (from rubble stockpile)

- Labelled containers for recyclable materials must be provided separate to general waste bins in the site camp and taken to the relevant depot when full. This aspect must be detailed in the Contractor's Waste Management Plan and explained to the site staff during environmental awareness training sessions.

4. Performance Criteria

Compliance with specification comprises:

- Accurate registers as specified above;
- No litter in the construction or site camp areas;
- Correct labelling and storage of all waste;
- No contamination of any environmental medium;
- No leachates;
- No vermin or other nuisances;
- Proof of recycling or re-use;
- Compliance with legislation regarding transportation and disposal of waste.

5. Responsibilities

- The Engineer is responsible for ensuring that no Contractor(s) commence any activities on site unless they have an approved Waste Management Plan.
- The ECO is responsible for reviewing the Waste Management Plans to determine that they accord with legislative requirements.
- The ECO is responsible for monitoring adherence to Waste Management Plans.
- The Contractors are responsible for complying with their Waste Management Plans.
- The Contractors are responsible for responding to any instructions from the Engineer regarding waste management.

6. Monitoring and reporting

- The ECO shall monitor compliance with the Waste Management Plan as part of the weekly and monthly reporting.
- The external auditor shall review and report on the compliance with the waste management plan.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 4
- Environmental Specification 5
- Environmental Specification 9
- Environmental Specification 12
- Environmental Specification 20

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to comply with the waste management plan shall

[redacted]

	constitute a breach and may attract a penalty of between R500 to R2 000 per day until compliance is achieved.

[redacted]

Environmental Specification 22: Site camp establishment and maintenance

Version No.	draft	Date of Approval	

1. Background

The construction of the WTP and associated pipeworks is likely to involve a main site camp located at the WTP site and additional site camps along the length of the pipelines at the various construction areas".. Consideration of environmental protection measures is essential both in the establishment and maintenance of the site camp(s).

2. Objectives

- The establishment of specifications for the establishment of site camp(s) and their maintenance so that environmental damage is avoided.

3. Specifications

Note: site camps and associated storage and work areas may only be established within the approved 27 m envelope along the pipeline length or within the approved WTP perimeter fence. Any deviation from this will require separate approval.

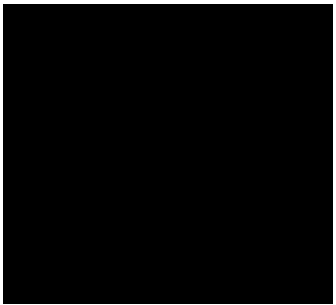
The Contractor(s) shall develop and submit for approval a Method Statement for site camp(s) establishment and maintenance detailing:

- Sensitive areas/ environments (such as watercourses) in the vicinity of the camp(s) and associated structures (such as access roads);
- What activities could affect those environments;
- How the environments will be protected by:
  - Siting of structures;
  - Construction of structures; and,
  - Management of structures and activities.
- In addition the Method Statement shall provide details on *inter alia*:
  - How waste will be minimised in the construction of the site camp infrastructure;
  - Fuel storage, dispensing and resupply;
  - Vehicle and general machinery maintenance and repair;
  - Working hours, noise and lighting management;
  - Restriction of working areas to protect sensitive environments;
  - Movement of heavy plant;
  - Reference to the Waste Management Plan;
  - Materials handing including handling and storage of hazardous substances;
  - Cement and concrete mixing and disposal;
  - Dust management (note: use of potable water for management of dust from stockpiles is not permitted in the City of Cape Town);
  - Energy management;
  - Water consumption and management;
  - Induction and training;
  - Eating areas
  - Ablutions;
  - Access roads
  - Fire prevention and management; and,
  - General housekeeping and litter management.

Note: the Contractor and ECO together may decide that a number of Method Statements is more appropriate in which each of the above aspects is dealth with in a separate document. This is still compliant under the condition that the elements of a Method Statement are included and each of the above items is dealt with as a minimum.

Minimum Requirements (Courtesy of Envirosense CC)

- All access points and roads to the various construction areas must be approved by and maintained in a serviceable condition to the satisfaction of the ECO and CoCT. Contractors and staff shall park their vehicles in locations approved by the Site Agent and shall not cause congestion on private roads or damage to the environment. All parking shall take place within the 27 m construction envelope along the pipeline or within the perimeter of the WTP



- A minimum of one toilet for every 15 contract personnel shall be provided within 100 m of construction activities which must be serviced at least twice per week. Toilets shall have lockable doors and shall be secured to prevent them falling or being blown over. Toilet paper shall be provided.
- Drinking and wash water shall be provided at all construction areas.
- Eating and drinking may only take place in designated areas. At least one such area shall be designated for each construction area.
- No undue traffic congestion through trucking of spoil off-site. Roads shall be kept free of significant mud/debris.
- No burning of cleared vegetation on site. Cleared vegetative material is not to be dumped anywhere other than an approved waste disposal site
- Dewatering activities do not result in erosion or pollution of on/off site environments. Dewatering systems shall make use of filtered extraction points to prevent silt uptake and extracted water shall be treated/released in such a manner as to avoid erosion on the site and prevent significant siltation or pollution of any natural drainage system and the receiving environment. Trenches and excavations are to be closed as soon as possible after services have been laid in them, to prevent them from posing safety hazards to people and traffic and to prevent rainwater erosion/ponding.
- Should significant erosion (e.g. through rain or wind) of temporarily stockpiled excavated material occur, the stockpiles must be secured/stabilised or covered with shade cloth or Geotech fabrics or similarly suitable material to prevent such erosion.
- All fuels/flammable substances are to be stored within a demarcated area in the Contractor's camp on site. The storage area and perimeter must be well away from stored combustible materials. The Contractor shall ensure that all liquid fuels (petrol and diesel) and other flammable substances are stored in containers with lids, which are kept firmly shut. All containers must be in such a condition as to be reasonably safe from damage and to prevent leakage there from. The rated capacity of a tank/container must be able to accommodate expansion of the product contained therein due to the rise in temperature during storage. Only empty and externally clean containers may be stored on the bare ground. Containers containing fuels as well as all empty and externally dirty containers shall be situated on a smooth and level impermeable surface (e.g. concrete floor) and must be contained within a bund wall. The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be equal to 110% multiplied (x) by the total capacity of all the storage containers/tanks. The floor of the bund must be sloped towards an oil trap or sump to enable any spilled fuel to be removed. A hydrocarbon absorption / remediation product approved by the ECO may be installed in the bund to reduce the risk of pollution. The requirements for fuel storage and management as detailed in SANS 10089 part 1 and SANS 10131 must be implemented. All safety requirements for flammables stores including signage shall be implemented by the Contractor's Health and Safety Officer. Sufficient fire-fighting equipment/extinguishers must be provided in an easily accessible position and in close proximity to all areas used for the storage and / or handling of fuel and other flammable substances. The above statements and requirements must further incorporate the regulations and specifications of any laws including the By-law relating to Community Fire Safety Chapter 8 - download at http://web1.capetown.gov.za/websearch/search/search.aspx?lib=acm/comsup/Weblib&docName=Bylaw
- All vehicles and equipment must be maintained in a good condition in order to minimise the risk of leakage and possible contamination of the soil or natural drainage system by fuels, oils and hydraulic fluids. All vehicles / plant requiring servicing, or which are parked on site overnight and found to leak oils, as well as any static plant e.g. generators and concrete mixers leaking fuels and oils, are to make use of a drip tray placed strategically to avoid incidental spillage of oils and fuels onto the ground. Drip trays shall be inspected at least weekly (daily, if affected by rainwater) and appropriate mop up products used to remove spillages. In particular, drip trays shall be closely monitored during rain events to ensure that they do not overflow.
- Shutter oils are to be applied under controlled conditions to avoid accidental and incidental spillage. Proper brush or roller tools shall be provided for this application. Small or appropriately sized containers shall be provided for the application of decanted oil in order to minimize accidental spillage.
- A suitable leak proof container for the storage of oiled equipment (filters, drip tray contents and soiled mop-up products, oil changes, etc.) must be established.
- All fuel, oil or hydraulic fluid spills are to be reported to the ECO immediately and be treated according
- The Contractor shall prevent discharge of any waste water containing pollutants, such as cements, lime, chemicals and oils and fuels into any water sources e.g. into the natural drainage system, or onto any adjacent land. Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas are not polluted. A Method Statement shall be required for all wash areas where hydrocarbon, hazardous materials and pollutants are expected to be used. This includes, but is not limited to paint equipment and concrete batch plant cleaning.
- Cement powder is to be stored in a secure weatherproof location to avoid contamination of the environment. Cement silos shall be hoarded off with shade cloth to limit the spread of cement dust. Concrete batching is to be avoided in prepared future landscape areas and is prohibited on finished road/floor surfaces. Cleaning of equipment and flushing of mixers shall not result in pollution of the surrounding environment: it is recommended that mortar boards and mixing trays be used at all significant mixing and supply points to prevent costly wastage of the materials and increased cleaning requirements and all runoff from batching areas shall be strictly controlled and kept localised. Ready mix trucks shall not clean out hoppers on site unless the concrete waste and wash water is directed to an impermeable sump created on site for this purpose. Avoid concrete spillage from chutes onto roads. All visible remains of excess concrete shall be physically removed to a licensed landfill site on completion of the plaster or concrete pour section and disposed of.
- Potable water may not be used for dust suppression of building material e.g. sand stockpiles or for the washing down of roads and paving. Wastage of water shall be avoided at all times. Only proper hoses and fittings in good repair shall be used on site. Wherever possible, pistol grip fittings should be used on the end of hoses. All taps shall remain properly closed when not in immediate use and all broken pipes / fittings shall be isolated immediately and repaired within 24 hours.
- The pollution of surface or ground water shall be prevented. Such pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, water from excavations, construction water, water carrying soil particles or

[redacted]

waste products etc. Water sampling and analysis may be required if the Principal Agent or ECO have reason to believe that an activity on site may have resulted in harmful effluent, or if natural drainage system is believed to be contaminated by the Development.

- During construction the Contractor shall protect areas susceptible to erosion and water logging by installing necessary temporary dewatering systems and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring slopes, stockpiles or areas off site.
- Water extracted from excavations on site shall be free of significant suspended silts/pollutants (e.g. through the use of a filtered dewatering system and if necessary settling sumps) prior to being directed into the natural environment . Any litter/foreign material are to be removed from any drainage lines on site regularly so that function is maintained at all times.
- Fuel and oil spills anywhere on site are to be treated immediately with an appropriate mop-up or bio-remedial products as directed by manufacturers to prevent contamination of runoff.
- No cement, concrete, mortar, plaster etc. wastes or washings are to be disposed of anywhere on the Site or into the water courses. No paints, untreated paint wash water or any other chemicals shall be disposed of anywhere except at a licensed landfill site and must not be allowed to contaminate the natural water course system. No dumping of materials or waste to take place within or near natural water courses.
- The Contractor shall take appropriate measures to minimise the generation of dust as a result of construction works, operations and activities to the satisfaction of the ECO and the Principal Agent. Potentially erosive stockpiles shall be located in wind sheltered areas wherever possible or covered or stabilised appropriately. The use of potable water for dust suppression on stockpiles must be avoided. Road surfaces shall be kept free of mud to avoid later dust generation from such roads once the mud has dried. Excavation, handling and transport of erodible materials shall be avoided under high wind conditions (excess of 45km/hr) when a visible dust plume is present. A wheel washer may need to be installed in order to minimise spread of mud and debris from truck tyres as they leave site. This shall be considered per an approved environmental method statement.
- All hazardous substances, as scheduled by the Hazardous Substances Act (No. 15 of 1973), shall be strictly handled, stored and disposed of as per the manufacturer's specifications. Material Safety Data Sheets (MSDS) for all hazardous materials used on site shall be available on the Contractor's environmental file for reference e.g. in first aid cases, to guide personal protective equipment use, to guide spill clean-ups etc. No hazardous substances may be disposed of on the site, to general landfill or into a sewer or natural drainage system. These shall be directed to a hazardous waste disposal site e.g. Vissershok and the contractor shall obtain safe disposal receipts as proof of safe disposal. No paint products and chemical additives and cleaners such as thinners and turpentine may be disposed of on Site or into a sewer or natural drainage system. Brush / roller wash facilities shall be established to the satisfaction of the ECO and hazardous disposal receipts shall be kept on file at the site office. A Method Statement, approved by the Principal Agent and ECO, will be required.
- If an animal is threatened by construction activities e.g. excavation or a nesting bird, such animal is to be relocated under the direction of the ECO
- Working hours are restricted to the following times 07h00 to 17h00 Mondays to Fridays. The use of significant noise generating equipment such as compressors, pneumatic breakers, power tools, piling rigs, mechanical plant and the like as well as the pouring of concrete is restricted to 08h00 to 17h00 Mondays to Fridays. If any construction work must be undertaken outside of the stipulated time frames, then the contractor shall motivate such to the Engineer and this shall be presented to the Community Liaison Forum in writing 48 hours prior to the work being undertaken. Noise, dust and vibrations shall be carefully controlled outside of the normal working hours. Appropriate directional and intensity settings are to be maintained on all hooters and sirens. No amplified music shall be allowed on site. In addition, vehicles" exhaust system silencers shall be correctly maintained and vehicles must not be used unnecessarily. Noise levels exceeding 85dB shall only be permitted where approved by the Principal Agent or during an emergency situation. Lighting shall not be unreasonably intrusive to occupants of neighbouring buildings.
- The safety of the public, residents and site staff during the works is of paramount importance. The work site is to be secured and access to the work sites by unauthorised persons is to be prevented by the Contractor, as far as is reasonably practical. The Contractor has to ensure traffic safety at all times and has to implement safety measures for this purpose. The Developer and Contractor is to take cognisance of the requirements of the Occupational Health and Safety Act No. 85 of 1993 and its relevant regulations, in particular the Construction Regulations dated July 2003. With the possible exception of any security staff that may be required to stay overnight, no personnel will be permitted to live on site. Any security lighting provided by the Contractor is to be placed in such a way as to not cause a nuisance to residents/users of the area at night and traffic on adjacent roads.

4. Performance Criteria

- The site camp(s) are established and managed according to approved Method Statements.
- Any contraventions of the Method Statements are remedied without delay.
- The Method Statements are amended if found to be inadequate.

5. Responsibilities

- The Contractor(s) is responsible for developing a site camp establishment and maintenance Method Statement prior to establishing the camp
- The ECO is responsible for reviewing the Method Statement in collaboration with the Health & Safety Agent.
- The Engineer is responsible for approving or requiring amendments to the Method

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Statement as appropriate.

- The Engineer is responsible for ensuring that the site camp is not established before the Method Statement is approved.
- The Contractor is responsible for ensuring that all staff adhere to the approved site camp Method Statement.

6. Monitoring and reporting

- The ECO is responsible for monitoring compliance with the Method Statement and reporting any non-compliance initially to the Contractor(s) and then the Engineer for action
- The Engineer is responsible for ensuring that the Contractor complies with any instructions issued by the ECO with regard to the Method Statement.
- The external auditor is responsible for reviewing compliance with this specification and the Method Statement.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 3
- Environmental Specification 4
- Environmental Specification 5
- Environmental Specification 6
- Environmental Specification 7
- Environmental Specification 21

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to comply with the site establishment and maintenance management plan shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until compliance is achieved.

[redacted]

Environmental Specification 23: Construction activities

Version No.	draft	Date of Approval	

1. Background

Due to the linear nature of this development it is likely that construction activities will be taking place at a number of different locations remote from the main site camp). It is therefore important that a Method Statement shall be developed and implemented to control activities in remote locations.

2. Objectives

- The establishment of specifications for construction activities along the pipeline route, access road, and within the perimeter of the reservoir and WTP so that environmental damage is avoided.

3. Specifications

The Contractor(s) shall compile and submit a Construction Activities Method Statement which addresses the mitigation measures from the EIR in the cell below and details (but is not limited to) the following

- Remote management of the construction activities;
- Use of local labour;
- Labour accommodation;
- Housekeeping;
- Waste management and litter control;
- Drinking water;
- Water management;
- Materials handling;
- Fuel storage and dispensing;
- Vehicle and general machinery maintenance and repair;
- No-go and sensitive areas;
- Cement and concrete works;
- River and watercourse crossing;
- Notification of road closures;
- Compliance with the rehabilitation plan;
- Compliance with the traffic management plan;
- Topsoil management;
- Dust control;
- Working hours, noise control and lighting;
- Management of any archaeological remains;
- Fire prevention and management (including fire breaks if necessary); and,
- Monitoring and record keeping.

Note: it is likely that each Contractor will develop site-specific Method Statements. This is still compliant under the condition that the elements of a Method Statement are included and each of the above items is dealt with as a minimum.

Summary of recommended mitigation measures from the Second Revised Draft Environmental Impact Report compiled by Chand Environmental Consultants November 2011

- Road closures, movement of abnormal load vehicles, land acquisitions and other activities that would affect general public will be communicated via the Community Liaison Forum and local newspapers.
- Construction shall:
  - Be planned in collaboration with a restoration ecologist to ensure that activities do not occur during construction which will limit post-construction rehabilitation.
  - Take place in the dry season to minimise impacts of blasting and bulk earth moving.
  - Limit stream flow disruption. Temporary diversions to be designed to flush sediment accumulations. Crossings to occur in late summer or when the streams are dry. Bank erosion must be prevented. All diversions to be removed once construction has been completed. Post-construction rehabilitation to be signed-off by the restoration ecologist.
- Soil disturbance shall be kept to a minimum.
  - Removal of vegetation shall be kept to a minimum

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- Exposed soil shall be protected from erosion.
- Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
- Exposed soil shall be revegetated as soon as construction has ceased.
- Post-construction rehabilitation to be signed-off by the restoration ecologist.

- Rare and endangered plants are to be fostered.
  - Ecologically sensitive areas shall be demarcated and maintained as no-go zones.
  - All invasive aliens to be removed within 100 m either side of the pipeline where indigenous vegetation or riparian areas are affected .
  - A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring.
  - A nursery is to be established to care for the rescued plants.
  - The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed.
  - Post-construction rehabilitation to be signed-off by the restoration ecologist.
- Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation.
  - Topsoil stockpiles to be protected against wind and rain dispersal.
  - Any topsoil run-off to be trapped and re-stockpiled.
  - No stockpile run-off may be permitted to enter any watercourse.
- Watercourses shall be protected from contamination.
  - All building materials should be stored away (at least 100 m) from aquatic ecosystems or outside 100 yr floodline, but within the 27 m construction footprint and the areas bunded appropriately such that there will be no runoff to watercourses.
  - If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse.
  - Vehicle and plant washing shall take place at least 50 m from watercourses the wash bay shall be constructed in such a way that waste water is contained within bunds and preventing from contaminating soil or any adjacent water bodies and any effluent water contained and treated prior to discharge to the watercourse.
  - No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses.
- Measures to reduce dust production and dispersal shall be included in a method statement submitted by the contractor. Use of potable water for dust suppression is not permitted.
- The burial/cemetery site on the Farm Simonsvlei alongside the Klapmuts Road is a no-go area and shall be demarcated as such.
- Should any unmarked human remains be disturbed, exposed or uncovered during excavations and earthworks for the proposed project, these shall be reported to the South African Heritage Resources Agency and not be disturbed or removed without official approval.
- In order to protect the County Fair Farm, the following measures shall be implemented:
  - Immediately notify County Fair of any damage to its existing water pipeline or any cessation or reduction in its water supply to 'Protea' and 'Linwood'. In the ~~even~~ event of any repairs to a breakage in the pipeline being required, such repair shall be effected on the same day but in the event of a breakage in the pipeline occurring in the late afternoon, such repairs shall be effected by 09h00 on the next day.
  - A buffer "no-go" zone must be established 100m from the County Fair Farms' perimeter fence.
  - All construction activity including transport of machinery, materials and people will be outside of the 100 metre buffer zone from the perimeter fence of the County Fair's property ;
  - All equipment will be in sound working order so as to avoid diesel and oil spillage (which may contaminate groundwater) and machinery breakdown. In the event of a breakdown and/or spillage, all reasonable steps will be taken to remove the equipment from the area for repair and to clean up any spillage so as to prevent any seepage into the groundwater.
  - Any incidents of ground water or soil pollution must be reported to the County Fair Farms so that they can monitor the steps being taken to prevent groundwater contamination;
  - No foodstuff is to be brought into the buffer zone. Tea and lunch breaks must be held outside of the buffer zone. In particular, no food cooking over fires or gas stoves are to be allowed in the buffer zone at all;
  - No equipment, pipes, fittings or stockpiled material may to be stored in the buffer zone, be it temporary or otherwise. All such material and equipment is to be stored away ~~from our client's property~~ County Fair's property and the buffer zone until such time that it will be used in the construction or placement thereof;
  - No construction personnel or machinery are to be in the buffer zone outside of working hours; and
  - Noise levels are to be kept to a minimum.

Minimum Requirements (Courtesy of Ecosense CC)

- All access points and roads to the various construction areas must be approved by and maintained in a serviceable condition to the satisfaction of the ECO and CoCT. Contractors and staff shall park their vehicles in locations approved by the Site Agent and shall not cause congestion on private roads or damage to the environment. All parking shall take place within the 27 m construction envelope along the pipeline or within the perimeter of the WTP
- A minimum of one toilet for every 15 contract personnel shall be provided within 100 m of construction activities which must be serviced at least twice per week. Toilets shall have lockable doors and shall be secured to prevent them falling or being blown over. Toilet paper shall be provided.
- Drinking and wash water shall be provided at all construction areas.
- Eating and drinking may only take place in designated areas. At least one such area shall be designated for each construction area.
- No undue traffic congestion through trucking of spoil off-site. Roads shall be kept free of significant mud/debris.

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- No burning of cleared vegetation on site. Cleared vegetative material is not to be dumped anywhere other than an approved waste disposal site
- Dewatering activities do not result in erosion or pollution of on/off site environments. Dewatering systems shall make use of filtered extraction points to prevent silt uptake and extracted water shall be treated/released in such a manner as to avoid erosion on the site and prevent significant siltation or pollution of any natural drainage system and the receiving environment. Trenches and excavations are to be closed as soon as possible after services have been laid in them, to prevent them from posing safety hazards to people and traffic and to prevent rainwater erosion/ponding.
- Should significant erosion (e.g. through rain or wind) of temporarily stockpiled excavated material occur, the stockpiles must be secured/stabilised or covered with shade cloth or Geotech fabrics or similarly suitable material to prevent such erosion.
- All fuels/flammable substances are to be stored within a demarcated area in the Contractor's camp on site. The storage area and perimeter must be well away from stored combustible materials. The Contractor shall ensure that all liquid fuels (petrol and diesel) and other flammable substances are stored in containers with lids, which are kept firmly shut. All containers must be in such a condition as to be reasonably safe from damage and to prevent leakage there from. The rated capacity of a tank/container must be able to accommodate expansion of the product contained therein due to the rise in temperature during storage. Only empty and externally clean containers may be stored on the bare ground. Containers containing fuels as well as all empty and externally dirty containers shall be situated on a smooth and level impermeable surface (e.g. concrete floor) and must be contained within a bund wall. The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be equal to 110% multiplied (x) by the total capacity of all the storage containers/tanks. The floor of the bund must be sloped towards an oil trap or sump to enable any spilled fuel to be removed. A hydrocarbon absorption / remediation product approved by the ECO may be installed in the bund to reduce the risk of pollution. The requirements for fuel storage and management as detailed in SANS 10089 part 1 and SANS 10131 must be implemented. All safety requirements for flammables stores including signage shall be implemented by the Contractor's Health and Safety Officer. Sufficient fire-fighting equipment/extinguishers must be provided in an easily accessible position and in close proximity to all areas used for the storage and / or handling of fuel and other flammable substances. The above statements and requirements must further incorporate the regulations and specifications of any laws including the By-law relating to Community Fire Safety Chapter 8 - download at http://web1.capetown.gov.za/websearch/search/search.aspx?lib=acm/comsup/Weblib&docName=Bylaw
- All vehicles and equipment must be maintained in a good condition in order to minimise the risk of leakage and possible contamination of the soil or natural drainage system by fuels, oils and hydraulic fluids. All vehicles / plant requiring servicing, or which are parked on site overnight and found to leak oils, as well as any static plant e.g. generators and concrete mixers leaking fuels and oils, are to make use of a drip tray placed strategically to avoid incidental spillage of oils and fuels onto the ground. Drip trays shall be inspected at least weekly (daily, if affected by rainwater) and appropriate mop up products used to remove spillages. In particular, drip trays shall be closely monitored during rain events to ensure that they do not overflow.
- Shutter oils are to be applied under controlled conditions to avoid accidental and incidental spillage. Proper brush or roller tools shall be provided for this application. Small or appropriately sized containers shall be provided for the application of decanted oil in order to minimize accidental spillage.
- A suitable leak proof container for the storage of oiled equipment (filters, drip tray contents and soiled mop-up products, oil changes, etc.) must be established.
- All fuel, oil or hydraulic fluid spills are to be reported to the ECO immediately and be treated according
- The Contractor shall prevent discharge of any waste water containing pollutants, such as cements, lime, chemicals and oils and fuels into any water sources e.g. into the natural drainage system, or onto any adjacent land. Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas are not polluted. A Method Statement shall be required for all wash areas where hydrocarbon, hazardous materials and pollutants are expected to be used. This includes, but is not limited to paint equipment and concrete batch plant cleaning.
- Cement powder is to be stored in a secure weatherproof location to avoid contamination of the environment. Cement silos shall be hoarded off with shade cloth to limit the spread of cement dust. Concrete batching is to be avoided in prepared future landscape areas and is prohibited on finished road/floor surfaces. Cleaning of equipment and flushing of mixers shall not result in pollution of the surrounding environment: it is recommended that mortar boards and mixing trays be used at all significant mixing and supply points to prevent costly wastage of the materials and increased cleaning requirements and all runoff from batching areas shall be strictly controlled and kept localised. Ready mix trucks shall not clean out hoppers on site unless the concrete waste and wash water is directed to an impermeable sump created on site for this purpose. Avoid concrete spillage from chutes onto roads. All visible remains of excess concrete shall be physically removed to a licensed landfill site on completion of the plaster or concrete pour section and disposed of.
- Potable water may not be used for dust suppression of building material e.g. sand stockpiles or for the washing down of roads and paving. Wastage of water shall be avoided at all times. Only proper hoses and fittings in good repair shall be used on site. Wherever possible, pistol grip fittings should be used on the end of hoses. All taps shall remain properly closed when not in immediate use and all broken pipes / fittings shall be isolated immediately and repaired within 24 hours.
- The pollution of surface or ground water shall be prevented. Such pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, water from excavations, construction water, water carrying soil particles or waste products etc. Water sampling and analysis may be required if the Principal Agent or ECO have reason to believe that an activity on site may have resulted in harmful effluent, or if natural drainage system is believed to be contaminated by the Development.
- During construction the Contractor shall protect areas susceptible to erosion and water logging by installing necessary temporary dewatering systems and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring slopes, stockpiles or areas off site.

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- Water extracted from excavations on site shall be free of significant suspended silts/pollutants (e.g. through the use of a filtered dewatering system and if necessary settling sumps) prior to being directed into the natural environment. Any litter/foreign material are to be removed from any drainage lines on site regularly so that function is maintained at all times.
- Fuel and oil spills anywhere on site are to be treated immediately with an appropriate mop-up or bio-remedial products as directed by manufacturers to prevent contamination of runoff.
- No cement, concrete, mortar, plaster etc. wastes or washings are to be disposed of anywhere on the Site or into the water courses. No paints, untreated paint wash water or any other chemicals shall be disposed of anywhere except at a licensed landfill site and must not be allowed to contaminate the natural water course system. No dumping of materials or waste to take place within or near natural water courses.
- The Contractor shall take appropriate measures to minimise the generation of dust as a result of construction works, operations and activities to the satisfaction of the ECO and the Principal Agent. Potentially erosive stockpiles shall be located in wind sheltered areas wherever possible or covered or stabilised appropriately. The use of potable water for dust suppression on stockpiles must be avoided. Road surfaces shall be kept free of mud to avoid later dust generation from such roads once the mud has dried. Excavation, handling and transport of erodible materials shall be avoided under high wind conditions (excess of 45km/hr) when a visible dust plume is present. A wheel washer may need to be installed in order to minimise spread of mud and debris from truck tyres as they leave site. This shall be considered per an approved environmental method statement.
- All hazardous substances, as scheduled by the Hazardous Substances Act (No. 15 of 1973), shall be strictly handled, stored and disposed of as per the manufacturer's specifications. Material Safety Data Sheets (MSDS) for all hazardous materials used on site shall be available on the Contractor's environmental file for reference e.g. in first aid cases, to guide personal protective equipment use, to guide spill clean-ups etc. No hazardous substances may be disposed of on the site, to general landfill or into a sewer or natural drainage system. These shall be directed to a hazardous waste disposal site e.g. Vissershok and the contractor shall obtain safe disposal receipts as proof of safe disposal. No paint products and chemical additives and cleaners such as thinners and turpentine may be disposed of on Site or into a sewer or natural drainage system. Brush / roller wash facilities shall be established to the satisfaction of the ECO and hazardous disposal receipts shall be kept on file at the site office. A Method Statement, approved by the Principal Agent and ECO, will be required.
- If an animal is threatened by construction activities e.g. excavation or a nesting bird, such animal is to be relocated under the direction of the ECO
- Working hours are restricted to the following times 07h00 to 17h00 Mondays to Fridays. The use of significant noise generating equipment such as compressors, pneumatic breakers, power tools, piling rigs, mechanical plant and the like as well as the pouring of concrete is restricted to 08h00 to 17h00 Mondays to Fridays. If any construction work must be undertaken outside of the stipulated time frames, then the contractor shall motivate such to the Engineer and this shall be presented to the Community Liaison Forum in writing 48 hours prior to the work being undertaken. Noise, dust and vibrations shall be carefully controlled outside of the normal working hours. Appropriate directional and intensity settings are to be maintained on all hooters and sirens. No amplified music shall be allowed on site. In addition, vehicles" exhaust system silencers shall be correctly maintained and vehicles must not be used unnecessarily. Noise levels exceeding 85dB shall only be permitted where approved by the Principal Agent or during an emergency situation. Lighting shall not be unreasonably intrusive to occupants of neighbouring buildings.
- The safety of the public, residents and site staff during the works is of paramount importance. The work site is to be secured and access to the work sites by unauthorised persons is to be prevented by the Contractor, as far as is reasonably practical. The Contractor has to ensure traffic safety at all times and has to implement safety measures for this purpose. The Developer and Contractor is to take cognisance of the requirements of the Occupational Health and Safety Act No. 85 of 1993 and its relevant regulations, in particular the Construction Regulations dated July 2003. With the possible exception of any security staff that may be required to stay overnight, no personnel will be permitted to live on site. Any security lighting provided by the Contractor is to be placed in such a way as to not cause a nuisance to residents/users of the area at night and traffic on adjacent roads.

Summary of recommended mitigation measures from the freshwater and biodiversity assessments conducted in 2022 and 2023:

- 2022 Freshwater Assessment Mitigations
  - Where the pipe comes close to (< 30m) a wetland or watercourse, the specifications for the pipe trenches should aim to minimise the footprint of construction (e.g. the shallower the pipe, the narrower the disturbed area).
  - Sensitive ecosystems must be demarcated prior to any construction activities, so that these can be avoided, unless construction is taking place within the boundaries of a wetland or watercourse.
  - Removal of indigenous vegetation should be kept to a minimum, and, where possible, impacted areas rehabilitated after construction.
  - Sensitive ecosystems should be demarcated prior to any construction activities, so that these can be avoided, wherever possible.
  - Special care should be taken around storm and heavy rain events. Construction sites should be inspected for erosion damage at these times.
  - All building materials must be stored away (at least 15m) from all aquatic ecosystems and the areas bunded appropriately such that there will be no runoff from these areas towards aquatic systems. All building materials should be removed after construction.
  - Consideration should be given at the design phase to remedial shaping of banks and

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slopes to their near-natural slope, geomorphological and bed characteristics and re-vegetated after clean-up.
    - Banks and slopes should be re-vegetated after construction is completed.
    - If construction areas are to be pumped of water (e.g. after rains), this water must first be pumped into a settlement area, and not directly into a natural aquatic ecosystems.
    - Care should be taken to not disturb flora and fauna, and construction lights (if needed) must be directed away from sensitive areas. Fencing must allow free movement of fauna.
    - Disruption of flow should be kept to a minimum, but where necessary, temporary diversion measures should allow flushing of the system to prevent build-up of material. Diversion techniques should take measures to limit erosion from temporary channels into watercourses or wetlands.
    - No obstructions to flow shall remain in the watercourses or wetlands after construction is completed.
    - Temporary diversion channels must be rehabilitated.
    - Washing of vehicles and machinery should take place well away (50m) from aquatic ecosystems. Machinery prone to oil or fuel leakage must be located at least 50m away from any aquatic ecosystem, and the area adequately bunded in order to contain leakages.
    - Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.
    - Concrete batching must be done well away from (50m minimum) from all sensitive environments.
    - All machinery should be regularly checked for leaks.
    - Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis.
    - In situ soils must preferably be used for rehabilitation of construction sites.
    - Where in situ soils are insufficient, topsoils used after construction must be bought from reliable sources, and must be free of alien seeds or grass runners.
    - Constant monitoring of the construction sites by the Site Engineer and ECO must occur, and all alien plant species removed from or destroyed on the site.
- 2023 Biodiversity Assessment Requirements:
    - Relocation of the Endangered plant species recorded in the Very High sensitivity is not the first choice, as the adult plants are very unlikely to survive, but an attempt should be made to take seed (in April/May) and cuttings (April/May), and an effort must be to translocate all the live plants (April/May) of Athanasia capitata from within the approved development footprint to nearby similar but secure habitat. As the Medium and Very High sensitivity habitat may support various other plant Species of Conservation Concern (SoCC) the city of Cape Town (CoCT) Environmental Management Branch staff should undertake Search and Rescue in the approved development footprints on at least two occasions in the appropriate seasons (July – late September) prior to any earthmoving on site.
    - During construction an ECO must ensure that no animals are trapped in the construction and pipeline trenches, and remove any that are. These should be checked every morning before work starts. Trenches should be infilled as soon as possible.

4. Responsibilities

- The Contractors is responsible for developing a construction activities Method Statement prior to establishing the camp.
- The ECO is responsible for reviewing the Method Statement in collaboration with the Health & Safety Agent.
- The Engineer is responsible for approving or requiring amendments to the Method Statement as appropriate.
- The Engineer is responsible for ensuring that construction activities do not commence before the Method Statement is approved.
- The Contractor is responsible for ensuring that all staff adhere to the approved construction activities Method Statement

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5. Monitoring and reporting

- The ECO is responsible for monitoring compliance with the Method Statement and reporting any non-compliance initially to the Contractor(s) and then the Engineer for action.
- The Engineer is responsible for ensuring that the Contractor complies with any instructions issued by the ECO with regard to the Method Statement.
- The external auditor shall review compliance with this environmental specification and the details of the construction activities Method Statement.

6. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 5
- Environmental Specification 6
- Environmental Specification 7
- Environmental Specification 8
- Environmental Specification 21
- Environmental Specification 22

7. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to comply with the construction activities management plan shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until compliance is achieved.

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Environmental Specification 24: Temporary site closure			
Version No.	**draft**	**Date of Approval**	

1. Background

If construction activities take place during holidays, it is essential that environmental protection measures are in place while the majority of staff members are absent.

2. Objectives

- To ensure that the risk of environmental damage is minimised during temporary closure.

3. Specifications

Prior to the temporary closure, the Contractor shall ensure:

- Emergency and Management telephone numbers to be available and displayed;
- Dust mitigation in place;
- Stockpiles stabilized;
- Material stockpiles secured;
- Fuels / hazardous substances stores secured and cleaned;
- Materials stores secured;
- Chemical toilets empty and secured;
- Refuse bins empty and secured and rubble removed;
- No-go area fencing in place;
- Drip trays empty & secure (where possible);
- Streambank and erosion protection measures are secure.

The ECO monitor the above activities and shall issue a temporary closure certificate verifying that all the above measures are in place.

4. Performance Criteria

Compliance.

5. Responsibilities

- The Contractor shall ensure that all measures required for temporary closure are in place.
- The ECO shall monitor and report on measures taken for temporary site closure.
- The Engineer shall ensure that the Contractor does not leave the site until the ECO has signed off on the temporary closure.

6. Monitoring and reporting

- The ECO shall monitor compliance with the above specification.
- The Contractor shall ensure that the site and all construction areas are monitored regularly during the temporary closure to identify and respond to any environmental risks or incidents.
- The external auditor shall review compliance with this specification.

7. Related documents

The following documents relate to this environmental specification:

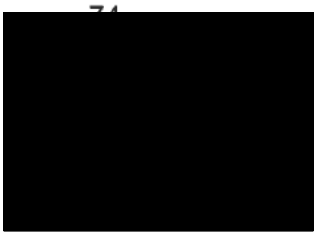
- Environmental Specification 4
- Environmental Specification 5
- Environmental Specification 21
- Environmental Specification 22
- Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor to comply with the above specification or to respond to recommendations by the ECO shall constitute a breach and may attract a penalty of between R500 to R2 000 per day until compliance is achieved.
- Environmental damage resulting from inadequate measures taken during



	temporary closure by the Contractor(s) shall constitute a breach and may attract a penalty of between R500 to R2 000 per incident.



Environmental Specification 25: Site Closure

Version No.	draft	Date of Approval	

1. Background

The construction of the WTP and pipelines will take place in various phases in various locations. There will therefore, be numerous "construction areas" Once the Contractor has confirmed that the works have been completed in a specific construction area, all construction materials must be removed so that rehabilitation can be completed.

The issue of a closure inspection report means that the ECO is satisfied that all aspects of environmental management as detailed the cEMP and related documents are complete.

The construction phase can, however, only be deemed to be completed when landscaping and rehabilitation are complete.

It is therefore likely that closure inspections will be undertaken for various components of the construction phase and certificates issued for each component. These components will be determined in consultation with the Engineer.

2. Objectives

- To ensure that all construction activities are complete and in accordance with environmental specifications.

3. Specifications

The ECO shall issues two certificates for every area of work:

Construction closure certificate:

- All construction materials have been removed from site;
- All waste has been removed from site;
- Any contaminated soil has been removed;
- The topsoil has been returned to its former position in accordance with the rehabilitation plan;
- Any temporary stream or watercourse diversions have been removed and the stream banks restored; and,
- Any erosion has been repaired.

Rehabilitation or landscaping closure certificate:

- Rehabilitation or landscaping has been completed as per the plans developed in Environmental Specification 6 and Environmental Specification 7.

The ECO shall only issue a completion inspection report if ALL the above elements for the specific closure report have been completed and if there is not residual repair or remedial work to be conducted.

4. Performance Criteria

- Compliance with this specification shall result in a completion inspection report being signed off by the ECO if all the above specifications have been complied with

5. Responsibilities

- The Contractor(s) is responsible for ensuring that all construction materials and waste have been removed from site and that the area has been cleaned and prepared for the rehabilitation plan as specified in that plan.
- The restoration ecologist or landscape architect are responsible for completing their respective plans.
- The ECO is responsible for checking compliance with this specification.
- The Engineer is responsible for ensuring that the Contractor complies with this specification.
- The Engineer shall withhold the final payment of the Contractor's fees until such time as a closure inspection report has been signed off by the ECO.

[redacted]

6. Monitoring and reporting

- The ECO shall check the compliance with this specification
- The external auditor shall check that the closure inspection report has been completed and signed off

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 4
- Environmental Specification 5
- Environmental Specification 6
- Environmental Specification 7
- Environmental Specification 18
- Environmental Specification 21
- Environmental Specification 22
- Environmental Specification 23

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the Contractor(s) to comply with the above specification or to respond to recommendations by the ECO shall constitute a breach and final payment of fees may be withheld until compliance is achieved.

[redacted]

Environmental Specification 26: Handover to operational staff

Version No.	draft	Date of Approval	

1. Background

Compliance with the cEMP and environmental specifications is a legal requirement. Proof of such compliance is required therefore essential, especially if public funds are used. It is therefore important that the ECO hands over the relevant documentation to the staff member appointed to be responsible for environmental management at the Muldersvlei WTP and Reservoir during the operational phase in a suitable ordered fashion.

2. Objectives

- To ensure that records of compliance are readily accessible to operational staff and external auditors after construction has ceased and the duties of the ECO have ended.

3. Specifications

The ECO shall collate and in an indexed filing system supply the operational staff with:

- Environmental Authorisation;
- Record of notification of I&APs of approval;
- Report on incorporation of recommendations into the detailed design;
- Record of notification of DEADP of the commencement of construction activities;
- Record of DEADP approval of the cEMP and any subsequent amendments;
- Minutes of the Community Liaison Forum;
- The most recent cEMP;
- The most recent Method Statements;
- Register of updates to the cEMP and Method Statements;
- Traffic management plan;
- Rehabilitation plan;
- Landscape plan;
- Weekly compliance monitoring checklists;
- Photographic evidence detailing the site, and date and subject matter;
- Incident investigations;
- Minutes of site meetings;
- Monthly compliance reports;
- External audit reports;
- Temporary closure certificates;
- Final environmental closure reports;
- Training records;
- Complaints register;
- Any other correspondence;
- Records of penalties paid and received by the beneficiaries; and,
- Revised oEMP.

The operational staff member at Muldersvlei WTP and Reservoir receiving the documentation shall sign receipt of the document.
The ECO shall provide the CoCT with a copy of the receipt as proof of compliance.

4. Performance Criteria

- The ECO shall be deemed to have completely discharged his/her responsibilities when the above specification has been complied with in full.

5. Responsibilities

- The CoCT shall ensure that the ECO has handed over all documentation specified above to the operational staff before final payment of the ECO's fees
- The CoCT shall ensure that the operational staff file and preserve the documentation for five years before it may be destroyed

6. Monitoring and reporting

- The external auditor or the operational phase or the construction shall ensure that

[redacted]

this specification has been complied with in full.

7. Related documents

The following documents relate to this environmental specification:

- Environmental Specification 2
- Environmental Specification 18
- Environmental Specification 19

8. Breach

- Any breaches shall be reported to the responsible party and attempts to gain resolution made. Only in the event of no resolution being reached within reasonable time frames, shall the penalty system be imposed as below.
- Failure by the ECO to comply with the above specification or to deliver an organised set of files to the operational staff shall constitute a breach and final payment of fees may be withheld until compliance is achieved. Failure by CoCT to take action against the ECO to ensure compliance shall require action on the part of DEADP in accordance with co-operative governance but still upholding the conditions of authorisation.

[redacted]

Annexure 1: Summary of mitigation measures from the EIR

Please note that the items below are extracted verbatim from the EIR for reference. Not all of them have been included in the above specifications for various reasons. Note: Some of the recommendations recorded below are not possible or not legally permissible. For this reason they have not been included in the specifications above. They are presented here as a record of their inclusion in the EIR only.

Summary of mitigations and recommendations for pipelines and access road

Discipline	Design Phase	Construction Phase	Operational Phase

Stakeholder engagement and facilitation	• A Community Liaison Forum shall be established prior to construction commencing.
	  • A single Community Liaison Forum shall provide an information sharing function for both the pipeline construction and the construction of the WTP and associated infrastructure.
	  • The Terms of Engagement and responsibilities shall be documented and approved by the applicant.
	  • The Terms of Engagement shall cover two phases and the different activities attendant on the two phases: the construction phase and the operational phase.
		• The Community Liaison Forum will negotiate the construction roll-out with affected landowners prior to construction commencing.
		• Road closures, movement of abnormal load vehicles, land acquisitions and other activities that would affect general public will be communicated via the Community Liaison Forum and local newspapers.
		• The Forum shall:
		  • Be an information-sharing portal
		  • Serve as a monitoring organisation
		  • Serve as a portal for stakeholder feedback and response.
			• The Community Liaison Forum shall cease construction phase activities once construction and rehabilitation has been completed along the length of the pipeline.

Biophysical (terrestrial and freshwater ecology) impact management	• The pipeline design shall be:
	  • Designed to minimise vertical and horizontal footprint (as shallow and narrow as possible).
	  • Aligned to avoid wetlands and rivers - especially for sites listed to be of moderate to high conservation importance. Where this is impossible artificial stabilisation using structures such as gabions to be kept to a minimum.
	  • Aligned to avoid crossing roads or railway lines or make use of
		• Construction shall:
		  • Be planned in collaboration with a restoration ecologist to ensure that activities do not occur during construction which will limit post-construction rehabilitation.
		  • Take place in the dry season to minimise impacts of blasting and bulk earth moving.
		  • Limit stream flow disruption. Temporary diversions to be designed to flush sediment accumulations. Crossings to occur in late summer or when the streams are dry. Bank erosion must be prevented. All diversions to be removed once construction has been completed. Post-construction rehabilitation to be signed-off by the restoration ecologist.
		• Soil disturbance shall be kept to a minimum.
		  • Removal of vegetation shall be kept to a minimum
		  • Exposed soil shall be protected from erosion.
		  • Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
			• The Operational Management Plan should highlight regular intervals during which inspections should be undertaken to monitor invasive alien plant establishment. Further to that a removal plan should be compiled.
			2022 Freshwater Assessment Mitigations
			• The potential interception and transfer of subsurface water by the drainage- and bedding material under and around inclined pipes should be inhibited with cut-off barriers perpendicular to the longitudinal profile of the trench (for example, 0.3m thick bentonite). The

Discipline	Design Phase	Construction Phase	Operational Phase
	existing crossings. • Ensure that the bedding medium does not form a preferential drainage line. • Commented upon by the freshwater ecologist prior to finalisation. • A post construction rehabilitation plan shall be developed in collaboration with a restoration ecologist and approved prior to the commencement of construction. This plan must highlight and minimise t any construction activities which could limit rehabilitation success. Such activities must be avoided where possible.	• Exposed soil shall be revegetated as soon as construction has ceased. • Post-construction rehabilitation to be signed-off by the restoration ecologist. • Rare and endangered plants are to be fostered. • Ecologically sensitive areas shall be demarcated and maintained as no-go zones. • All invasive aliens to be removed within 100 m either side of the pipeline where indigenous vegetation or riparian areas are affected . • A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring. • A nursery is to be established to care for the rescued plants. • The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed. • Post-construction rehabilitation to be signed-off by the restoration ecologist. • Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation. • Topsoil stockpiles to be protected against wind and rain dispersal. • Any topsoil run-off to be trapped and re-stockpiled. • No stockpile run-off may be permitted to enter any watercourse. • Watercourses shall be protected from contamination. • All building materials should be stored away (at least 50 m) from aquatic ecosystems and the areas bunded appropriately such that there will be no runoff to watercourses. • If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse. • Vehicle and plant washing shall take place at least 50 m from watercourses and any effluent water contained and treated prior to discharge to the watercourse. • No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses. • 2022 Freshwater Assessment Mitigations • Where the pipe comes close to (< 30m) a wetland or watercourse, the specifications for the pipe trenches should aim to minimise the footprint of construction (e.g. the shallower the pipe, the narrower the disturbed area). • Sensitive ecosystems must be demarcated prior to any construction activities, so that these can be avoided, unless construction is taking place within the boundaries of a wetland or watercourse. • Removal of indigenous vegetation should be kept to a minimum, and refilled trenches must be rehabilitated after construction. Refer to Section 8.9 for rehabilitation plan and guidelines (Note: Areas under cultivation where the Wynland pipeline is removed can be returned to cultivation). • Where the access road will be re-aligned through the valley-bottom wetland in lower Aquatic Ecosystem 3, the old road footprint (current access road to County Fair) must be rehabilitated, to the guidelines provided. A total of 1636m2 of wetland and	barriers should be spaced at 24m intervals and extend a minimum of 0.5m past the sides of the trench profile, and up to rock level or a minimum of 0.5m deeper than the trench bottom (whichever comes first). • At all road crossings over aquatic ecosystem 3, the natural surface flow of water should be accommodated in several pipes or wide culverts, in order ensure that flow is not concentrated downstream of the crossings. • The impacted footprint of the pipeline and road should be kept to a minimum in close (< 30m) proximity to all wetlands and watercourses, e.g. by reducing the depth to which the pipes are laid, where possible. • Mowing or clearing of the pipeline or road servitudes of vegetation must be kept to a minimum. 2023 Biodiversity Assessment Requirements: • The applicant (CoCT Bulk Water) must provide all necessary funding for all the required mitigation (including ongoing site management) and must transfer management responsibility and al necessary funding for the 5.5ha conservation area (See Figure 5) to the CoCT Environmental Management Branch, within three months of any project approval. • The 1ha of currently cultivated or fallow area north of the road that has been expropriated must be rehabilitated to local indigenous Renosterveld vegetation as soon as possible, and should form part of the main drainage line conservation area.

Discipline	Design Phase	Construction Phase	Operational Phase
		700m2 of riparian habitat will be lost, and 1119m2 gained. Additional rehabilitation of the wetland (such as shaping of the erosion gullies in the wetland) and watercourse (such as stabilising erosion and re-planting with indigenous plant species) will achieve the balance required, such that there will be no residual loss. • The specifications for the relocated pipe trenches should aim to minimise the footprint of construction (e.g. the shallower the pipe, the narrower the disturbed area) where the pipe comes close to (< 30m) a wetland or watercourse, and sensitive ecosystems should be demarcated prior to any construction activities, so that these can be avoided, wherever possible. • Special care should be taken around storm and heavy rain events. The construction sites should be inspected for erosion damage at these times. • Consideration should be given at the design phase to remedial shaping of banks to their near-natural slope, geomorphological and bed characteristics and re-vegetated after clean-up. • Banks and slopes should be re-vegetated after construction is completed. A detailed planting plan should be developed, in consultation with a landscaper and ecologist. • If construction areas are to be pumped of water (e.g. after rains), this water must first be pumped into a settlement area, and not directly into a natural aquatic ecosystem. • • Disruption of flow should be kept to a minimum, but where necessary, temporary diversion measures should allow flushing of the system to prevent build-up of material. • Diversion techniques should take measures to limit erosion from temporary channels into watercourses or wetlands. • No obstructions to flow shall remain in the watercourses or wetlands after construction is completed. • Temporary diversion channels must be rehabilitated. • All building materials must be stored away (at least 15m) from all aquatic ecosystems and the areas bunded appropriately such that there will be no runoff from these areas towards aquatic systems. All building materials should be removed after construction. • Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind, to prevent spread of fine materials across the site. • Sensitive areas that are impacted by the dumping or storage of materials must be ripped and re-planted after construction is complete. • The pipeline contractor should work the relocated Wynland pipeline route in sections, backfilling as they go, which will reduce the width of disturbed area – i.e. it is not as necessary to spread the spoil wide, if it can spread along a greater length. • Washing of vehicles and machinery should take place well away (50m) from aquatic ecosystems. • Machinery prone to oil or fuel leakage must be located at least 50m away from any aquatic ecosystem, and the area adequately bunded in order to contain leakages. • Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks –	

[redacted]

Discipline	Design Phase	Construction Phase	Operational Phase
		these must be cleaned regularly. • Concrete batching must be done well away from (50m minimum) from all sensitive environments. • All machinery should be regularly checked for leaks. • Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis. • If construction areas are to be pumped of water (e.g. after rains), this water must first be pumped into a settlement area, and not directly into a natural ecosystem. • Pathways and temporary access roads must be routed around the wetlands and should cross drainage channels as seldom as possible. • Sensitive areas must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process. • Affected areas must be ripped and re-planted after construction, according to the specifications set out in the CEMPr, and to the satisfaction of the ECO. • The construction sites and pathways must avoid sensitive areas. If lights are used, these must be directed away from all sensitive areas. • The sensitive areas (i.e. the edges of the buffers around the wetlands, watercourses) not affected by construction must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process, except where work is occurring. • In situ soils must preferably be used for rehabilitation of construction sites. • Where in situ soils are insufficient, top soils used after construction must be bought from reliable sources, and must be free of alien seeds or grass runners. • Constant monitoring of the construction sites by the Site Engineer and ECO must occur, and all alien plant species removed from or destroyed on the site. • 2023 Biodiversity Assessment Requirements: • Relocation of the Endangered plant species recorded in the Very High sensitivity is not the first choice, as the adult plants are very unlikely to survive, but an attempt should be made to take seed (in April/May) and cuttings (April/May), and an effort must be to translocate all the live plants (April/May) of Athanasia capitata from within the approved development footprint to nearby similar but secure habitat. As the Medium and Very High sensitivity habitat may support various other plant Species of Conservation Concern (SoCC) the city of Cape Town (CoCT) Environmental Management Branch staff should undertake Search and Rescue in the approved development footprints on at least two occasions in the appropriate seasons (July – late September) prior to any earthmoving on site. • During construction an ECO must ensure that no animals are trapped in the construction and pipeline trenches, and remove any that are. These should be checked every morning before work starts. Trenches should be infilled as soon as	

Discipline	Design Phase	Construction Phase	Operational Phase
		possible. •	
Agricultural impact management	• Compensation for expropriated land and lost production shall be finalised prior to construction.	• Measures to reduce dust production and dispersal shall be included in a method statement submitted by the contractor.	
Heritage	• The pipeline route should: • Be above the valley floor . • Be separated from public scenic road edges by vineyards or other relevant planted agricultural land. • Avoid running alongside scenic drive edges. • Avoid crossing tree-lined main approach avenues. • Be set back a minimum 5 m from tree canopy drip lines where running parallel with, and adjacent to, belts of trees. • Be separated from private roads by planted tree. • Be set back a minimum 10 m from the edge of a river or watercourse • Be laid below watercourse and stream beds. • Run close to and preferably on the southern side of the (disused) railway embankment running along the valley. • Follow existing vineyard and other agricultural boundaries wherever possible, particularly where farm service roads are already in existence. • Avoid bisecting or encroaching on vineyards. • Avoid the use of obtrusive service structures.		
Archaeological		• The burial/cemetery site on the Farm Simonsvlei alongside the Klapmuts Road is a no-go area and shall be demarcated as such. • Should any unmarked human remains be disturbed, exposed or uncovered during	

Discipline	Design Phase	Construction Phase	Operational Phase
		excavations and earthworks for the proposed project, these shall be reported to the South African Heritage Resources Agency and not be disturbed or removed without official approval.	

Summary of mitigations and recommendations for the reservoir and WTP

Discipline	Design Phase	Construction Phase	Operational Phase

Stakeholder engagement and facilitation	• A Community Liaison Forum shall be established prior to construction commencing.
	  • A single Community Liaison Forum shall provide an information sharing function for both the pipeline construction and the construction of the WTP and associated infrastructure.
	  • The Terms of Engagement and responsibilities shall be documented and approved by the applicant.
	  • The Terms of Engagement shall cover two phases and the different activities attendant on the two phases: the construction phase and the operational phase.
		• The Community Liaison Forum will negotiate the construction roll-out with affected landowners prior to construction commencing.
		• Road closures, movement of abnormal load vehicles, land acquisitions and other activities that would affect general public will be communicated via the Community Liaison Forum and local newspapers.
		• The Forum shall:
		  • Be an information-sharing portal
		  • Serve as a monitoring organisation
		• Serve as a portal for stakeholder feedback and response.
			• The Community Liaison Forum shall change function and become a liaison forum for the operational phase. The Forum shall:
			  • Be an information sharing portal
			  • Serve as a monitoring organisation
			  • Serve as a portal for stakeholder feedback and response.

Biophysical (terrestrial and freshwater ecology)	• The WTP and associated infrastructure design shall:
	  • Minimise the footprint.
	  • Move the proposed access road 30m to the east to avoid the Renosterveld remnant.
		• Construction shall:
		  • Be planned in collaboration with a restoration ecologist to ensure that activities do not occur during construction which will limit post-construction rehabilitation.
		  • Take place in the dry season to minimise impacts of blasting and bulk earth moving.
		  • Limit stream flow disruption. Temporary diversions to be designed to flush sediment accumulations. Crossings to occur in late summer or when the streams are dry. Bank erosion must be prevented. All diversions to be removed once construction has been completed. Post-construction rehabilitation to be signed-off by the restoration ecologist.
		• Soil disturbance shall be kept to a minimum.
		  • Removal of vegetation shall be kept to a minimum.
		  • Exposed soil shall be protected from erosion.
		  • Construction areas shall be restored to the natural slope and geomorphology through rehabilitation.
		  • Exposed soil shall be revegetated as soon as construction has ceased.
		  • Post-construction rehabilitation to be signed-off by the restoration ecologist.
			• The freshwater ecology shall be preserved by:
			  • Conducting continuous effluent quality testing.
			  • Discharging treated effluent only when it meets requirements of the DWA General Authorisation 399 (March 2004).
			  • Conducting annual monitoring of affected freshwater ecosystems – this should include testing for nutrient levels (at least orthophosphates and nitrates, and chlorophyll-a (as algal biomass).
			  • Irrigating effluent away from sensitive environments, especially watercourses and wetlands.
			  • Implementing a scheduled maintenance program for the treatment package plant.
			2022 Freshwater Assessment Mitigations
			  • The geomorphological characteristics (shape, gradient, slopes) of the impacted ecosystems must be re-instated after construction – this will reduce the likelihood of increased erosion or sedimentation.
			  • If it is necessary to stabilise the watercourse or wetland bed or banks with gabions or rip rap, these should be kept to a minimum, and should be done in

Discipline	Design Phase	Construction Phase	Operational Phase

		• Rare and endangered plants are to be fostered.
		  • Ecologically sensitive areas shall be demarcated and maintained as no-go zones.
		  • All invasive aliens to be removed within 100 m either side of the pipeline where indigenous vegetation or riparian areas are affected .
		  • A restoration ecologist shall be contracted to conduct a search and rescue of rare or endangered plants along the route of the pipeline in late winter/ spring (at least twenty plants of the rare Athanasiacapitata associated with Area BA4 would have to be relocated).
		  • A nursery is to be established to care for the rescued plants.
		  • The rescued plants shall be replanted under the supervision of a restoration ecologist once construction has been completed.
		  • Post-construction rehabilitation to be signed-off by the restoration ecologist.
		• Topsoil to be removed and stockpiled for replacement during post-construction rehabilitation.
		  • Topsoil stockpiles to be protected against wind and rain dispersal.
		  • Any topsoil run-off to be trapped and re-stockpiled.
		  • No stockpile run-off may be permitted to enter any watercourse.
		• Watercourses shall be protected from contamination:
		  • All building materials should be stored away (at least 50 m) from aquatic ecosystems and the areas bunded appropriately such that there will be no runoff to watercourses.
		  • If construction areas are to be pumped of water (e.g. after rains), this water shall be routed via a settlement area and not directly to a watercourse.
		  • Vehicle and plant washing shall take place at least 50 m from watercourses and any effluent water contained and treated prior to discharge to the watercourse.
		  • No run-off from construction areas may be permitted to enter any watercourses unchecked. Any chemical or fuel spills shall be contained and cleaned immediately to prevent contamination of water courses.
		• 2022 Freshwater Assessment Mitigations
		  • Disruption of flow should be kept to a minimum, but where necessary, temporary diversion measures should allow flushing of the system to prevent build-up of material.
		  • Diversion techniques should take measures to limit erosion from
			an ecologically sensitive manner. For example, gabions could be top-soiled to allow for the establishment of vegetation, which would also serve the purpose of reducing erosion.
			• Mowing should not be more frequently than annually.
			• Vegetation within the pipeline servitudes should be allowed to recover (in some cases, re-planted), within the constraints of ongoing maintenance of the pipeline.
			• Ongoing monitoring of the pipeline and WTP site and associated infrastructure should be implemented (part of the ongoing EMP) in order to ensure that exotic plant species are not introduced or become established due to the disturbance.

Discipline	Design Phase	Construction Phase	Operational Phase
		temporary channels into watercourses or wetlands. • No obstructions to flow shall remain in the watercourses or wetlands after construction is completed. • Temporary diversion channels must be rehabilitated. • All building materials must be stored away (at least 15m) from all aquatic ecosystems and the areas bunded appropriately such that there will be no runoff from these areas towards aquatic systems. All building materials should be removed after construction. • Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind, to prevent spread of fine materials across the site. • Sensitive areas that are impacted by the dumping or storage of materials must be ripped and re-planted after construction is complete. • Washing of vehicles and machinery should take place well away (50m) from aquatic ecosystems. • Machinery prone to oil or fuel leakage must be located at least 50m away from any aquatic ecosystem, and the area adequately bunded in order to contain leakages. • Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly. • Concrete batching must be done well away from (50m minimum) from all sensitive environments. • All machinery should be regularly checked for leaks. • Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis. • If construction areas are to be pumped of water (e.g. after rains), this water must first be pumped into a settlement area, and not directly into a natural ecosystem. • Pathways and temporary access roads must be routed around the wetlands and should cross drainage channels as seldom as possible. • Sensitive areas must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process. • Affected areas must be ripped and re-planted after construction, according to the specifications set out in the CEMPr, and to the satisfaction of the ECO.	

Discipline	Design Phase	Construction Phase	Operational Phase
		• The construction sites and pathways must avoid sensitive areas. If lights are used, these must be directed away from all sensitive areas. • The sensitive areas (i.e. the edges of the buffers around the wetlands, watercourses) not affected by construction must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process, except where work is occurring. • In situ soils must preferably be used for rehabilitation of construction sites. • Where in situ soils are insufficient, top soils used after construction must be bought from reliable sources, and must be free of alien seeds or grass runners. • Constant monitoring of the construction sites by the Site Engineer and ECO must occur, and all alien plant species removed from or destroyed on the site.	
Agricultural impact management	• Compensation for expropriated land and lost production shall be finalised prior to construction.	• Measures to reduce dust production and dispersal shall be included in a method statement submitted by the contractor.	

Visual	• The visual impact of the WTP infrastructure shall be mitigated by:
	  • Blending and varying colours and textures to fit in with the existing environment.
	  • Grading earth embankments to the proposed reservoir into the natural contours.
	  • Landscaping the WTP premises to blend with the surrounding environment.
	  • Ensuring that only essential security lighting is used and that it faces away from the perimeter.
	  • Employing sustainable design elements such as:
	  • Using renewableand natural materials and elements where possible, as well as recycled and reconstituted materials.		

[redacted]

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Discipline	Design Phase	Construction Phase	Operational Phase
	• Using locally produced, as opposed to imported materials. • Planning construction and finishing to limit repainting/re-finishing intervals; and replacement and repair costs.		
Heritage		• Local labour to be used wherever practical.	
Archaeological		• The burial/cemetery site on the Farm Simonsvlei alongside the Klapmuts Road is a no-go area and shall be demarcated as such. • Should any unmarked human remains be disturbed, exposed or uncovered during excavations and earthworks for the proposed project, these shall be reported to the South African Heritage Resources Agency and not be disturbed or removed without official approval.	

[redacted]

Additional mitigation measures to be implemented (quoted verbatim from EIR)

Construction Phase Impacts

The following general construction related impacts were identified in the EIR. These impacts will have a low significance as they will be temporary in nature, will occur at a local extent and will be managed to acceptable levels through the implementation of an EMP:

Construction Campsite Impacts

Impacts associated with an increased number of workers on the site such as the generation of waste and sewage on site which has the potential to cause soil and water pollution will be mitigated with standard EMP specifications. Awareness raising and training of workers to comply with on-site rules relating to solid waste disposal, use of toilets etc. will be undertaken.

Impact Associated with Concrete Works

Concrete works have the potential for contamination. Therefore, careful measures would have to be introduced to prevent contamination of surrounding areas. Such measures could include cut-off channels and temporary ponds. It would also be a requirement that all wastewater resulting from batching of concrete, runoff emanating from batching areas, and the cleaning of equipment and flushing of mixers shall be disposed of via the wastewater management system.

Noise

Noise associated with standard construction activities such as the transportation of building materials and equipment, and the construction of the bulk water infrastructure will occur. The EMP would make specific provisions regarding the limiting of noise output levels. Given that the sites are fairly remote from large receptor groups, this temporary impact should be of even less consequence. However to ensure that noise impacts to the surrounding farming community are kept to reasonable limits, this aspect will be monitored.

Dust

Since a large part of the construction activities and the transportation of construction materials and plant would take place in close proximity to vineyards, orchards and residential and commercial buildings, particular care would have to be taken in respect of dust control, especially in the summer months. Dust suppression measures will be included in the EMP.

Stormwater Impacts

Stormwater runoff from the construction site, temporary access routes and upstream areas draining onto the construction site would have to be carefully controlled to minimise erosion, sedimentation and contamination of adjacent land and watercourses. Measures to minimise such impacts could include the construction of temporary ponds on-site to detain runoff, cut–off trenches and the implementation of silt traps. The protection of topsoil which is temporarily stockpiled is of particular importance within the agricultural areas.

Accidental Spillage of Chemicals/Fuels on Site

The EMP will include measures for the safe storage, handling and disposal of chemicals and fuels on site.

Blasting

Should blasting activities need to be undertaken, strict controls in this regard according to standard practice will be adhered to.

Impact on private property access

Temporary access routes across private properties would be negotiated with landowners during the detail design stage, but it would be endeavoured to limit the number of access points as far as practically possible in order to minimise the impact on the affected landowners. It is foreseen that full-time access to certain parts of affected properties might not be possible as a result of the construction activities. However, temporary or alternative access routes would be negotiated with each landowner to ensure that critical access routes are not cut off without the consent of the landowner.

Interruption of existing services

A large number of existing services, i.e. irrigation, Telkom and electricity lines, would be affected as a result of the construction activities. Some of these services are critical to the operation and safety of farms, residences, etc. It would be endeavoured to identify all services affected before construction commences by means of electronic detection devices and/or hand excavation in conjunction with the affected landowners. Further to this, the timing and the extent of the disruption to services as well as the provision of temporary services, where required, would be negotiated with the affected landowners in conjunction with the relevant authorities, e.g. Telkom.

Traffic Impacts/Interruptions

Where pipelines need to cross-existing roads and highways, interruptions to traffic flow can be anticipated.

(a) Impact on National Roads

The proposed pipeline routes cross the N1 in a number of locations and connections need to be made to the Wemmershoek pipeline, which is located in the median of the N1, in the Muldersvlei area. The N1 is under the control of the South African National Road Agency Ltd (SANRAL). The SANRAL has indicated that open trench excavation across the N1 is not allowed and therefore pipe jacking would have to be utilised. However, where connections need to be made to the existing Wemmershoek pipeline, it is expected that some encroachment onto the roadway is unavoidable.

(b) Impact on Provincial Roads

Apart from the N1, all of the other pipeline crossings across major access roads would be across roads under the jurisdiction of the Roads Infrastructure Branch of the Provincial Department of Transport and Public Works. This Department has indicated that through-traffic must be provided as far as possible on all paved roads. One-way traffic is, however, allowed on gravel roads.

(c) Impact on Railway lines

All railway lines would have to be crossed by means of pipe jacking, unless permission is obtained from Spoornet at the detail design stage to use open cut excavation in the case of disused railway lines.

- Traffic accommodation measures would need to be formulated during the detail design stage of the project and in consultation with traffic law enforcement. This should form part of a traffic management plan to be included for this phase of the development.
- The requirements of SANRAL, the Department of Transport and Public Works and Spoornet must be satisfied.
- Appropriate signage will need to be erected to warn road users where traffic interruptions are to take place and speed control measures will need to be enforced where appropriate.

Increased traffic on farm roads

There will be more traffic on farm roads associated with the construction activities, however, the implementation of speed control measures and other safety controls such as flag men on site will mitigate impacts to acceptable levels.

Influx of work seekers on site

A clear recruitment strategy will need to be implemented with a recruitment office based off-site, e.g. in Klapmuts, to avoid this impact.

Labour shedding to the WTP and reservoir

Landowners have expressed the concern that permanent staff on their farms may decide to seek employment at the WTP and reservoir. The concern is that the farm may be required to house people who are no longer in in its service and provide additional housing for new workers it will have to employ as replacements. In terms of the ESTA, tenured workers no longer in service may not be evicted from the property. This concern will need to be addressed by affected property owners in collaboration with the CCT.

Local employment opportunities

The project would present the opportunity for the creation of employment opportunities. These opportunities could be beneficial to local communities such as Klapmuts, provided preference is given to the local community. A total of roughly 1 180 person years of labour (i.e. 1 180 jobs of one year duration each) would be required for the establishment phase, implying a relatively high intensity impact over the establishment phase at the local level. Impacts for the local area would be of a **moderate to high positive** significance during construction, regardless of which site is chosen.

Mitigation

Source as many workers from the local area, such as Klapmuts, as possible. Targets should preferably be set for how much local labour should be used, based on the needs of the proponent and the availability of skills. Contractors that tender for work should also be required to meet targets for how many locals are given employment.

[redacted]

Annexure 2: Specimen incident report form

A2. Incident Report Form

Version 1: October 2009

Note: In the event of a significant incident which is defined in terms of section 30(1)(a) of NEMA as an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the incident shall be reported to the National Department of Water and the Environment and an appropriate incident form completed and submitted to the regional office or as instructed by the competent official.

Section One: To be completed by the person reporting the incident

Name		**Designation**	
Contact number		**Physical location of incident**	

Describe the incident

Was there damage/ contamination of any of the following? (Tick the appropriate box)

Potable water supply		**Storm water**		**Ground water**	
Air		**Soil**		**Roadways**	

What remediation has been undertaken? (Describe)

Has the damage/ contamination been completely remediated?	
If not, what residual damage remains (detail the residual damage).	
If residual damage remains- what is the reason and what is planned with respect to the environmental damage. CoCT must counter sign this form in this event before it can be closed. (see below)	
Upon investigation, what was found to be the cause of the incident? (Detail)	
Is this a repeat of a similar incident?	
What is the reason that planned changes did not prevent a recurrence of the incident?	

[redacted]

What is to be changed to ensure that the incident will not be repeated? (Detail)

Section Two: To be completed by the ECO

Does the incident comprise a contravention of legislation?	
What action has been taken?	
In the opinion of the ECO is the remediation action sufficient?	
If not, what further actions must be taken? (detail)	
Have all the required and appropriate actions been taken to the satisfaction of the ECO?	
Have all parties signed the incident form?	

[redacted]

Date	Contractor
Date	ECO
Date	CoCT (if required)

3.7.11 HEALTH AND SAFETY SPECIFICATIONS

The following Health and Safety Specifications applicable to this project are included hereunder:

Reference	Description	Pages
	Project Health and Safety Specification	54
Spec 2221528-AppD	Guideline for safe working procedures for pipelines close to powerline servitudes	13
		67

The tendered rates for Health and Safety shall ensure full compliance with these specifications.

[redacted]

Project Health and Safety Specification

In terms of Construction Regulations 2014

Project Client

CITY OF CAPE TOWN

Description of Project Works

CONSTRUCTION OF MULDERSVLEI 300ML RESERVOIR AND ASSOCIATED INFRASTRUCTURE

Project Location

OFF R304
PAARL FARMS
CAPE TOWN

Preparation Date

JULY 2023

Project Health and Safety Specification developed by:

[redacted]

Total Pag[redacted]

[redacted]

PROJECT HEALTH AND SAFETY SPECIFICATION

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Total P[redacted]

[redacted]

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Annexure B Legal Appointments

Annexure C Baseline Risk Assessment

Annexure D Safety Specification and Baseline Risk Assessment Issue Register

[redacted]

1.0 SPECIFIC PROJECT INFORMATION

1. 1 INTRODUCTION AND DEFINITIONS

THE REQUIREMENTS OF THE CONSTRUCTION REGULATIONS 2014 (AND GUIDANCE NOTES OF 2017) HAVE BEEN IN EFFECT SINCE 7TH AUGUST 2014. THE REGULATIONS PLACE LEGAL DUTIES UPON PRINCIPAL CONTRACTORS AND CONTRACTORS. ALTHOUGH THIS HEALTH AND SAFETY SPECIFICATION INCLUDES MUCH OF THE CONTENT OF THE REGULATIONS, THE CONTRACTOR WILL BE DEEMED TO BE FAMILIAR WITH THE REQUIREMENTS OF THESE REGULATIONS, AND OTHER ASSOCIATED HEALTH AND SAFETY REGULATIONS, AND TO HAVE FACTORED IN ALL THE DUTIES PLACED UPON CONTRACTORS AND PRINCIPAL CONTRACTORS IN THE TENDER. A COPY OF THE REGULATIONS CAN BE VIEWED ON THE DEPARTMENT OF LABOUR'S WEBSITE.

PLEASE NOTE THAT THE TERMS "CONTRACTOR" AND "PRINCIPAL CONTRACTOR" HAVE THE SAME MEANING AS THAT IN THE CONSTRUCTION REGULATIONS AND ARE USED INTERCHANGEABLY IN THIS DOCUMENT, I.E., REFERENCES TO "CONTRACTOR" REFER TO PRINCIPAL CONTRACTOR AND/OR CONTRACTOR AS THE REGULATIONS PERTAIN TO THEIR FUNCTIONS.

This Health and Safety Specification contains clauses that are generally applicable to construction activities, as well as imposing pro-active controls associated with activities that impact on Health and Safety as it relates to work on site. Compliance to the requirements of the Occupational Health and Safety Act 1993 is an additional requirement of this Health and Safety Specification and is part of the Contractor's responsibility. The Client, and/or their agents, will monitor that all Contractors comply with the requirements of such legislation.

ALL REFERENCES TO CLIENT IN THIS HEALTH AND SAFETY SPECIFICATION ALSO REFER TO SAFETY AGENT, WHERE SO APPOINTED.

Definitions (as per the Construction Regulations 2014) applicable to this Health and Safety Specification:

"agent" means a competent person who acts as a representative for a Client;

"angle of repose" means the steepest angle of a surface at which a mass of loose or fragmented material will remain stationary in a pile on the surface, rather than sliding or crumbling away;

"bulk mixing plant" means machinery, appliances or other similar devices that are assembled in such a manner so as to be able to mix materials in bulk for the purposes of using the mixed product for construction work;

"client" means any person for whom construction work is being performed;

"competent person" means a person who has, in respect of the work or task to be performed, the required knowledge, training and experience and, where applicable, qualifications, specific to that work or task: Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training; and is familiar with the Act and with the applicable regulations made under the Act;

"construction manager" means a competent person responsible for the management of the physical construction processes and the coordination, administration, and management of resources on a construction site;

"construction site" means a workplace where construction work is being performed;

[redacted]



"construction supervisor" means a competent person responsible for supervising construction activities on a construction site;

"construction vehicle" means a vehicle used as a means of conveyance for transporting persons or material, or persons and material, on and off the construction site for the purposes of performing construction work;
"construction work" means any work in connection with -

- the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or
- the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work;

"construction work permit" means a document issued in terms of regulation 3;

"contractor" means an employer who performs construction work;

Note:
a) Includes organisations and or self-employed person that contracts with a client, principal contractor, or a contractor to carry out construction work.

"demolition work" means a method to dismantle, wreck, break, pull down or knock down of a structure or part thereof by way of manual labour, machinery, or the use of explosives;

"design" in relation to any structure, includes drawings, calculations, design details and specifications;

"designer" means a competent person who-

- prepares a design;
- checks and approves a design;
- arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer; or
- designs temporary work, including its components;
- an architect or engineer contributing to, or having overall responsibility for a design;
- a building services engineer designing details for fixed plant;
- a surveyor specifying articles or drawing up specifications;
- a contractor carrying out design work as part of a design and building project; or
- an interior designer, shop-fitter, or landscape architect;

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimise human well-being and overall system performance;

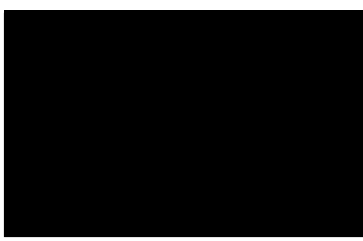
"excavation work" means the making of any man-made cavity, trench, pit or depression formed by cutting, digging or scooping;

"explosive actuated fastening device" means a tool that is activated by an explosive charge and that is used for driving bolts, nails, and similar objects for the purpose of providing fixing;
"fall arrest equipment" means equipment used to arrest a person in a fall, including personal equipment, a body harness, lanyards, deceleration devices, lifelines, or similar equipment;

"falsework" means a combined system of formwork and support work;

"formwork" means temporary or permanent shutters used to form wet concrete into elements of a structure, and includes both horizontally and vertically placed shutters;

"fall prevention equipment" means equipment used to prevent persons from falling from a fall risk position, including personal equipment, a body harness, lanyards, lifelines or physical equipment such as guard-rails, screens, barricades, anchorages or similar equipment;



[redacted]

"fall protection plan" means a documented plan, which includes and provides for -

- all risks relating to working from a fall risk position, considering the nature of work undertaken;
- the procedures and methods to be applied in order to eliminate the risk of falling; and
- a rescue plan and procedures;

"fall risk" means any potential exposure to falling either from, off or into;
"health and safety file" means a file, or other record containing the information in writing required by these Regulations;

"health and safety plan" means a site, activity or project specific documented plan in accordance with the Client's health and safety specification;

"health and safety specification" means a site, activity or project specific document prepared by the Client pertaining to all health and safety requirements related to construction work;
"material hoist" means a hoist used to lower or raise material and equipment, excluding passengers;

"medical certificate of fitness" means a certificate contemplated in regulation 7(8);

"mobile plant" means any machinery, appliance or other similar device that is able to move independently, and is used for the purpose of performing construction work on a construction site;

"National Building Regulations" means the National Building Regulations made under the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), and promulgated by Government Notice No. R. 2378 of 30 July 1990, as amended by Government Notices No's R. 432 of 8 March 1991, R. 919 of 30 July 1999 and R. 547 of 30 May 2008;

"person day" means one normal working shift of carrying out construction work by a person on a construction site;

"principal contractor" means an employer appointed by the Client to perform construction work;

"Professional Engineer or Professional Certificated Engineer" means a person holding registration as either a Professional Engineer or Professional Certificated Engineer in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000);

"Professional Technologist" means a person holding registration as a Professional Engineering Technologist in terms of the Engineering Profession Act, 2000;

"provincial director" means the provincial director as defined in regulation 1 of the General Administrative Regulations, 2003;

"scaffold" means a temporary elevated platform and supporting structure used for providing access to and supporting workmen or materials or both;

"shoring" means a system used to support the sides of an excavation and which is intended to prevent the cave-in or the collapse of the sides of an excavation;

"structure" means-

- any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;
- any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or
- any fixed plant in respect of construction work which includes installation, commissioning, decommissioning, or dismantling and where any construction work involves a risk of a person falling;

[redacted]

[redacted]

"support work" means the temporary structure erected to support the formwork before the casting of a concrete element of a structure.

"suspended platform" means a working platform suspended from supports by means of one or more separate ropes from each support;

"temporary works" means any falsework, formwork, support work, scaffold, shoring or other temporary structure designed to provide support or means of access during construction work;

"the Act" means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);

"tunnelling" means the construction of any tunnel beneath the natural surface of the earth for a purpose other than the searching for or winning of a mineral.

Reference should be made to the following documentation in conjunction with this Safety Specification (including existing surveys, drawings, and reports):

- Tender documents
- Drawings
- Annexure D – Guidelines for safe working procedures for pipelines close to powerline servitudes

IMPORTANT NOTE:
This Health and Safety Specification has been prepared to comply with the requirements of the Construction Regulations 2014.

1.2 BACKGROUND TO THE HEALTH AND SAFETY SPECIFICATION

Historically, the Construction Industry has had a poor health and safety record. Due to the complex and potentially dangerous operations being undertaken, there is a high risk of incidents, accidents, and injuries. In many instances poor adherence to the Act and Regulations has resulted in severe consequences for Health and Safety performance. The Client is determined that the highest Health and Safety standards will prevail throughout the Contract and that there will be full commitment from all parties involved.

To achieve this goal the Client has arranged for the preparation of this Health and Safety Specification. The Health and Safety Specification sets out guidelines and minimum levels of awareness and guidance for Health and Safety requirements for the project. Contractual responsibility for adhering to these requirements rests with the Contractors. All employees are encouraged to be pro-active in compliance.

The Client is committed to ensuring the highest Health and Safety standards for all work undertaken within the Contract.

Contractors as employers are fully responsible and accountable for compliance with all Health and Safety requirements.

IMPORTANT NOTE:

Compliance with the Occupational Health and Safety Act and Regulations shall not be limited to this Health and Safety Specification and definitions contained in this document.

Contractors shall be conversant with the requirements and effects of Health and Safety legislation upon their activities, in particular the Construction Regulations, 2014, and the Occupational Health and Safety Act, 1993, and to have made adequate resource in their tender submission to comply with all legislative requirements.

Failure to comply with the requirements of this Safety Specification will result in severe sanction and the severity of the sanction will depend on the severity of the noncompliance.

[redacted]



The Contractor's personnel will be responsible for the auditing of the implementation of the Health and Safety Specification and maintaining the document control and record systems associated with the Health and Safety Specification. The Client will arrange for Health and Safety audits to be conducted on site on their behalf to monitor health and safety compliance by contractors.

1.3 PURPOSE OF THE HEALTH AND SAFETY SPECIFICATION

The purpose of this site-specific Health and Safety Specification is to comply with legal requirements and to provide health and safety information about specific project risks known by the Client, Designer and Safety Agent to be applicable to this project. This document also provides minimum health and safety requirements, standards, and expectations that the contractor must adhere to.

The Contractor must take into account all information in this specification and ensure that their tenders include adequate resource and competence to deal with the matters detailed herein so that all relevant contents are dealt with in a way which is in compliance with legislation and the ethical concerns for the safeguarding of employees, contractors and other persons affected by the construction activities. Please note that a detailed OHS bill of quantities must be provided by the contractor on all Construction Work Permit projects. The Bill of Quantities will form part of the Construction Work Permit appellation presented to Department of Labour for approval.

The Health and Safety Specification will be implemented during construction of the works and any construction activity that the Client has control over.

This will also assist in ensuring that all the costs related to the compliance with Occupational Health Act 85 of 1993 and the Construction Regulations 2014, as well as this Health and Safety Specification, are taken into consideration at Tender stage.

No advice, approval of any document required by the Health and Safety Specification such as hazard identification and risk assessment action plans or any other form shall be construed as an acceptance by the Client of any obligation that absolves the Contractor from achieving the required level of performance and compliance with legal requirements.

Further, there is no acceptance of liability by the Client which may result from the Contractor failing to comply with the Health and Safety Specification unless the Client has issued an instruction to any requirement, i.e. the Contractor remains responsible for achieving the required performance levels.

1.4 IMPLEMENTATION OF THE HEALTH AND SAFETY SPECIFICATION

This Health and Safety Specification forms an integral part of the Contract, and Contractors shall make it an integral part of their Contracts with other Contractors and Suppliers. Contractors employed by the Client are to ensure that the provisions of the Health and Safety Specification are applied both on the site and in respect of all off site activities relating to the project, in particular in transport activities and project dedicated off site fabrication works.

The Contractor shall enforce the provisions of the Health and Safety Specification amongst all Contractors and suppliers for the project.

The Contractor shall sign the acknowledgment on the last page of this safety specification that he/she has familiarized him/herself with the content of the Health and Safety Specification and shall comply with all obligations in respect thereof.
The successful Contractor will be required to compile a Health and Safety Plan based on the requirements of the Occupational Health Act 85 of 1993 and these Specifications, which will need to be approved by Client (or their appointed safety agent) prior to commencement with construction work.



[redacted]

1.4.1 Client Duties

In terms of the Construction Regulations 2014 the Client (or their Agent, where appointed) has legal duties. Where an Agent (refer to "definitions" section of this document) is appointed in terms of this project, these Health and Safety duties assigned will also apply.

All references to "Client" will apply to their appointed "Safety Agent", where so appointed, in this Health and Safety Specification.

The Client must:

- Prepare a baseline risk assessment for the construction work
- Prepare a suitable, sufficiently documented, and coherent site specific Health and Safety specification for the intended construction work, based on the baseline risk assessment
- Include the health and safety specification in the tender documents
- Ensure that potential principal contractors submitting tenders have made adequate provision for the cost of health and safety measures
- Ensure that the principal contractor to be appointed has the necessary competencies and resources to carry out the construction work safely
- Take reasonable steps to ensure co-operation between all contractors appointed by the Client to enable each of those contractors to comply with the regulations
- Ensure, before work commences, that every principal contractor is registered and in good standing with the compensation fund, or with a licensed compensation insurer as contemplated in the Compensation for Occupational injuries and Diseases Act, 1993 (Act no 130 of 1993)
- Appoint each principal contractor in writing for the project, or part thereof
- Discuss and negotiate with the principal contractor the contents of the principal contractor's safety plan and thereafter finally approve that plan for implementation
- Ensure that a copy of the principal contractor's health and safety plan is implemented and maintained
- Ensure that periodic health and safety audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days
- Ensure that a copy of the health and safety audit report is provided to the principal contractor within 7 days after the audit
- Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons which is not in accordance with the principal contractor's health and safety plan for site
- Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to the principal contractor to execute the work safely
- Ensure that the health and safety file is kept and maintained by the principal contractor.
- Where the Client requires additional work to be performed as a result of a design change or error in construction due to the actions of the Client, the Client must ensure that sufficient safety information and appropriate additional resources are available to execute the required work safely.
- Where more than one principal contractor is appointed, the Client must take reasonable steps to ensure co-operation between all principal contractors and contractors to ensure compliance with the Regulations
- Where the Client has appointed a Safety Agent for the project, their details for this project are contained in the Project Directory section of this health and safety specification.

1.4.2 Designer Duties

It must be noted that the Designer also has Health and Safety duties assigned in terms of the Construction Regulations. Where the contractor fulfils a design function in terms of this project (refer to "definitions"

[redacted]

[redacted]

section of this document), these duties will also apply. Please refer to Regulation 6 of the Construction Regulations 2014.

Please note that the designer of temporary works must ensure that:

- all temporary works are adequately designed so that it will be capable of supporting all anticipated vertical and lateral loads that may be applied;
- the designs of temporary works are done with close reference to the structural design drawings issued by the contractor, and in the event of any uncertainty consult the contractor;
- all drawings and calculations pertaining to the design of temporary works are kept at the office of the temporary works designer and are made available on request by an inspector; and
- the loads caused by the temporary works and any imposed loads are clearly indicated in the design.

1.5 PROJECT DIRECTORY		
Project Client **Contact Person**	City of Cape Town [redacted]	**Tel:** [redacted] **Cell:** TBA **e-mail:** [redacted]
Project Manager **Contact Person**	Zutari [redacted]	**Cell:** [redacted] **e-mail:** [redacted]
Civil Engineer **Contact Person**	Zutari [redacted]	**Cell:** [redacted] **e-mail:** [redacted]
Electrical Engineer **Contact Person**	Zutari [redacted]	**Cell:** TBA **e-mail:** [redacted]
Construction Safety Agent **Contact Person**	Safe Working Practice [redacted]	**Tel:** [redacted] **Cell:** [redacted] **e-mail:** [redacted]
Architect **Contact Person**	Company [redacted]	**Cell:** TBA **e-mail:** [redacted]
Geotechnical Engineer **Contact Person**	[redacted]	**Cell:** TBA **e-mail:** [redacted]
Dams Safety Engineer **Contact Person**	Zutari [redacted]	**Cell:** TBA **e-mail:** [redacted]

[redacted]

[redacted]

OTHER PARTIES DIRECTORY	
Department of Labour WESTERN CAPE - [redacted]	**Tel:** [redacted] **e-mail:** [redacted] **Cell:** [redacted]
Telecommunications, Gas, Water and Electricity Contractor to apply for and refer to wayleave information from service providers for the nature and location of services. Refer all queries Project Manager.	

1.6 PROJECT DETAILS

Description of Works

Construction of Muldersvlei 300ML Reservoir and associated infrastructure, including:

- Construction of the new Muldersvlei 300ML earth embankment, concrete lined reservoir and its interconnecting pipework.
- DN1600 steel incoming pipeline and a DN1200 steel outgoing pipeline between the reservoir and the existing Wemmershoek pipeline
- OSEC disinfection facility
- Admin building
- Site services (water and sewer)
- Internal roads
- Stormwater infrastructure.

This description of the works is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract.

Anticipated Construction Duration
45 months

Provisional Start Date
October 2026 approx

Provisional Completion Date
TBA

Construction Work Permit Required for the Project?
Yes.

1.7 EXISTING ENVIRONMENT

Hazards particular to this project by virtue of location:

- Greenfield site. Surrounding area is mainly farmland used for agricultural activities.
- Members of the public present (road traffic), farm labourers, etc.
- Working in/next to existing roadways.
- Existing live services in the area.
- High water table.
- Potential presence of snakes.

[redacted]

[redacted]

- Possibility of flood waters in water source at culvert crossing in area of site works.
- Some of the existing farming irrigation pipelines contain Asbestos

Overhead, Above Ground and Underground Services crossing the site:

Overhead: Principal Contractor to check area and take precautions against damage to services and risk of injury to employees. Eskom overhead lines and Telkom present in works area.

Underground: Principal Contractor to check area and take precautions against damage to services and risk of injury to employees. Fibre optic services and irrigation pipes present.

Ground level: none known to exist on site

Service Drawings available: Yes.

Wayleaves required: Yes. ESKOM servitude applications for pipelines and roads. Provincial Government Department of Transport for gravel roads. SANRAL for N1 pipeline crossings/connections

Permits required: Yes, overhead electrical services. Principal Contractor to discuss with the Client.

Isolations required: Principal Contractor to discuss with the Client.

Note – please refer to Annexure D – Guidelines for safe working procedures for pipelines close to powerline servitudes.

Existing structures on site and surrounding land use (with a significant impact on Health & Safety):

- Greenfield site
- Existing roadways
- Services may be present
- Commercial farm present
- Wedding venue/Bed and Breakfast accesses in area of the works
- Farm access will form part of the site area
- Existing culvert present in area of works

Existing ground conditions and ground survey report:

- Principal Contractor to discuss with the Client.
- Geotech report available.
- Maximum excavation depth 6m.
- Dewatering required, shoring will be required in some instances.
- Blasting is not anticipated based on the Geotech, however, it is included in this specification just in case it becomes applicable.

Existing Traffic Systems

Condition: Existing roads in good condition.

Restrictions to access: Not to the main site, the project will only commence after the access road has been constructed. Access to the pipelines will have to be through privately owned farmlands.

Speed restrictions: Usual urban speed limits apply, to be reduced in traffic managed areas.

[redacted]

[redacted]

1.8 AVAILABLE DRAWINGS

Refer to tender documentation.

1.9 PROJECT HEALTH AND SAFETY REQUIREMENTS

Significant health and safety hazards identified by Client, Designer and Safety Agent:

Protection of members of public and road users – Traffic management will be required where the pipelines will connect to the existing Wemmershoek pipeline in the median of the N1, and for the gravel road pipeline crossings. Traffic Management Plan supplied by principal contractor must be approved by the Project Manager to address safe accommodation of traffic and the measures to be in place to protect members of the public and workers from any dangers associated with the construction works being undertaken. The health and safety of members of public, road users and workers must be a priority at all times and all necessary steps must be taken to protect them. Existing roads will remain open during works. This is a critical hazard to traffic/members of public and to workers in the road. Stop / Go controls, delineators, cones and trained flag personnel may be required to be in place as per Traffic Management Plan. The Principal Contractor is responsible for directional signage to divert the public and road users. All flag persons to be trained and to control traffic with red flags and to have high visibility clothing on at all times. The Contractor shall ensure that residents have access to their properties at all times during the Construction period. Access to County Fair commercial premises will be via existing access off R304, MUST BE KEPT OPEN AT ALL TIMES AND ACCOMMODATION MADE FOR SAFE USE BY COUNTY FAIR VEHICLES. Full time TSO required for work on R304. Hokkies must have new jersey barrier protection as well as road marking buggies having escort vehicles front and rear.

Excavations – Pipelines up to 6m, Reservoir up to +-15m approx.
All workers must receive induction prior to commencement of works. Shoring of excavations may be required though there should be enough space for battering back to a safe angle to prevent risk of collapse. **Excavations must be backfilled by end of each shift as far as is reasonably practicable.** If this cannot be done then appropriate safety measures must be put in place by the contractor to prevent unauthorised entry to excavations, including barriers and warning signage.

- ALL EXCAVATIONS MUST HAVE A MINIMUM OF AT LEASE 1M HIGH BARRIERS IN PLACE.
- Red & white danger tape is not permitted for securing excavated areas.
- Excavated soil is to be placed at a sufficiently safe distance from the excavation itself.
- Dewatering will be required.

Use of delivery or support trucks used for the delivery and removal of material and equipment on open roadways – plant must be effectively separated from members of public and unauthorised personnel. Trained flag persons wearing high visibility clothing to be in place as required. Exclusion zone to be in operation when the support vehicles are in use next to the roadways.

It is envisioned that **plant** will be moving on the road and must be made visible at all times. Parking of this plant must be strictly monitored by the contractor at all times. Use trained flag persons as applicable. Plant must be effectively separated from members of public and unauthorised personnel.

Noise and Dust control: Measures to be put in place by the appointed contractor to minimize the dust and noise on site. Contractor must take sufficient steps to reduce the production of noise and dust.

Existing services – Contractor to ensure that services are not damaged, or pose risk to workforce. Note – please refer to Annexure D – Guidelines for safe working procedures for pipelines close to powerline servitudes.

Warning Notices: Construction warning signage must be prominently displayed to avoid access to site areas by unauthorised persons.

[redacted]

[redacted]

Risk of fires caused by construction works and / or Smoking – ensure correct measures are in place for fire control to ensure no fires will break out. Fire extinguishing equipment to be readily available at all times especially during high risk activities. The smoking of cigarettes is also to be monitored and adequate smoking areas and smoking control measures to be put in place.

Working next to water (particularly in winter rain events) – Contractor to ascertain risk of flood events and provide safety equipment to mitigate risk of flooding as applicable. Emergency evacuation procedures to be in place. There are dams/ponds along the incoming and outgoing pipelines. Works in and around retention ponds.

Lifting/lowering operations – including working with mobile elevated working platforms (eg: cherry pickers) – all operators must provide copies of their up to date competency and medical certificates and driver's license. Loads must be slung or secured by person with appropriate training and competence. Daily plant inspection registers to be completed and records kept in the safety file. Valid load test certificates and record of inspections by competent personnel must be available and maintained throughout the project. Rotating amber lights and reverse alarms to be active when operating all plant on site. Plant must be effectively separated from members of public and unauthorised personnel. Use trained flag persons as applicable. Exclusion zone under lifting/lowering operations to be enforced particularly where there is a risk of any materials falling to ground from roof or from position of lifting operations, as applicable. Particular attention must be paid to lifting operations in windy conditions.

Working at height - Up to 8m for buildings, Reservoir earth embankment up to 20m. All access equipment to be built and maintained in a safe condition by competent and trained personnel. Any scaffold structures must be built as per the SANS Regulations. A Fall Protection Plan and Rescue Plan will be required for approval prior to commencement of any activities at height. All workers must have Fall Protection Plan training in the form of a toolbox talk with a signed register of attendance. Workers working at height must have appropriate and sufficient safety equipment. Safety harnesses with securely attached lanyards must be worn in areas where safety while working at height cannot be assured by other means. Edge protection in the form of guard rails and toe boards must be in place to prevent materials and people from falling. Note that exclusion zones under the works at ground level will be required when working over vehicle or pedestrian trafficked areas. Note that wind will make working at heights more risky.

Hot works – All hot works will require a method statement and permit to work. All hot works will require a fire extinguisher at hand.

Hazardous Chemical Substances - High concentration of chlorine dosing during the commissioning of disinfection facility buildings. Bursting of pipelines and mechanical failures. MSDS to be on hand, PPE. Emergency procedures to be known by all exposed personnel.

Asbestos - Some of the existing farming irrigation pipelines contain Asbestos. The contractor to comply with the requirements and duties as per the requirements of the Asbestos Abatement Regulations of 2020.

Other construction hazards that the contractor can reasonably expect are as follows:

Compacting and Filling
Compactor Operations
Cutting Off Disc
Electric Tools and Electrical Installations
Flammable Liquids / Gas
Hand tools
Manual Handling of General Items
Plant/Vehicle and Equipment Operation

[redacted]

[redacted]

Road Construction

NOTE: Please refer to end of this Health and Safety Specification for the baseline risk assessment for these hazards and risks.

ACTIVITIES REQUIRING APPROVED METHOD STATEMENTS (FOR HEALTH AND SAFETY)

Pre-Construction Phase Method Statements

- Site establishment

Construction Phase Method Statements

- Traffic management
- Temporary works
- Deep excavations
- Working at Height
- Working next to Water

Other method statements required to be advised by the professional team.

ACTIVITIES REQUIRING PERMITS (FOR HEALTH AND SAFETY PURPOSES)

Permit to Dig: To be advised.

Permit to Enter Excavations: The Principal Contractor is to formally manage all excavation work.

Road Works Permit: To be advised.

Permit to Work with Electricity: To be advised.

Confined Space Permit: The Principal Contractor is to formally manage all confined space work..

Hot Works Permit: The Principal Contractor is to formally manage all hot work.

Permit to Work under Power Lines: Yes.

Blasting: The Principal Contractor is to formally manage all basting operations.

Client issued permit for work in restricted areas: To be advised.

Temporary Works: The Principal Contractor is to formally manage all temporary works.

CONTRACTOR SAFETY OFFICER PROVISION

Records of safety audits undertaken by the Contractor's Safety Officer must be kept on site in the safety file and nonconformances reported by the Safety Officer to the Contractor's management team. All nonconformances identified by the Safety Officer and client's safety agent must be investigated and corrective action taken by the Contractor to prevent re-occurrence.

Please note that as from 7th August 2018 the safety officer must be professionally registered with the SACPCMP. Proof of registration with the SACPCMP must be provided.

If registered as a Candidate proof of mentorship and weekly visits by mentor must be available on site.

The requirement for this site is that a full time Safety Officer be appointed by the Principal Contractor for the site.

[redacted]

[redacted]

MEDICAL CERTIFICATE OF FITNESS (ANNEXURE 3)

The contractor must ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template.

MANAGEMENT AND SUPERVISION OF CONSTRUCTION WORK

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate competent person must be appointed by the principal contractor. Proof of an all-inclusive assessment by the Principal Contractor of the Construction Manager's Competency in construction management and health and safety competency must be available in the Safety File.

The Construction Manager, Alternate Construction Managers, Assistant Construction Managers, and designated construction supervisor/s must, as a minimum, have training in Legal Liability, Construction Regulation 2014 and the OHS Act and Regulations.

TRAFFIC MANAGEMENT AND TRAFFIC SAFETY OFFICER PROVISION

The Traffic Management Plan must be approved by the Project Manager and, as required, the Traffic Chief as per the National Road Traffic Act, No. 93 of 1996. The Traffic Safety Officer must have training as per Unit Standard 14561 or similar.

- The Principal Contractor to ensure that a qualified Traffic Safety Officer is present on site, as applicable.
- The Principal Contractor is to submit a formal Traffic Management Plan to the Project Manager prior to the start of works. The TMP is to be site specific.
- TMP is to address the safe management of the pedestrian walkways and the management of the road closures.
- Traffic management will only be required where the pipelines will connect to the existing Wemmershoek pipeline in the median of the N1, and for the gravel road pipeline crossings. TMP required, TSO only required on site when installing pipes at these places.

ENVIRONMENTAL CONDITIONS

Contractor must take into account adverse weather conditions on site activities and implement control measures to mitigate risk. This includes risk of exposure to excessive heat, cold, rain, lightning and wind.
The open nature of the site works will not preclude any of the above.

ARRANGEMENTS FOR ACCESS, PARKING, DELIVERIES, ETC.

Access to site by Construction Vehicles: Via existing roads.

Access to site by Construction Workers and Visitors: Via existing roads.

All service providers must sign a 37.2 Mandatory Agreement and must be inducted before they can be allowed on site.

ARRANGEMENTS FOR SITE CAMP, ABLUTIONS AND YARD

Site camp location and set up

- **Restrictions / requirements:**
- **Storage areas:**
- **Security:**

} Contractor to advise in consultation with Engineer / Professional Team

[redacted]

[redacted]

Ablutions and Welfare Arrangements
Contractor to supply ablutions and facilities in line with the Construction Regulations 2014, refer to section 2.31 of this health and safety specification regarding the below. Toilets should be provided with built in facilities for hand washing. Please note further that control measures form an important part of ablutions provision on site ref soap and water/hand sanitiser, signage, etc:

- **Toilets:** } Contractor to provide as per Regulations
- **Washing facilities:** }
- **Drinking Water:** }
- **Shelter:** } Contractor to provide as per Regulations
- **Showers:** }

Mobile site facilities requirements:

A mobile toilet will be required for sites that cannot facilitate a permanent location for ablution units and must be available for each gender per location.

The use of a mobile toilet must be prepared and setup correctly with additional anchors and available toiletries prior to each working day and to be first priority when changing location of works along a set working path.

Teams are to ensure that the toilets are cleaned correctly and suitable for easy and hygienic uses and recorded on a daily register.

PROTECTION OF SITE AGAINST UNAUTHORISED ACCESS BY PUBLIC

Excavation Fencing: excavations are to be fenced off to protect the public, deep excavations (as applicable) must be properly supported to prevent collapse.

General Fencing of Site: The existing work areas are only partially fenced off. The pipeline routes will not be fenced off Requirements are to be discussed with the Project Manager.

- Pedestrian foot traffic is to be redirected in a safe manner where applicable – Pedestrian safety is to be observed.
- Road closure / barricading regarding vehicle traffic is to be erected in line with the TMP.
- Exclusion zone for sandblasting works to be established for road marking, as applicable

Warning Notices: Construction warning signage must be prominently displayed to avoid unauthorised access to site and to warn of dangers associated with construction works.

Look Outs: TBA

PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Client requires the Contractor to ensure that employees (and others under his/her control) wear the following minimum PPE:

Overalls: Yes.

Safety Harnesses: As per risk assessment..

[redacted]

[redacted]

Hard Hats: As per risk assessment.

Reflective Vests: Yes.

Goggles / gloves / ear defenders / respiratory protection: Yes – as per risk assessment.

Safety Footwear: Yes.

Specialist Equipment (e.g. for confined Spaces): yes, for confined space work and traffic management and working next to water as per risk assessment.

HAZARDOUS SUBSTANCES

The following materials and substances have, or may have, to be used in the works and are identified as potentially posing special health and / or safety hazards during the project. Appropriate measures will need to be specified for their control:

Fuels – oils – solvents – cement - bitumen – road marking paint - chlorine

1.10 INTERFACE AND RESTRICTIONS BY CLIENT

Contractor must note that the following Client activities will continue during construction:

- No Client activities noted.
- Roadway area is accessible to the general public.

The following Client safety rules and/or requirements are to be observed:
All workers are to receive induction prior to commencement of work on site.
Other safety rules and requirements to be advised at induction.
Please also refer to tender document.

Restrictions on times, access or other restrictions by Client
Please refer to tender document.
Other restrictions may be advised at induction.

1.11 Project Close Out

The Health and Safety files for the Principal Contractors and all Contractors require closure and handover to the Client at the completion of the project in the form of a consolidated safety file. The following list is an example of what should be included but is not exhaustive. The Safety Agent or the Client may require further information at the time of completion and the Principal Contractor is to ensure that all instructions are responded to. Documentation would include all health and safety related records from the start of the project. All records to be in hard copy or electronic format and submitted to the Safety Agent for approval in adequately formatted lists and folders. Layout should be logical and in the same order as in the site files.

Consolidated Health and Safety close out file requirements include:

- Health and safety specification (most recent version)
- Principal Contractor's health and safety plan/s
- Site safety organograms
- Legal appointments
- Notification to Department of Labour of commencement of work / Construction Work Permit
- Workman's Compensation Letters of Good Standing for the project
- Full safety files for all contractors as well as their close out reports

[redacted]

[redacted]

- List of all contractors who worked on site
- Letters of safety plan approval of contractors by the Principal Contractor
- Mandatory agreements (section 37.2 agreements)
- Incident and accident records / Occupational Disease records
- Contractor Nonconformance records
- Safety agent's audit reports
- Safety Officer reports
- Method Statements
- Risk assessments
- Safe work procedures
- Medical surveillance certificates of fitness. Medical records are to be kept according to the Occupational Health and Safety Act, as amended.
- All temporary works drawings (suspended beams/scaffolds, etc.)
- Copies of test results, policies, and procedures for environmental monitoring (silica, noise, dusts, etc.)
- Detailed registers of all material used
- Copies of all Checklists completed

1.12 SAFETY FILE RETURN TO CLIENT

The consolidated Health and Safety Files for the Project is to be handed over by the Principal Contractor to the Client upon Project Completion in either hard copy or electronic format.

2.0 FURTHER REQUIREMENTS

2.1 Duties of Principal Contractor / Contractor in terms of Construction Regulations 2014

A Principal Contractor must:

- provide and demonstrate to the Client a suitable, sufficiently documented and coherent site specific health and safety plan, based on the Client's documented health and safety specifications, *which* plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses;

- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, which must be made available on request to an inspector, the Client, the Client's Safety Agent, or a Contractor; and

- on appointing any other contractor, in order to ensure compliance with the provisions of the Act –

  - provide contractors who are tendering to perform construction work for the principal contractor, with the relevant sections of the health and safety specifications pertaining to the construction work which has to be performed;

  - ensure that potential contractors submitting tenders have made sufficient provision for health and safety measures during the construction process;

  - ensure that no contractor is appointed to perform construction work unless the principal contractor is reasonably satisfied that the contractor that he or she intends to appoint, has the necessary competencies and resources to perform the construction work safely;

[redacted]



- ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993;

- appoint each contractor in writing for the part of the project on the construction site

- take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained on the construction site;

- ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;

- stop any contractor from executing construction work which is not in accordance with the Client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons;

- where changes are brought about to the design and construction, make available sufficient health and safety information and appropriate resources to the contractor to execute the work safely;

- discuss and negotiate with the contractor the contents of their health and safety plan and finally approve that plan for implementation;

- ensure that a copy of both the principal contractor and contractor's health and safety plan is available on request to an employee, an inspector, a contractor, the Client, or the Client's Safety Agent;

- hand over a consolidated health and safety file to the Client upon completion of the construction work, to include a record of all drawings, designs, materials used and other similar information concerning the completed structure;

- in addition to the documentation required in the health and safety file include and make available a comprehensive and updated list of all the contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done;

- ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

A contractor must prior to performing any construction work-

- provide and demonstrate to the principal contractor a suitable and sufficiently documented health and safety plan, based on the relevant sections of the Client's health and safety specification and provided by the principal contractor, which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the contractor as work progresses;

- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, and which must be made available on request to an inspector, the Client, the Client's Safety Agent or the principal contractor;

- before appointing another contractor to perform construction work be reasonably satisfied that the contractor that he or she intends to appoint has the necessary competencies and resources to perform the construction work safely;

- co-operate with the principal contractor as far as is necessary to enable each of them to comply with the provisions of the Act;



[redacted]

- as far as is reasonably practicable, promptly provide the principal contractor with any information which might affect the health and safety of any person at work carrying out construction work on the site, any person who might be affected by the work of such a person at work, or which might justify a review of the health and safety plan.

Where a contractor appoints another contractor to perform construction work, the duties that apply to the principal contractor will apply to the contractor as if he or she were the principal contractor.

A principal contractor must take reasonable steps to ensure co-operation between all contractors appointed by the principal contractor to enable each of those contractors to comply with these Regulations.

No contractor may allow or permit any employee or person to enter any site unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.

A contractor must at all times keep on his or her construction site records of the health and safety induction training and such records must be made available on request to an inspector, the Client, the Client's Safety Agent or the Principal Contractor.

A contractor must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3 (a template of which can be found in the Construction Regulations, 2014).

2.2 Management and Supervision of Construction Work

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate must be appointed by the principal contractor. Proof of all-inclusive assessment of the Construction Manager's Competency in construction management and H & S competency must be available in the Safety File. The Construction Manager must, as a minimum, have a Construction Regulation course. No contractors may be left unsupervised on site by the principal contractor.

A principal contractor must upon having considered the size of the project, in writing appoint one or more assistant construction managers for different sections thereof: Provided that the designation of any such person does not relieve the construction manager of any personal accountability for failing in his or her management duties in terms of this regulation.

Where the construction manager has not appointed assistant construction managers, or, in the opinion of an inspector, a sufficient number of such assistant construction managers have not been appointed, that inspector must direct the construction manager in writing to appoint the number of assistant construction managers indicated by the inspector, and those assistant construction managers must be regarded as having been appointed.

No construction manager appointed in terms of the Regulations may manage any construction work on or in any construction site other than the site in respect of which he or she has been appointed.

A contractor must, after consultation with the Client and having considered the size of the project, the degree of danger likely to be encountered or the accumulation of hazards or risks on the site, appoint a full-time or part-time construction health and safety officer in writing to assist in the control of all health

[redacted]



and safety related aspects on the site: Provided that, where the question arises as to whether a construction health and safety officer is necessary, the decision of an inspector is decisive.

No contractor may appoint a construction health and safety officer to assist in the control of health and safety related aspects on the site unless he or she is reasonably satisfied that the construction health and safety officer that he or she intends to appoint is registered with a statutory body approved by the Chief Inspector and has necessary competencies and resources to assist the contractor

A construction manager must in writing appoint construction supervisors responsible for construction activities and ensuring occupational health and safety compliance on the construction site. Proof of all-inclusive assessment of the Construction Supervisor's competency in construction supervision and H&S competency must be available in the Safety File. The Construction Supervisor must, as a minimum, have a supervision course as per Unit Standard 262845 (Civil Engineering), 119080 (Building Construction) and 262884 (Civil Engineering).

A contractor must, upon having considered the size of the project, in writing appoint one or more competent employees for different sections thereof to assist the construction supervisor, and every such employee has, to the extent clearly defined by the contractor in the letter of appointment, the same duties as the construction supervisor: Provided that the designation of such employee does not relieve the construction supervisor of any personal accountability for failing in his or her supervisory duties.

Where the contractor has not appointed such an employee, or, in the opinion of an inspector, a sufficient number of such employees have not been appointed, that inspector must instruct the employer to appoint the number of employees indicated by the inspector.

No construction supervisor appointed may supervise any construction work on or in any construction site other than the site in respect of which he or she has been appointed: Provided that if a sufficient number of competent employees have been appropriately designated on all the relevant construction sites, the appointed construction supervisor may supervise more than one site.

2.3 Notification of Intention to Commence Construction Work

Not thought to be applicable to this project, unless blasting is undertaken..

2.4 Construction Work Permit

A client who intends to have construction work carried out, must at least 30 days before that work is to be carried out apply to the provincial director in writing for a construction work permit to perform construction work on projects that will –

1. exceed 365 days and will involve more than 3600 person days of construction work; or
2. the tender value limit is grade 7, 8 or 9 of the Construction Industry Development Board (CIDB) grading.

- Grade 7 = R60 000 000
- Grade 8 = R 200 000 000
- Grade 9 = No limit

A client may appoint a Construction Health and Safety Agent or Construction Health and Safety Manager to apply for this permit from the Provincial Director and construction work may not commence until the permit has been issued by the Provincial Director.

A copy of this permit will be required to be kept in the principal contractor's safety file, and the site specific number issued by the Provincial Director must be displayed at the site entrance.





A client may appoint a Construction Health and Safety Agent, or Construction Health and Safety Manager based on the scope and risk profile of construction work to represent him/her on matters of health and safety. Provided that, where the question arises as to whether a Construction Health Safety Agent or a Construction Health and Safety Manager is necessary, the decision of an inspector is decisive.

The following minimum documentation will be required during the permit application process:

- Principal Contractor's Health and Safety Plan CR 5(1)(m)
- Baseline Risk Assessment CR 5(1)(a)
- Appointed Principal Contractor's Letter for Good Standing as per CR 5(1)(j)
- Issue Register signed by Designer CR 5 (1)(c)
- Issue Register signed by Principal Contractor
- Declaration signed by Designer CR 5(1)(d) and CV
- Principal Contractor made adequate provision for the cost of health and safety measures (Bill of Quantities) CR 5(1)(g)
- Proof of Principal Contractor's competency and resources to carry out the construction work safely CR 5(1)(h)
- Appointment Letter for Construction Manager, CV, Certificates and List of projects
- Appointment Letter of Safety Officer & Safety Officer's Registration for SACPCMP
- Principal Contractor's Appointment Letter CR 5(1)(k), Company Profile and CIDB grading

After approval of the Construction Work Permit any changes made to the appointed persons on the annexure 1 must be submitted to Department of Labour for approval before the appointed persons are allowed to commence with their tasks.

PLEASE NOTE THAT THE CONSTRUCTION MANAGER (8(1)) NAMED ON THE CONSTRUCTION WORK PERMIT MUST BE THE SAME PERSON THAT ACTS AS THE CONSTRUCTION MANAGER ON SITE. IF THIS WILL NOT BE THE CASE FOR SOME REASON THEN THE SAFETY AGENT MUST BE NOTIFIED OF THE CHANGE BY THE PRINCIPAL CONTRACTOR AT LEAST 7 DAYS BEFORE THE CHANGE IS MADE SO THAT THE SAFETY AGENT CAN AMEND THE CONSTRUCTION WORK PERMIT APPLICATION AND ADVISE THE DEPARTMENT OF EMPLOYMENT AND LABOUR ACCORDINGLY.

2.5 Assignment of Contractor's Responsible Persons to Manage Health and Safety on Site

The Contractor shall submit management and supervisory appointments as well as any relevant appointments in writing (as stipulated by the Construction Regulations 2014 and the Occupational Safety and Health Act 1993), prior to commencement of work (refer to **Annexure B** at the end of this Health and Safety Specification).

2.6 Competency for Contractor's Responsible Persons

The Contractor's responsible persons shall be competent in health and safety and be familiar with the Occupational Health and Safety Act 1993, and applicable regulations. Valid proof of pertinent health and safety courses attended by such persons will be required to be presented to the Client.

2.7 Compensation of Occupational Injuries and Diseases Act 130 of 1993 (COIDA)

The successful Contractor shall submit to the Client a valid letter of good standing with the Compensation Insurer prior to appointment.



[redacted]

2.8 Occupational Health and Safety Policy

The Contractor shall submit their Health and Safety Policy, prior to construction commencement, signed by the Chief Executive Officer. The Policy must outline objectives and how they will be achieved and implemented within the company operations. The Policy must be communicated to all employees and proof thereof must be available in the Safety File.

2.9 Health and Safety Organogram

The Contractor shall submit an organogram, prior to construction commencement, outlining the Health and Safety Site Team that will be assigned to the project, if successful with the tender. In cases where appointments have not been made, the organogram shall reflect the position. The organogram shall be updated when there is a change in the site team.

2.10 Risk Assessments

Baseline Risk Assessment

The Client shall cause a baseline risk assessment to be conducted by a competent person before the design process and tender process commence, and the assessed risks shall form part of the health and safety specifications.

The Contractor must, before commencement of any construction work, and during construction work, have risk assessments performed by a competent person appointed in writing, which risk assessments form part of the health and safety plan to be applied on the site and must include:

- The identification of the risks and hazards to which persons may be exposed to;
- An analysis and evaluation of the risks and hazards identified; based on a documented method
- A documented plan and applicable safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;
- A monitoring plan; and
- A review plan

The Contractor must ensure that, as far as is reasonably practicable, ergonomic related hazards are analysed, evaluated, and addressed in a risk assessment.

The Contractor must ensure that all employees under his control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures and/or control measures **before any work commences** and thereafter **at the times determined in the risk assessment monitoring and review plan of the relevant site.**

The Principal Contractor must ensure that all contractors are informed regarding any hazard that is stipulated in the risk assessment **before any work commences** and thereafter **at the times determined in the risk assessment monitoring and review plan of the relevant site.**

The Contractor must consult with the health and safety committee or with a representative trade union or representative group of employees if no health and safety committee exists, on the monitoring and review of the risk assessments for the site.

The Contractor must ensure that copies of risk assessment for this site are available on site for inspection purposes by interested parties (inspector, the Client, Client's Safety Agent, any contractor, any employee, a representative trade union, a health and safety representative or safety committee member.

A Contractor must review the relevant risk assessment where changes are effected to the design and/or construction that result in a change to the risk profile, or when an incident has occurred.

[redacted]

[redacted]

Preventative measures must first address the elimination of the hazard or risk. Should PPE be required to reduce risk, the equipment or clothing to be used must be SABS approved.

In general, the Contractor must ensure that the Risk Assessment involves identifying the hazards present in a work activity on site. This is followed by an evaluation of the extent of the risk involved taking into account those precautions already being taken.
The following general principle should be followed when conducting a risk assessment:

- All relevant risks and/or hazards should be systematically addressed;
- The risk assessment should address what actually happens in the workplace during the work activity;
- All employees and those who may be affected must be considered, including maintenance staff, security guards, visitors, and Contractors;
- The risk assessment should highlight those groups and individuals who may be required to work alone or who have disabilities;
- The risk assessment process should take into account the existing safety measures and controls.
- The level of detail on a risk assessment should be appropriate to the level of risk.

2.11 Health and Safety Representative(s)

The Contractor shall ensure that Health and Safety Representative(s) is/are elected and trained to carry out his / her functions. The Safety Representative(s) must be democratically nominated, elected, and appointed in writing. The Health and Safety Representative(s) shall carry out regular inspections, keep records and report to the supervisor to take appropriate action. The Safety Representative(s) shall attend Health and Safety Committee Meetings. The Health and Safety Representative shall be part of the team that will investigate incidents, accidents, and non-conformances. The Safety Representative(s) must be (a) full time employee(s) who is/are acquainted with conditions and activities at that workplace or section thereof. The Safety Representatives must have Safety Representative training and must be capable of performing their duties.

2.12 Health and Safety Committee

Where two or more health and safety representatives have been appointed on site, the Contractor shall ensure that monthly health and safety meetings are held with such representatives and minutes are kept on record. Meetings must be organized and chaired by the Contractor's Health and Safety Committee Chairperson. Minutes of these meetings must be available for the employees of the contractor to refer to.

PLEASE NOTE THAT THE SAFETY AGENT MAY REQUIRE THAT THE PRINCIPAL CONTRACTOR CONVENES A SAFETY COMMITTEE MEETING ON SITE IN THE INTERESTS OF HEALTH AND SAFETY ON SITE. SUCH COMMITTEE MEETING MAY REQUIRE ATTENDANCE OF CONTRACTORS SAFETY OFFICERS/SAFETY REPRESENTATIVES, CONSTRUCTION SUPERVISION AND THE SAFETY AGENT.

2.13 Medical Certificate of Fitness

The contractor must ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template (refer to the Construction Regulations 2014 on the Department of Labour website for a sample of this form).

Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template.

[redacted]

[redacted]

2.14 Health and Safety Training

The Contractor shall quarterly conduct a training needs analysis to ascertain what health and safety training is required. A plan of action should be devised and forwarded to the Client for records. Once the identified people have attended the training, the Contractor must provide the Client with copies of certificates obtained.

2.14.1 Induction

No Contractor may allow or permit any employee or person to enter site unless they have undergone health and safety induction training pertaining to the hazards prevalent on site at the time of entry. This includes visitors to site. The Contractor must ensure that visitors to site have the necessary protective equipment (PPE). A copy of attendance registers of all employees who attend inductions shall be kept.

2.14.2 Awareness

The Contractor shall conduct periodic toolbox talks on site, weekly or before any hazardous work takes place. The talks shall cover the relevant activity and an attendance register must be signed by all attendees. This record of who attended and the content of the topic will be kept on the site health a safety file as evidence of training.

2.15 Competency

After the Contractor has identified the training to be conducted as part of the competency requirement, and based on Risk Assessment, he shall send the relevant persons on appropriate courses and keep certificates of training for reference. Familiarity with the Health and Safety Act and Regulations is an integral part of the definition of competence. All training must be conducted by an accredited training provider and the certificates must display the applicable unit standards and the expiry dates thereof.

2.16 General Record Keeping

The Contractor shall keep and maintain Health and Safety records to demonstrate compliance with the Health and Safety Specification and the Occupational Health and Safety Act. The contractor shall ensure that all records of incidents, spot fines, training, etc. are kept on site. All documents shall be available for inspection by the Client, or the Department of Labour's Inspectors.

2.17 General Inspection, Monitoring and Reporting

The Contractor shall carry out inspections as required by this Health and Safety Specification, as well as by health and safety legislation.

2.18 Emergency Procedures

The Contractor shall submit a detailed Emergency Procedure for approval by the Client prior to commencement on site. The procedure shall detail the response plan including the following:

- List of key personnel;
- Details of emergency services;
- Actions or steps to be taken in the event of the emergency; and
- Information on hazardous materials / situations, including each material's hazardous potential impact or risk on the environment or human and measures to be taken in the event of an accident.

Emergency procedure(s) shall include, but shall not be limited to, fire, spills, accidents to employees, use of hazardous substances, dangers as a result of riot / service delivery protests / intimidation, etc. The Contractor shall advise the Client in writing of any on-site emergencies, together with a record of action

[redacted]



taken, within 24 hours of the emergency occurring. A contact list of all service providers (Fire Department, Ambulance, Police, Medical and Hospital, etc.) must be maintained and available to site personnel.

2.19 First Aid Box and First Aid Equipment

The Contractor shall provide first aid box/es and appoint, in writing, First Aider(s) for this project in line with the results of the Contractor's risk assessment for the project, this health and safety specification as well as the provisions of the General Safety Regulations. The appointed First Aider(s) are to be sent for accredited first aid training before starting on site. Valid certificates are to be kept on site.

- First Aid box/es must be adequately stocked at all times, accessible and be controlled by a qualified First Aider.
- Perishables to be checked and replaced when expired.
- Stock per content list as per the General Safety Regulations Annexure.
- Signage to be in place.
- To be numbered and sealed with name of first aider on or above the First aid box.
- Dressing logbook to be available in the first aid box.
- If more than 5 employees are present, there must be a first aid box available.
- Register to be checked by a Competent person.

If required by the Client, the Contractor shall have a stretcher on site to be used in case of a serious incident.

2.20 Accident / Incident Reporting and Investigation

The Contractor shall, in addition to the prescribed requirements of the Occupational Health and Safety Act and General Safety Regulations, investigate, record, and report all Section 24 reportable incidents to the Client within 24 hours of the incident occurring. Incident investigations shall be conducted by the Contractor's appointed Accident Investigator – this Investigator must be a competent person or persons who have sufficient knowledge to carry out an investigation.

In the event of a fatality or a permanent disabling injury the Contractor must submit proof of reporting of incident to Department of Labour as well as proof of preventative measures to the Client. The Client reserves the right to conduct investigations into any incidents that they deem fit and the Contractor is required to provide full co-operation in this regard.

2.21 Hazards and Potential Situations

The Contractor shall immediately notify other Contractors of any hazardous or potentially hazardous situations, which may arise during performance of the activities.

2.22 Occupational Health and Safety Signage

The Contractor shall ascertain and provide adequate on site health and safety signage. This signage shall include, but shall not be limited to, Hard Hat / Helmet Area; Safety Shoes to be worn on site; Dust Masks to be worn in areas where there might be exposure to excessive dust; Ear Plugs / Muffs to be worn where there might be noise exposure over 85 dB; Gloves; Safety Goggles; Safety Harness, Workers in Excavation, traffic management, etc. The Contractor shall be responsible to maintain the quality and replacement of signage. Signage must comply with the requirements of SABS.

2.23 Management of Contractors by Principal Contractor

The Principal Contractor shall ensure that all contractors under his control are complying with the respective Health and Safety Plans, as well as Health and Safety Legislation.



[redacted]

2.24 Stacking of Materials

In addition to the provisions for the stacking of articles in the General Safety Regulations, 2003, the contractor must ensure that –

- a competent person is appointed in writing with the duty of supervising all stacking and storage on a construction site;
- adequate storage areas are provided;
- there are demarcated storage areas; and
- storage areas are kept neat and under control.

2.25 Housekeeping and General Safeguarding on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, promulgated by Government Notice No. R. 2281 of 16 October 1987, ensure that suitable housekeeping is continuously implemented on each construction site, including-

- the proper storage of materials and equipment;
- the removal of scrap, waste and debris at appropriate intervals;
- ensuring that materials required for use, are not placed on the site so as to obstruct means of access to and egress from workplaces and passageways;
- ensuring that materials which are no longer required for use, do not accumulate on and are removed from the site at appropriate intervals;
- ensuring that waste and debris are not disposed of from a high place with a chute, unless the chute complies with the requirements set out in the regulations;
- ensuring that construction sites in built-up areas adjacent to a public way are suitably and sufficiently fenced off and provided with controlled access points to prevent the entry of unauthorized persons; and
- ensuring that a catch platform or net is erected above an entrance or passageway or above a place where persons work or pass under or fencing off the danger area if work is being performed above such entrance, passageway, or place so as to ensure that all persons are kept safe in the case of danger or possibility of persons being struck by falling objects.

2.26 Construction Vehicles and Mobile Plant

A contractor must ensure that all construction vehicles and mobile plant-

- are of an acceptable design and construction;
- are maintained in a good working order;
- are used in accordance with their design and the intention for which they were designed, having due regard to safety and health;
- are operated by a person who-
    - has received appropriate training, is certified competent and in possession of proof of competency and is authorised in writing to operate those construction vehicles and mobile plant;
    - has a medical certificate of fitness to operate those construction vehicles and mobile plant, issued by an occupational health practitioner in the form of Annexure 3.
- have safe and suitable means of access and egress;
- are properly organized and controlled in any work situation by providing adequate signalling or other control arrangements to guard against the dangers relating to the movement of vehicles and plant, in order to ensure their continued safe operation;
- are prevented from falling into excavations, water, or any other area lower than the working surface by installing adequate edge protection, which may include guard-rails and crash barriers;
- are fitted with structures designed to protect the operator from falling material or from being crushed should the vehicle or mobile plant overturn;
- are equipped with an acoustic warning device which can be activated by the operator;

[redacted]



- are equipped with an automatic acoustic reversing alarm;
- are equipped with fire extinguishers (2.5 – 4.5 kg); and
- are inspected by the authorised operator or driver on a daily basis using a relevant checklist prior to use and that the findings of such inspection are recorded in a register kept in the construction vehicle or mobile plant.

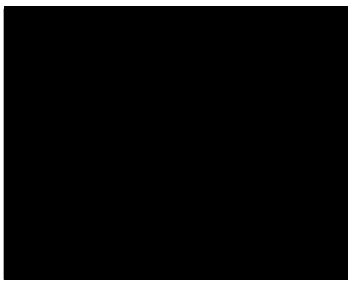
A contractor must ensure that-

- no person rides or is required or permitted to ride on a construction vehicle or mobile plant otherwise than in a safe place provided thereon for that purpose;
- every construction site is organized in such a way that, as far as is reasonably practicable, pedestrians and vehicles can move safely and without risks to health;
- the traffic routes are suitable for the persons, construction vehicles or mobile plant using them, are sufficient in number, in suitable positions and of sufficient size;
- every traffic route is, where necessary, indicated by suitable signs;
- all construction vehicles and mobile plant left unattended at night, adjacent to a public road in normal use or adjacent to construction areas where work is in progress, have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, in order to identify the location of the vehicles or plant;
- all construction vehicles or mobile plant when not in use, have buckets, booms, or similar appendages, fully lowered, or blocked, controls in a neutral position, motors stopped, wheels chocked, brakes set, and ignition secured;
- whenever visibility conditions warrant additional lighting, all mobile plant are equipped with at least two headlights and two taillights when in operation;
- tools, material, and equipment are secured and separated by means of a physical barrier in order to prevent movement when transported in the same compartment with employees;
- vehicles used to transport employees have seats firmly secured and adequate for the number of employees to be carried; and
- all construction vehicles or mobile plant travelling, working, or operating on public roads comply with the requirements of the National Road Traffic Act, 1996.
- all plant and vehicles are be fitted with amber rotating beacons and reverse alarms.
- ALL construction site vehicles must be inspected daily especially if it has dangerous "items" (fuel, explosives, etc.) on vehicle, completed inspection registers must also be available for inspection.
- the vehicles must resemble the original manufacturer's product. Levers, alarms, and amber lights to be fitted to construction vehicle for notification of vehicle.
- fire extinguishers, signage, and licence disc to be correctly mounted and displayed.
- when the vehicle is stationary no key to be left in or on vehicle or plant.
- Drip tray must be present when stationary.

2.27 Electrical Installations and Machinery on Construction Sites

A contractor must, in addition to compliance with the Electrical Installation Regulations and the Electrical Machinery Regulations, ensure that –

- before construction commences and during the progress thereof, adequate steps are taken to ascertain the presence of and guard against danger to workers from any electrical cable or apparatus which is under, over or on the site;
- all parts of electrical installations and machinery are of adequate strength to withstand the working conditions on construction sites;
- the control of all temporary electrical installations on the construction site is designated to a competent person who has been appointed in writing for that purpose;
- all temporary electrical installations used by the contractor are inspected at least once a week by a competent person and the inspection findings are recorded in a register kept on the construction site; and
- all electrical machinery is inspected by the authorized operator or user on a daily basis using a relevant checklist prior to use and the inspection findings are recorded in a register kept on the construction site.





2.28 Use and Temporary Storage of Flammable Liquids on Construction Sites

A contactor must, in addition to compliance with the provisions for the use and storage of flammable liquids in the General Safety Regulations, 2003, ensure that –

- where flammable liquids are being used, applied, or stored at the workplace concerned, it is done in a manner that does not cause a fire or explosion hazard, and that the workplace is effectively ventilated;
- no person smokes in any place in which flammable liquid is used or stored, and the contractor must affix a suitable and conspicuous notice at all entrances to any such areas prohibiting such smoking;
- an adequate amount of efficient fire-fighting equipment is installed in suitable locations around the flammable liquids store with the recognized symbolic signs;
- only the quantity of flammable liquid needed for work on one day is taken out of the store for use;
- all containers holding flammable liquids are kept tightly closed when not in actual use and, after their contents have been used up, are removed from the construction site and safely disposed of;
- where flammable liquids are decanted, the metal containers are bonded and earthed; and
- no flammable material, including cotton waste, paper, cleaning rags or similar material is stored together with flammable liquids
- proper containers are to be used for fuel. Marked and labelled as per the content.
- diesel on site; more than 800 litres must have a certificate, fire safe certificate. Locked in a ventilated, secure area with a drip tray and have a designated, responsible person to use it.

2.29 Water environments

A contractor must ensure that where construction work is done over or in close proximity to water, provision is made for –

- preventing persons from falling into water; and
- the rescuing of persons in danger of drowning.

A contractor must ensure that where a person is exposed to the risk of drowning by falling into the water, the person is provided with and wears a lifejacket.

2.30 Fire precautions on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, ensure that –

- all appropriate measures are taken to avoid the risk of fire;
- sufficient and suitable storage is provided for flammable liquids, solids, and gases;
- smoking is prohibited and notices in this regard are prominently displayed in all places containing readily combustible or flammable materials;
- in confined spaces and other places in which flammable gases, vapours or dust can cause danger-
  - only suitably protected electrical installations and equipment, including portable lights, are used;
  - there are no flames or similar means of ignition;
  - there are conspicuous notices prohibiting smoking;
  - oily rags, waste, and other substances liable to ignite are without delay removed to a safe place; and
  - adequate ventilation is provided;
- combustible materials do not accumulate on the construction site;
- welding, flame cutting, and other hot work are done only after appropriate precautions have been taken to reduce the risk of fire;
- suitable and sufficient fire-extinguishing equipment is placed at strategic locations or as may be recommended by the Fire Chief or local authority concerned, and that such equipment is maintained in a good working order;



- the fire equipment contemplated above is inspected by a competent person, who has been appointed in writing for that purpose, in the manner indicated by the manufacturer thereof;
- a sufficient number of workers are trained in the use of fire-extinguishing equipment;
- where appropriate, suitable visual signs are provided to clearly indicate the escape routes in the case of a fire;
- the means of escape is kept clear at all times;
- there is an effective evacuation plan providing for all -
  - persons to be evacuated speedily without panic;
  - persons to be accounted for; and
  - plant and processes to be shut down; and
- a siren is installed and sounded in the event of a fire.

2.31 Construction Employees' Facilities

A contractor must, in terms of the Construction Regulations 2014, provide:

- Shower facilities after consultation with the employees or employees' representatives, or at least one shower facility for every 15 persons;
- at least one sanitary facility for each sex and for every 30 workers;
- Toilets to be within walking distance
- Hygiene registers to be completed
- Proof of safe disposal of effulgent waste disposal certificates to be obtained
- changing facilities for each sex;
- and sheltered/shaded eating area.
- Protection from the Elements and raised off the ground.
- Every employer shall provide sanitary facilities at the workplace in accordance with the provisions of Parts F, P and Q of the National Building Regulations.
- Sufficient clean water for all employees. 500ml to each employee every hour.

A contractor must provide reasonable and suitable living accommodation for the workers at construction sites who are far removed from their homes and where adequate transportation between the site and their homes, or other suitable living accommodation, is not available.

2.32 Fall protection

The Contractor must:

- designate a competent person to be responsible for the preparation of a fall protection plan
- ensure that the fall protection plan contemplated above is implemented, amended where and when necessary and maintained as required; and
- take steps to ensure continued adherence to the fall protection plan.

A fall protection plan contemplated above must include-

- a risk assessment of all work carried out from a fall risk position and the procedures and methods used to address all the risks identified per location;
- the processes for the evaluation of the employees' medical fitness necessary to work at a fall risk position and the records thereof;
- a programme for the training of employees working from a fall risk position and the records thereof;
- the procedure addressing the inspection, testing, and maintenance of all fall protection equipment; and
- a rescue plan detailing the necessary procedure, personnel and suitable equipment required to affect a rescue of a person in the event of a fall incident to ensure that the rescue procedure is implemented immediately following the incident.

[redacted]

A Contractor must ensure that a construction manager appointed under regulation 8(1) is in possession of the most recently updated version of the fall protection plan.

A Contractor must ensure that all unprotected openings in floors, edges, slabs, hatchways, and stairways are adequately guarded, fenced, or barricaded or that similar means are used to safeguard any person from falling through such openings;

Also that no person is required to work in a fall risk position, unless such work is performed safely as contemplated in above and fall prevention and fall arrest equipment are approved as suitable and of sufficient strength for the purpose for which they are being used, having regard to the work being carried out and the load, including any person, they are intended to bear; and securely attached to a structure or plant, and the structure of plant and the means of attachment thereto are suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and person who could fall, and fall arrest equipment is used only where it is not reasonably practicable to use fall prevention equipment.

2.33 Temporary works

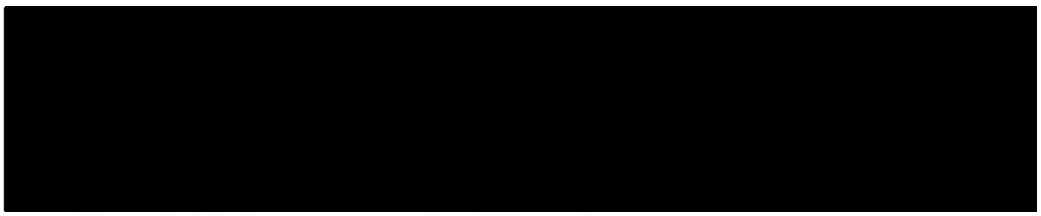
A contractor must appoint a temporary works designer in writing to design, inspect and approve the erected temporary works on site before use.

A contractor must ensure that all temporary works operations are carried out under the supervision of a competent person who has been appointed in writing for that purpose.

A contractor must ensure that-

- all temporary works structures are adequately erected, supported, braced and maintained by a competent person so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them, and that no loads are imposed onto the structure that the structure is not designed to withstand;
- all temporary works structures are done with close reference to the structural design drawings, and where any uncertainty exists the structural designer should be consulted;
- detailed activity specific drawings pertaining to the design of temporary works structures are kept on the site and are available on request to an inspector, other contractors, the Client, the Client's Safety Agent, or any employee;
- all persons required to erect, move, or dismantle temporary works structures are provided with adequate training and instruction to perform those operations safely;
- all equipment used in temporary works structure are carefully examined and checked for suitability by a competent person, before being used;
- all temporary works structures are inspected by a competent person immediately before, during and after the placement of concrete, after inclement weather or any other imposed load and at least on a daily basis until the temporary works structure has been removed and the results have been recorded in a register and made available on site;
- no person may cast concrete, until authorization in writing has been given by the competent person contemplated above;
- if, after erection, any temporary works structure is found to be damaged or weakened to such a degree that its integrity is affected, it is safely removed or reinforced immediately;
- adequate precautionary measures are taken in order to-
  - secure any deck panels against displacement; and
  - prevent any person from slipping on temporary works due to the application of release agents;
- as far as is reasonably practicable, the health of any person is not affected through the use of solvents or oils or any other similar substances;
- upon casting concrete, the temporary works structure is left in place until the concrete has acquired sufficient strength to safely support its own weight and any imposed load, and is not removed until authorization in writing has been given by the competent person
- the foundation conditions are suitable to withstand the loads caused by the temporary works structure and any imposed load in accordance with the temporary works design.
- provision is made for safe access by means of secured ladders or staircases for all work to be carried out above the foundation bearing level;

[redacted]



- a temporary works drawing, or any other relevant document includes construction sequences and methods statements;
- the temporary works designer has been issued with the latest revision of any relevant structural design drawing;
- a temporary works design and drawing is used only for its intended purpose and for a specific portion of a construction site; and
- the temporary works drawings are approved by the temporary works designer before the erection of any temporary works.

No contractor may use a temporary works design and drawing for any work other than its intended purpose.

2.34 Excavation

A contractor must-

- ensure that all excavation work is carried out under the supervision of a competent person who has been appointed in writing for that purpose; and
- evaluate, as far as is reasonably practicable, the stability of the ground before excavation work begins.

A contractor who performs excavation work-

- must take reasonable and sufficient steps in order to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation;
- may not require or permit any person to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where-
  - the sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or
  - such an excavation is in stable material: Provided that-
    - permission has been given in writing by the appointed competent person contemplated above upon evaluation by him or her of the site conditions; and
    - where any uncertainty pertaining to the stability of the soil still exists, the decision from a professional engineer or a professional technologist competent in excavations is decisive and such a decision must be noted in writing and signed by both the competent person and the professional engineer or technologist, as the case may be;
- must take steps to ensure that the shoring or bracing contemplated above is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question;
- must ensure that no load, material, plant or equipment is placed or moved near the edge of any excavation where it may cause its collapse and consequently endangers the safety of any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing;
- must ensure that where the stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons;
- must cause convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six metres from the point where any worker within the excavation is working;
- must ascertain, as far as is reasonably practicable, the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed, and must before the commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all persons involved;
- must ensure that every excavation, including all bracing and shoring, is inspected-
  - daily, prior to the commencement of each shift;
  - after every blasting operation;



[redacted]

- after an unexpected fall of ground;
- after damage to supports; and
- after rain,

by the competent person, in order to ensure the safety of the excavation and of persons, and those results must be recorded in a register kept on site and made available on request to an inspector, the Client, the Client's Safety Agent, any other contractor or any employee;

- must cause every excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, to be –
  - adequately protected by a barrier or fence of at least one metre in height and as close to the excavation as is practicable; and
  - provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor, or have resort to any other suitable and sufficient precautionary measure where this is not practicable;
- must ensure that all precautionary measures stipulated for confined spaces as determined in the General Safety Regulations, 2003, are complied with by any person entering any excavation;
- must, where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and must ensure that a method statement is developed by that person in accordance with the applicable explosive's legislation; and
- must cause warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections or tests.

2.35 Demolition Work

Not thought to be applicable to this project.

2.36 Tunnelling

Not thought to be applicable to this project.

2.37 Scaffolding

A contractor must appoint a competent person in writing who must ensure that all scaffolding work operations are carried out under his or her supervision and that all scaffold erectors, team leaders and inspectors are competent to carry out their work as per the SANS 10085 of 2004.

A contractor using access scaffolding must ensure that such scaffolding, when in use, complies with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act and SANS 10085. Scaffold must be;

- Level and balanced upon the correct footing such as base jacks, U-Jacks, and mobile wheels
- Have the correct Ledgers and bracing methods to secure the frames and Standards
- To be fully boarded with the correct edge protection on both the 0.500m and 1 metre height per working platforms.
- Working platforms to be in accordance with the Tables 4 and 5 of the SANS 10085 for weight restrictions
- Have the correct access that is fitted within the scaffold and grants access to the working platforms and must be fitted with a trap door system.
- Secured with fastening methods such Reveal and fixed ties according to table 7 of SANS 10085. Buttresses to be used when required.
- signage must be displayed to indicate if the scaffold is safe or unsafe to use.
- Trestles to be built in accordance to section 10.16.1 of the SANS 10085 and safety requirements to be met by the scaffolding inspector and scaffold supervisors on site.

2.38 Bulk mixing plant

Not thought to be applicable to this project.

[redacted]

[redacted]

2.39 Rope Access Work

Not thought to be applicable to this project.

2.40 Hazardous Chemical Substances (HCS)

In addition to the requirements in the HCS Regulations, the principal contractor must provide proof in the Health and Safety Plan that:

- Material Safety Data Sheets (MSDS's) of the relevant materials / hazardous chemical substances are available prior to use by the contractor. All MSDS's shall be available for inspection by the agent at all times.
- Risk assessments are done at least once every 6 months.
- Exposure monitoring is done according to OESSM and by an Approved Inspection Authority (AIA) and that the medical surveillance programme is based on the outcomes of the exposure monitoring.
- How the relevant HCS's are being/going to be controlled by referring to:
  - Limiting the amount of HCS
  - Limiting the number of employees
  - Limiting the period of exposure
  - Substituting the HCS
  - Using engineering controls
  - Using appropriate written work procedures
- The correct PPE is being used.
- HCS are stored and transported according to SABS 072 and 0228.
- Training with regards to these regulations was given.

The Health and Safety plan should make reference to the disposal of hazardous waste on classified sites and the location thereof (where applicable).

The First Aider must be made aware of the MSDS and trained in how to treat HCS incidents appropriately.

2.41 Noise Induced Hearing Loss

Where noise is identified as a hazard the requirements of the NIHL regulations must be complied with and the following must be included / referred to in the Health and Safety Plan:

- Proof of training with regards to these regulations.
- Risk assessment done within 1 month of commencement of work.
- That monitoring carried out by an AIA and done according to SABS 083.
- Medical surveillance programme established and maintained for the necessary employees.
- Control of noise by referring to:
- Engineering methods considered
- Admin control (number of employees exposed) considered
- Personal protective equipment considered/decided on
- Describe how records are going to be kept for 40 years.

2.42 Explosives and Blasting

The Contractor shall ensure that the use of explosives and blasting (where required) be undertaken by a specialist contractor or a Contractor with proven track record in the type of work to be performed.

[redacted]



The Contractor may only use explosives for work purposes where the following conditions in place:

- Explosives Regulations to be complied with in all respects.
- Contractor must be in possession of a Blasting Licence
- Blasting permit to be obtained
- Permit to transport explosives to be obtained
- Method statement to be drawn up and approved by professional team
- Municipal authorities may require advance notice of planned use of explosives
- Contractor must notify Provincial Director of Department of Labour on Annexure 2 at least 7 days prior to blasting taking place
- Contractor must have Workman's Compensation and appropriate insurances in place

2.43 Personal Protective Equipment (PPE)

The Contractor shall carry out PPE or clothing needs analysis in accordance with his risk assessment, to determine the necessary PPE or clothing to be used during construction. The Contractor shall make provision to keep adequate quantities of appropriate, SABS approved PPE or clothing on site at all times.

The Contractor must ensure that personnel are trained in the correct use of PPE to be used.

The Contractor must ensure that lost, stolen, worn out or damaged PPE is replaced as required and receipt signed for by employees on site.

2.44 Asbestos

The Contractor shall ensure that all asbestos work is done only by registered "Asbestos Contractor" as prescribed by the Asbestos Abatement Regulations, 2020 and in accordance with said Regulations. The Contractor shall submit an Asbestos Certificate from Department of Labour which refer to the prescribed requirements. The Contractor shall notify the Client if there are any asbestos materials encountered on site that have not been advised to be present on site by the Client or Professional Team.

"asbestos clearance certificate" means a written document verifying that the regulated asbestos fibre concentration in the air meets the clearance indicator;

"type 1 asbestos work" means:
(a) painting of asbestos cement products in a manner that does not require surface preparation and does not cause the release of asbestos fibres; or

(b) the removal of less than 10 square metres of asbestos cement products or equivalent gutters and piping or asbestos insulating board, where removal work may not be repeated on the same site within a period of six months; and does not require registration as a registered asbestos contractor with the chief inspector;

"type 2 asbestos work" means:
(a) the repair or encapsulation of asbestos cement products in a manner that does not require surface preparation; or

(b) the removal of asbestos cement products or asbestos insulating board; and, requires registration as a type 2 registered asbestos contractor with the chief inspector;

"type 3 asbestos work" means:
(a) the removal, repair or encapsulation of any asbestos and asbestos-containing material; and, requires registration as a type 3 registered asbestos contractor with the chief inspector;





Besides the requirements listed above, should asbestos be identified as a hazard at the workplace, the contractor must, as per AAR 2020, include the following in the health and safety plan/file and must be implemented on site:

- An asbestos risk assessment must be carried out, as far as is reasonably practicable, immediately by a competent person and thereafter at intervals not exceeding 24 months.
- If asbestos-containing materials are identified a written asbestos management plan for the workplace must be prepared by a competent person.
- Train Employees, visitors and persons who may have incidental asbestos exposure to asbestos.
- The Chief Director: Provincial Operations must be notified as per the Annexure 2 when asbestos work will be done, at least seven days prior to commencement of work.
- The contractor may only undertake the type of asbestos work for which they are registered by the chief inspector.
- Must appoint an occupational health and safety representative as contemplated in section 17 of the Act.
- Submit the approved plan of work to the Chief Director: Provincial Operations at least seven days prior to commencement of asbestos work.
- Appoint an asbestos removal supervisor for each asbestos work site.
- Adhere to the repair or removal methodology and associated control measures provided in the plan of work approved for that specific asbestos work.
- Ensure that the employee medical and training records are available on site for inspection and validation.
- Keep employee information for a minimum period of 50 years.
- For type 2 and type 3 asbestos work, ensure that air monitoring is in place.
- All asbestos contractor employees must be put under medical surveillance.
- Close off all asbestos containing or affected areas.
- The contractor must provide the required PPE, washing facilities and decontamination facilities as per the type of asbestos work.
- A document must be obtained from the asbestos disposal site for all asbestos waste removed from the workplace; all asbestos waste is disposed of only on sites specifically designated for this purpose
- When all asbestos is removed an inspection must be done by and approved inspection authority and an asbestos clearance certificate issued.
- Comply with the Prohibitions in regulation 24.

2.45 Pressure Vessels (Including Gas Bottles)

The Contractor shall comply with Pressure Vessel Regulations, including:

- Providing competency and awareness training to the operators;
- Providing PPE or clothing;
- Providing and maintain appropriate signage in areas where pressure vessels are used, as applicable;
- Inspect equipment regularly and keep records of inspections;
- Providing appropriate firefighting equipment (Fire Extinguishers).
- Under pressure vessels to have the following in place;
    - Service date
    - Seals on valves with no leaks and not broken
    - flash arrestors
    - Should be stored and chained together
    - Oxygen / Acetylene bottles to have clips
    - Signage to be visible
    - Gauges in working condition and be visible
    - Permits for use
    - Pressure equip Regs 6. (1) The user shall ensure that the pressure equipment is operated and maintained within its design and operating parameters.



[redacted]

2.46 Fire Extinguishers and Fire Fighting Equipment

The Contractor shall provide adequate, regularly serviced fire extinguishers located at strategic points on site. The Contractor shall keep spare serviced portable fire extinguishers. The Contractor shall have adequate persons trained or competent to use the Fire Fighting Equipment.

Safety signage shall be posted up in all areas where fire extinguishers are located.

2.47 Lifting Machinery and Tackle

The Contractor shall ensure that lifting machinery and tackle is inspected before use and on a monthly basis. The Contractor shall have lifting machinery and tackle inspector who will inspect the equipment at intervals required by the Driven Machinery Regulations, taking into account that:

- All lifting machinery and tackle have a safe working load clearly indicated
- Regular inspection and servicing is carried out
- Records are kept of inspections and of service certificates
- Thorough examinations are carried out by competent personnel at the frequencies required by legislation
- There is proper supervision in terms of guiding the loads which includes a trained banks man to direct and check lifting tackle if it is safe for use
- Forklift to be inspected every year and lift plan every 2 years
- Load test certificate to be no older than 6 months
- Sufficient props to be used and max weight to be displayed
- Slings to be checked with regard to integrity, chains, serial numbers, checked for tears, cuts links and all other materials
- Hooks to be oiled, not in a fixed position and closed to prevent materials from slipping/falling off
- Lifting equipment must be used for the scope of work carried out

2.48 Ladders and Ladder work

The Contractor shall ensure that all ladders are numbered and inspected regularly keeping record of inspections. It should be noted that Aluminium ladders are preferred to wooden ladders.

2.49 General Machinery

The Contractor shall comply with the Driven Machinery Regulations, which include inspecting machinery regularly, appointing a competent person to inspect and ensure maintenance, issuing PPE or clothing and training those that use machinery and enforce compliance.

2.50 Portable Electrical Tools

The Contractor shall ensure that use and storage of all explosive actuating fastening devices and portable electrical tools are in compliance with relevant legislation.

The Contractor shall consider that:

- A competent person undertakes routine inspections;
- Only authorised persons use the tools;
- There are safe working procedures applied;
- Awareness training is carried out and compliance is enforced at all times; and
- PPE and clothing is provided and maintained.

[redacted]

[redacted]

2.51 High Voltage Electrical Equipment

The Contractor shall ensure that, where the work is under, on or near high-voltage electrical equipment the Electrical Installation Regulations, together with safety instructions (Regulations of the Owner of the Equipment) are complied with. Such equipment includes:

- Eskom and the Local Authority equipment
- The Contractor's own power supply; and
- Electrical equipment being installed but not yet taken over from a Contractor by The Client.

2.52 Public Health and Safety

The Contractor shall ensure that each person working on or visiting a site, and the surrounding community, shall be made aware of the dangers likely to arise from onsite activities and the precautions to be observed to avoid or minimize those dangers. Appropriate health and safety signage shall be posted at all times.

2.53 Night Work

The Contractor shall not undertake any night work without prior arrangement and a written permit from the Client. The Contractor shall ensure that adequate lighting is provided for all night work and failure to do so shall result in work being stopped.

2.54 Environmental Conditions and Flora and Fauna

The Contractor must be mindful of adverse weather conditions upon the health and safety of the workforce. This includes inclement weather, strong wind, heat stress, extreme cold, etc. The Contractor's risk assessment process must take into account the risks associated with such weather conditions. The same is true when working in an environment where there is a risk to employees' health and safety from presence of poisonous flora, or wildlife (including bees, snakes, etc). The Contractor's risk assessment process must take these risks into account.

2.55 Occupational Health

Exposure of workers to occupational health hazards and risks are quite common in any work environment, especially in construction. Occupational health hazards and risks exposure is a major problem and all Contractors are to ensure that proper health and hygiene measures are put in place to prevent exposure to these hazards and risks.

The occupational hazards and risks may enter the body in three ways:

- Inhalation through breathing e.g. cement dust;
- Ingestion through swallowing maybe through food intake;
- Absorption through the skin (pores) e.g. painting or use of thinners.

The contractor is required to ensure that all his personnel are medically fit prior to being allowed onto the work site.

All Contractors should ensure that Occupational Hygiene surveys are conducted as per the Occupational Health and Safety Act to ensure employees are not exposed to hazards. Risk Assessments should identify areas where surveys are to be conducted.

2.56 Suspended Platforms

Not thought to be applicable to this project.

[redacted]

[redacted]

2.57 Material Hoists

Not thought to be applicable to this project.

2.58 Explosive Actuated Fastening Device

Not thought to be applicable to this project.

2.59 Confined Spaces

Confined space work must be closely monitored by a competent person appointed by the contractor, to include, but not restricted to, ensuring that the confined space is sufficiently ventilated prior to entry. Oxygen levels to be tested in confined space to ensure that it is safe for entry. Permit system to be in place to declare confined space safe for entry prior to entry. PPE must be worn (such as proper masks) if air supply is insufficient or not of sufficient quality.

Sufficient training must take place in use of all confined space monitoring and access equipment prior to any works commencing in such confined space. It is strongly recommended that a tripod and winch system be in place to afford easy access and egress and for emergency evacuation from the confined space (manholes and chambers). Please also refer to GSR5 on safety requirements for Work in Confined Spaces.

General safety Regulations 5.
(1) An employer or a user of machinery shall take steps to ensure that a confined space is entered by an employee or other person only after the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof, and who has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

(2) Where the provisions of sub regulation (1) cannot be complied with the employer or user of machinery, as the case may be, shall take steps to ensure that any confined space in which there exists or is likely to exist a hazardous gas, vapour, dust or fumes, or which has or is likely to have, an oxygen content of less than 20 per cent by volume, is entered by an employee or other person only when-- (a) subject to the provisions of sub regulation (3), the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken; and (b) the confined space has been isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a valve or a cock, or, if this is not practicable, only when all valves and cocks which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.
(3) Where the provisions of sub regulation (2)(a) cannot be complied with, the employer or user of machinery shall take steps to ensure that the confined space in question is entered only when the employee or person entering is using breathing apparatus of a type approved by the chief inspector and, further, that—
(a) the provisions of sub regulation (2) (b) are complied with;
(b) any employee or person entering the confined space is using a safety harness or other similar equipment, to which a rope is securely attached which reaches beyond the access to the confined space, and the free end of which is attended to by a person referred to in paragraph (c);
(c) at least one other person trained in resuscitation is and remains in attendance immediately outside the entrance of the confined space in order to assist or remove any or persons from the confined space, if necessary; and
(d) effective apparatus for breathing and resuscitation of a type approved by the chief inspector is available immediately outside the confined space.

(4) An employer or user of machinery shall take steps to ensure that all persons vacate a confined space on completion of any work therein.

[redacted]

[redacted]

(5) Where the hazardous gas, vapour, dust or fumes contemplated in sub regulation (2) are of an explosive or flammable nature, an employer or user of machinery shall further take steps to ensure that such a confined space is entered only if –
(a) the concentration of the gas, vapour, dust or fumes does not exceed 25 per cent of the lower explosive limit of the gas, vapour, dust or fumes concerned where the work to be performed is of such a nature that it does not create a source of ignition; or
(b) such concentration does not exceed 10 per cent of the lower explosive limit of the gas, vapour, dust or fumes where other work is performed.

2.60 Alcohol and drugs (GSR 2)

1. A contractor shall not permit any person who is or who appears to be under the influence of intoxicating liquor or drugs, to enter or remain at a site.

2. No employee shall be under the influence of or have in his or her possession or partake of or offer any other person intoxicating liquor or drugs.

3. An employer or a user, as the case may be, shall, in the case where a person is taking medicines, only allow such person to perform duties at the site if the side effects of such medicine do not constitute a threat to the health or safety of the person concerned or other persons at such site.

2.61 General Practices when Working at Heights

- No Homemade structures or ladders will be permitted on the project.
- Trestle tables are not to be fully extended and must be fully boarded, no drums to be used.
- Surroundings to be clear of rubble.
- Fall protection, fall prevention, and fall rescue plans to be in place and communicated to site employees.
- Ladders to be structurally sound and not broken and in accordance to GSR 13A.
- Only competent persons may be allowed to work at heights
- Correct personal protective equipment to be used (safety harness and lanyard) and edge protection / life lines to be used.
- Anchor points to be in place and determined by an engineer. Anchor points must be pull tested prior to use.
- GSR (6) 6. No employer shall require or permit any person to work in an elevated position and no person shall work in an elevated position, unless such work is performed safely from a ladder or scaffolding, or from a position where such person has been made as safe as if they were working from scaffolding.
- Construction regulation 10 of 2014 to be implemented when working at heights and to prevent any person from falling from heights.
- Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template.

2.62 Traffic Accommodation

All traffic signs must be displayed as per the traffic management plan drawings.
Size of signs used must be as per the traffic management drawings and all signs to be visible and in good condition.

- Traffic management Plan issued per Road and Traffic act (chapter 13). Must be approved by the Traffic Chief (as applicable) and professional team.
- Plans for signage deployment must be in order and must be placed correctly.
- Traffic management plan must be submitted and must be suitable for the tasks being performed.

[redacted]



- Traffic plan must be implemented and controlled by the sites Traffic safety officer and flag persons.
- Jersey barriers, where used, to be linked.
- No signs to be obstructed.
- STOP/GO structures must be protected against being struck by vehicles (e.g. new jersey barriers)
- Road marking buggies/vehicles must be protected by escort vehicles front and rear.
- Displayed traffic signs must be maintained in a daily register to be checked morning and evenings after works have been finalised.

Traffic Safety Officer must check signage daily and Responsible Person must sign it off daily/as per schedule.

2.63 Ventilation and Lighting in the Work Place

Every employer shall cause every workplace in his undertaking to be lighted in accordance with the illuminance values specified in the Schedule to the General Safety Regulations:

Provided that where specialised lighting is necessary for the performance of any particular type of work, irrespective of whether that type of work is listed in the Schedule or not, the employer of those employees who perform such work shall ensure that such specialised lighting is available to and is used by such employees.

The Contractor must ensure that:
- the average illuminance at any floor level in a workplace within five meters of a task is not less than one fifth of the average illuminance on that task;
- glare in any workplace is reduced to a level that does not impair vision;
- lighting on rotating machinery in such that the hazard of stroboscopic effects is eliminated; and
- luminaires and lamps are kept clean and, when defective, are replaced or repaired forthwith.

With a view to the emergency evacuation of indoor workplaces without natural lighting or in which persons habitually work at night, every employer shall, in such workplaces, provide emergency sources of lighting which are such that, when activated, an illuminance of not less than 0.3 lux is obtained at floor level to enable employees to evacuate such workplaces: Provided that where it is necessary to stop machinery or shut down plant or processes before evacuating the workplace, or where dangerous materials are present or dangerous processes are carried out, the illuminance shall be not less than 20 lux.

The contractor must ensure that the emergency sources of lighting prescribed above:
- are capable of being activated within 15 seconds of the failure of the lighting prescribed by subregulation (1);
- will last long enough to ensure the safe evacuation of all indoor workplaces;
- are kept in good working order and tested for efficient operation at intervals of not more than three months; and
- where directional luminaires are installed, these are mounted at a height of not less than two meters above floor level and are not aimed between 10° above and 45° below the horizontal line on which they are installed.

The contractor must ensure that all rooms, stairways, passageways, gangways, basements, and other places where danger may exist through lack of natural light, to be lighted such that it will be safe.

The contractor must ensure that every workplace in his undertaking is ventilated either by natural or mechanical means in such a way that –

- the air breathed by employees does not endanger their safety;



[redacted]

- the time-weighted average concentration of carbon dioxide therein, taken over an eight-hour period, does not exceed one half per cent by volume of air;
- the carbon dioxide content thereof does not at any time exceed three per cent by volume of air;
- the prescribed exposure limits for airborne substances therein are not exceeded; and
- the concentration therein of any explosive or flammable gas, vapour or dust does not exceed the lower explosive limit of that gas, vapour, or dust.

2.64 Nuclear Density Gauge (Troxler)

The use of a Troxler on site must be in line with the SANS 3001 of March 2014. The SANS consists of 5 sections

The in-situ density of road construction materials is only determined in civil engineering using indirect methods such as the nuclear density gauge and sand replacement methods.
This method forms part of a set of methods used to operate nuclear gauges, and includes the following:
a) administration, handling, and maintenance (see SANS 3001-NG1);
b) validation of standard calibration blocks (see SANS 3001-NG2);
c) calibration of a nuclear gauge (see SANS 3001-NG3);
d) verification of a nuclear gauge (see SANS 3001-NG4):
e) in situ density determination using a nuclear gauge (see SANS 3001-NG5)

When used Troxlers must be:

- Stored in a dedicated, lockable area and must have a warning signage displayed.
- Must only be transported in a dedicated vehicle with the required signage displayed and by an authorised employee that has been appointed in writing.
- Must have a Troxler Calibration Certificate in place.
- Must have a Troxler Technician Appointment on file and signed and proof of competency within the safety file.

2.65 Ergonomics Regulation of 2019

"competent person" in relation to ergonomics, means a person who– *(a)* has in respect of the work or task to be performed the required knowledge, training and experience in ergonomics and, where applicable, qualifications specific to ergonomics: provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualifications Framework Act, 2008 (Act No. 67 of 2008), those qualifications and that training must be regarded as the required qualifications and training; and *(b)* is familiar with the Act and the applicable regulations made under the Act;

"ergonomic risk" means a characteristic or action in the workplace, workplace conditions, or a combination thereof that may impair overall system performance and human well-being;

"ergonomic risk assessment" means a programme, process, or investigation to identify, analyse, valuate and prioritise any risk from exposure to ergonomic risks associated with the workplace;

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance;

The ergonomics regulations will apply to any employer or self-employed person who carries out work at the workplace who may expose any person to an ergonomic risk in the work place and any designer, manufacturer, importer or supplier of machinery, plant, or work systems for the work place.

[redacted]



An employer must, before the commencement of any work that may expose employees to ergonomic risks, have an ergonomic risk assessment performed by a competent person.

The ergonomic risk assessment must be done at intervals not exceeding two years and must include the following;

- a complete hazard identification and all persons who may be affected by the ergonomic risk.
- how employees may be affected by the ergonomic risks;
- the analysis and evaluation of the ergonomic risks;
- the prioritisation of ergonomic risks.

An employer must review the relevant ergonomic risk assessment if:

- such assessment is no longer valid;
- control measures are no longer effective;
- technological or scientific advances allow for more effective control methods;
- there has been a change in –
  - the work methods;
  - the type of work carried out; or
  - the type of equipment used to control the exposure; and
  - an incident occurs or medical surveillance reveals an adverse health effect, where ergonomic risks are identified as a contributing factor.

An employer must ensure that an employee is placed under medical surveillance, which is overseen by an occupational medicine practitioner, if–

- the ergonomic risk assessment referred to in regulation 6 indicates the need for the employee to be placed under medical surveillance; or
- an occupational health practitioner recommends that relevant employees must be under Medical surveillance, in which case the employer may call upon an occupational medicine practitioner to ratify the appropriateness of such recommendation.

An employer must ensure that the medical surveillance consists of–

- in the case of a new employee, an initial health examination before the employee commences employment or within 30 days of commencement of such employment;
- a periodic health examination informed by the ergonomic risk assessment, at intervals specified by an occupational medicine practitioner, but not exceeding two years; and
- an exit health examination informed by the ergonomic risk assessment.

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Both the Client and the Contractor have a duty in terms of health and safety legislation to do all that is reasonably practicable to make members of the public and others being affected by the construction processes aware of possible risks and put preventative measures in place to mitigate the risks. The public and/or visitors shall go through a brief health and safety induction detailing hazards and risks they may be exposed to and what measures are in place to control these hazards and risks.



[redacted]

OTHER HEALTH AND SAFETY SPECIFICATION REQUIREMENTS

The contractor must be aware of the following additional requirements:

What	When	Output
Awareness training (Toolbox Talks)	At least weekly and before hazardous work is carried out	Attendance Register
Health and Safety Committee Meetings	Monthly	Minutes signed by the employer (Contractor) covering: a) Health and Safety Representative Checklist b) Safety report from Safety Officer and Safety Agent
Health and Safety Reports	Monthly	Report covering: a) Incidents/Accidents and Investigations b) Non-conformance c) Health and Safety Training d) HIRA Updates e) Internal and External Audits
General Inspections	As per Health and Safety Specification and OHSA	Report on Health and Safety Specification and OHSA compliance: a) Scaffolding b) Lifting Machinery c) Excavation
General Inspections	Monthly	Covering: a) Firefighting Equipment b) Portable Electrical Equipment c) Ladders
Record keeping	Ongoing	Covering: a) General complaints b) Fines c) General incidents d) MSDS e) Surveillance Medicals f) Inspection Register g) Dept of Labour Notices
Permits	Before commencement with certain activities	As stipulated by the Health and Safety Specification and the OHSA / Construction Regulations

Key:

OHSA – Occupational Health and Safety Act, 1993

[redacted]

[redacted]

ANNEXURE A – REQUIREMENTS FOR THE SAFETY PLAN ASSESSMENT

The Contractor must note that the information below is pertinent to the compilation of their safety plan response to this site-specific safety specification and it would be preferred if the Safety Plan is written in the order of the assessment documented below.

No	Item	Notes
1	**Project Directory**	Please state details of Project Client, Project Manager/Principal Agent, Safety Agent, Consulting Engineer, etc. (Name, address, contact details).
2	**Contractors Directory**	Please indicate if you will be using Contractors on this project, if yes, include their details, trade, and FEM details.
3	**Other Parties Directory**	Please indicate contact details for any services applicable (electricity, water, etc.) as well as Department of Labour and Emergency Services.
4	**Project Safety Statement**	The Project Safety Statement must be included in the Safety Plan.
5	**Health and Safety standards for the project (OHS Act, construction regulations, basic conditions of employment, etc.)**	Health and Safety standards must be included in the Safety Plan.
6	**Project Particulars**	Scope of works must be included in the Safety Plan. This is critical.
7	**Existing environment – Structures and Surroundings, Services (Electrical, Water, Sewerage, etc.), Traffic Arrangements, Parking, Access to Site, Storage of Plant and Materials**	Please include these items in the plan. The items must be Site Specific, the location of services and services that will be affected must be mentioned.
8	**Management Structure for safety on the Project**	A structured organogram with names of the responsible people must be included.
9	**Appointed Persons, Supervision**	The required appointments must be identified. A list of the appointed persons must be included in the Safety Plan.
10	**Security Procedures**	Please indicate if a security company will be appointed and include the contact information in the Safety Plan.
11	**Registers list and inspection frequency**	A list of the Inspection Registers that will be on file must be included in the Safety Plan.
12	**Design Co-ordination**	Please indicate your procedure for implementation of design changes by designer on the project, and the procedures for liaison and implementation of temporary works design on the project.
13	**Contractor Co-ordination**	Mention must be made of how Contractors will be co-ordinated on site to ensure that they work together and not adversely affected health and safety.

[redacted]

[redacted]

No	Item	Notes
14	**Housekeeping, stacking and storage**	Housekeeping policies and procedures must be included in the Safety Plan.
15	**Waste Disposal Arrangements**	Waste disposal arrangements procedures must be included in the Safety Plan.
16	**Noise and dust control**	Please indicate if any noisy operations (more than 85 decibels) will be carried out and what measures will be used to reduce noise exposure to workforce.
17	**Training Requirements**	Training requirements must be identified and recorded.
18	**Plant and Equipment**	A list of plant and equipment to be used on site must be included in the Safety Plan.
19	**Safety Monitoring Arrangements**	The name, contact details and SACPCMP registration status of the Safety Officer must be included in the Safety Plan. State how often the Safety officer will be on site (note safety specification requirement in section 1.7).
20	**Information for Contractors**	State how information will be given to Contractors on site.
21	**Consultation/communication arrangements with Employees**	State how information will be given to employees e.g. notice board.
22	**Selection of Contractors Procedures**	Principal contractor must state what health and safety procedures they will use to assess the competence and resources of their contractors on site.
23	**Activities with risk to Health and Safety (Risk Assessment)**	A Baseline Risk Assessment must be included in the Safety Plan, it must address the Risks identified in the Safety Specification as well as the risk of any other hazards that the Principal Contractor is aware of that are relevant to the site.
24	**Hazardous Substances**	Must be listed in the Safety Plan and addressed in the Risk Assessment.
25	**First Aid and Medical Procedures**	Please indicate name of first aider, position of first aid box, location of nearest medical facility and emergency numbers.
26	**Fire and Emergency Procedures**	List of emergency telephone numbers must be drawn up and included in the Safety Plan. The position of Fire Extinguishers, Assembly Point location, fire drill frequencies, numbers of fire marshals, etc.
27	**Accident and Incident Reporting and investigation**	State the Accident and Incident Reporting and investigation procedures of your company.
28	**Welfare and Site Facilities**	Elaborate on toilets and eating areas, water provision, how will workers be protected during wet weather conditions etc.
29	**Site Rules**	The Site Rules must be included in the Safety Plan.
30	**Personal Protective Equipment**	The necessity must be identified by Risk Assessments, the required PPE for site risks and control measures.
31	**Health & Safety File arrangements**	Please indicate arrangements for the return of the Health and Safety File to the safety agent at the end of the project.

[redacted]

[redacted]

No	Item	Notes
32	**Method Statements/Safe System of Works**	A list of Method Statements/Safe System of Works must be included in Safety Plan for all High-risk activities.
33	**Permits and wayleaves**	List of activities that Principal Contractor anticipates will require permits and wayleaves (including those stated in the safety specification) to be included.
34	**Fall Prevention and Protection Plan and Fall Rescue Plan**	A copy of the Fall Prevention and Protection Plan, fall rescue plan and fall risk assessment must be included in the Safety Plan.
35	**Demolition method statement**	A copy of the Demolition Method Statement must be included in the Safety Plan.
36	**Confined spaces**	The Principal Contractors' procedures for managing access, egress and work in confined spaces must be specified in the Safety Plan. Includes permit procedures, air monitoring, PPE, etc.
37	**Safety Representatives and Safety Committees**	When a project has more than 20 employees a designated employee must be chosen by the labourers to represent them. A safety committee must be established if 2 or more safety representatives are appointed. Please note Safety Specification requirements regarding this section (section 2.12).
38	**Have the significant hazards from the safety specification been addressed?**	See section 1.9 of the Specifications and ensure practical measures have been detailed in the safety plan.
39	**Safety File - Safety Policies in File and Signed by 16(1) CEO.**	Safety Policies must be signed and explained to employees.
40	**Safety File - A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.**	A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.
41	**Safety File - Signed copy of the 37.2 Mandatary Agreement**	A 37.2 Mandatary Agreement needs to be signed between the Client and the Principal Contractor.
42	**Safety File - Appointment letter from Client (as well as 5.1.K)**	The Client must appoint the Principal Contractor in writing.
43	**Safety File – Notification / Permit**	A copy of the Annexure 2 Notification (and proof of submission) to Department of Labour must be available. This can be in the form of a Department stamp, email, or copy of Construction Work Permit.

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ANNEXURE B – LEGAL APPOINTMENTS The contractor shall make the following appointments, as required:
Chief Executive Officer (OSH Act 16(1)
Contract Director/Manager (OSH Act 16(2)
Construction Manager (CR 8(1)
Construction Supervisor (CR 8(7)
Assistant Construction Supervisor (CR 8(8)
Construction Safety Officer (CR 8(5)
Traffic Safety Officer
Safety Representative (where > 20 employees on site)
Temporary work Designer (CR 12(1)
Temporary work Supervisor (CR12(2)
Construction risk assessor (CR 9(1))
Excavation Supervisor (CR13(1)(a)
Demolition Supervisor (CR14(1)
Scaffold Supervisor (CR16(1)
Suspended Platform Supervisor (CR17(1)
Material Hoist Inspector (CR19(8)(a)
Material Hoist Operator (CR19(6)
Bulk Mixing Plant Supervisor (CR20(1)
Bulk Mixing Plant Operator (CR20(2)
Controller of Explosive Actuated Fastening Devices Nails, Cartridges or Studs Issue and Collection (CR21(2)(g)(1)
Construction Vehicle and Mobile Plant Operator (CR23(1)(d)(i)
Controller of Temporary Electrical Installations (CR24(c)
Stacking Supervisor (CR28(a)
Fire Extinguishing Equipment Inspector (CR29(h)
Fall Protection Plan Developer (CR 10(1)(a)
Incident Investigator (OSH Act 9(2)
Competent Person – Confined Spaces (GAR 5(1)

[redacted]

[redacted]

ANNEXURE C - BASELINE RISK ASSESSMENT FOR PROJECT

Irrespective of the risk presented on site, it will be ensured that sufficient supervision is in place on site, that personnel are trained in accordance with legislation, including the requirement for site specific inductions on site to inform personnel on site of the risks and hazards applicable to the site. Site supervision is responsible for ensuring that the control measures required below are implemented on site.

	HAZARD	RISK	MINIMUM CONTROL MEASURES
1.	Asbestos Cement Pipes	Release of asbestos fibres	• Ensure safe access and egress is provided • Erect physical barriers to prevent entry by unauthorised persons, as applicable • damp down exposed area to contain fibre release • Personnel involved to wear asbestos respiratory protection • Exclusion zone may be required • Only Department of Labour registered asbestos contractors may work with asbestos, and strictly in accordance with the requirements of the Asbestos Abatement Regulations, 2020.
2.	Compacting and Filling	Contact with tipping materials Contact with moving plant Vehicles/personnel falling into excavations Contact with underground services	• Trained banksman to control vehicles movement • Only trained personnel use plant • Personal Protective Equipment to be worn • Personnel to stand clear as materials are being tipped • Use stop blocks and signs to warn vehicles of excavations, where applicable • Stand clear of plant whilst materials are being compacted • Establish position of underground services and protect services from damage
3.	Compactor Operations	Crushing of feet	• Only trained and competent personnel to use the machine • Ensure operative wears steel toe cap shoes or boots at all times
4.	Cutting Off Disc	Noise Cuts from machine Fire (particularly at refuelling) Flying debris Blade shattering Contamination by fume created or exhaust fume	• Use competent personnel. • Hot works control- fire extinguisher, fire watchman. (Permit may be required) • PPE to include gloves, eye protection, hearing protection • Solid working position. • Clear working area • Correct grade of blade must be used. • Good ventilation to be provided (forced if necessary). • Changing of wheels to be by competent persons only • Cut off discs must not be used for grinding (grinding disc thicker) • Bystanders to wear hearing protection, as applicable
5.	Electric Tools and Electrical Installations	Electric shock Fire	• Electric tools and installations to be in good condition • Inspect electric tools before use • Do not use electric tools in wet/damp conditions • Use personal protective equipment such as insulated gloves • Electrical installations register to be maintained, inspected by competent person
6.	Fire	Injuries to workers, pedestrians, residents, road users, damage to property through fire	• No littering on site which could become fire hazard, maintain site in clean condition. • No fires to be lit on site. Have a working fire extinguisher at hand at all times. • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices
7.	Flammable Liquids and	Fire Explosion	• No littering on site which could become fire hazard, maintain site in clean condition.

[redacted]

[redacted]

	HAZARD	RISK	MINIMUM CONTROL MEASURES
	Gases (Use of)		• Have a working fire extinguisher at hand at all times. • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices • Equipment must be in good condition, maintained • Personnel using substances must be trained in safe use and risks
8.	Hand tools	Injuries caused by use of hand tool Impact with the tool Falls due to access problems Contamination with substance being worked	• Ensure: • Tool is correct for job • Tool is in good order and suitably sharp • Personnel must be competent/instructed in tool usage and tool safely • Lighting is sufficient • Access is safe, working platform is secure, leading edge is guarded • Operative is wearing all necessary PPE
9.	Hazardous Substances	Injuries to workers through use of hazardous substances, e.g. injuries to eyes, skin, etc.	• Use substances in accordance with data sheet, particularly reference protective clothing required (example: gloves, goggles, etc.) • Know what First Aid measures are • Have welfare facilities available for washing of hands, etc.
10.	Hot Works	Burns to eyes or other parts of the body	• Personal Protective Equipment to include eye, skin, and hearing protection • Respirator maybe be required where cutting galvanized steel or anywhere else toxic fumes and gases arise. Dust can also be a problem and forced ventilation may be required.
11.	Lifting Operations	Falling material Crushing by materials Hand injuries to the slinger Toppling crane	• Check test certificate • Check examination certificate • Check inspection have been carried out • Check certificates for lifting equipment (chains, slings, shackles, etc.) • Ensure lifting gear is rated to carry load (SWL) • Ensure materials being lifted are properly packaged and slung. • Be aware that there should be a minimum clearance of 600mm between any slewing parts of a crane and any fixed installation to prevent being trapped. • Access to the work area during lifting operations is to be restricted to those involved with and trained in the work in hand. Do not allow members of the public to gain access to the area. • Only trained banksmen to be used. • The crane driver and the banksman are to ensure that the signals given are clearly understood.
12.	Manual Handling of General Items	Muscular skeletal injuries if the load is too heavy or awkward Operative falling/ tripping Contamination from the substance being carried Fall of material being carried	• Personnel should be aware of safe manual handling techniques • Personnel to wear Personal Protective Equipment when carrying items, e.g. safety footwear and gloves. • Ensure good housekeeping against tripping/fall hazards. • Operative to get assistance if load too heavy- team lift if necessary. • Utilise mechanical lifting and carrying aids where possible. • Personnel to ensure access equipment, ladders will take weight of operative and load being carried. • Personnel to ensure item being carried is properly bonded or is not be liable to break apart whilst being manually handled.
13.	Members of	Injury to member of public and road	• Barriers and signage to be in place

[redacted]

[redacted]

	HAZARD	RISK	MINIMUM CONTROL MEASURES
	Public – Protection of	users from site works	• Workers must warn away any members of public from the works • Footpaths and bridges which are open to public must be closed off if in area of works or otherwise made safe so that no injury occurs to members of public • Traffic turning into site – traffic management and signage as required. • Signage to be on road at site entrance warning motorists that construction traffic turning into/out of site access. Keep roads free of mud where possible • Refer to plant risk assessment for details on plant safety precautions • NOTE: SIGNAGE TO BE POSTED ON SITE TO WARN OF CONSTRUCTION TRAFFIC MOVEMENTS. SAFE MEANS OF ACCESS FOR BOTH CONSTRUCTION TRAFFIC TO SITE AND PUBLIC TO BE AGREED.
14.	Noise and Dust	Breathing in dust can cause long term health problems, noise can damage hearing	• Wear respiratory and hearing protection • Dampen down and minimise dust where possible.
15.	Plant or Vehicles and Equipment Operation	Workers injured by passing traffic Road users and pedestrians at risk from plant operation Noise	• Implement traffic protection measures • Trained and competent operators must be used • Check plant and vehicles on daily basis before use and record inspections. Maintain vehicles in safe condition. • Medical certificates of fitness required for construction plant. • Crossing of road by construction vehicles or machines must be limited to the practical minimum • Plant and vehicles must be fitted with amber rotating beacons and reverse alarms. • Wear appropriate protective clothing/equipment, e.g. goggles, gloves, ear defenders, etc. as appropriate.
16.	Road Construction	Risk of being struck by vehicles	• Ensure traffic management measures in place • No construction activities to commence until adequate provision made to accommodate traffic in accordance with the South African Traffic Signs Manual. • Wear reflective waistcoats when working on or near the road or road shoulder as well as any other required personal protective clothing. • Crossing of road by personnel must be limited to the practical minimum • Use of fencing or other barriers as appropriate
17.	Road Working – working in or next to road	Injury to workers caused by passing traffic Injury to road users and pedestrians by works	• Flagmen to be used where interface with construction plant with passers-by or where hazard posed by delivery vehicles turning into/out of site. • Traffic management plan to be approved by Municipality and, if necessary, traffic department • No construction activities to commence until adequate provision made to accommodate traffic in accordance with the South African Traffic Signs Manual. • Use safety signage to warn traffic and pedestrians of construction works • Where existing walk ways/pavements affected by works, must direct pedestrian traffic away to safe walking area. • Wear reflective waistcoats when working on or near the road or road shoulder as well as any other required personal protective clothing. • Crossing of road by personnel must be limited to the practical minimum • Use of fencing or other barriers as appropriate
18.	Snakes	Snake bite	• Qualified first aider required for site who can treat snakebite • Check area before working • Find out nearest hospital and get emergency telephone

[redacted]

[redacted]

	HAZARD	RISK	MINIMUM CONTROL MEASURES
			numbers.
19.	Temporary Works	Collapse of temporary work	• Wear personal protective equipment such as gloves and goggles • Temporary works must be designed and built by trained person and also be inspected by competent person and results entered into register on site
20.	Troxler – use of	Radiation exposure Transportation and storage of nuclear equipment Working in road	Ensure • Training of Troxler gauge operators in basic radiation safety and correct operating procedure to satisfactory level of competence • An enclosed vehicle must be used for transport of the gauge • After use and before storing the gauge, a visual check to be carried out to confirm shutter is properly closed • Warning signage to be displayed at entrance to store indicating presence of radioactive material • Wear reflective vests when working in or near the road or road shoulder as well as any other required personal protective clothing. •
21.	Overhead Services	Striking of overhead services	• Make all necessary enquiries to establish what services are in the area. Consult drawings and advice from service provider (e.g. Municipality or ESKOM) when planning work. • Assume all service to be live (Unless confirmation is received to confirm that services are isolated or otherwise made safe). Do not work near live services without authorisation from site management. • Comply with the requirements of the safe system of work for overhead services • Check vertical clearance level and ensure distances are strictly enforced
22.	Underground Services	Striking of buried services	• Make all necessary enquiries to establish what services are in the area. Consult drawings and advice from service provider (e.g. Municipality or ESKOM) when planning work. • Assume all service to be live (Unless confirmation is received to confirm that services are isolated or otherwise made safe). Do not work near live services without authorisation from site management. • Comply with the requirements of the safe system of work for underground services. • Where available, locate services with a locator • Hand dig around services
23.	Work over or next to Water	Drowning	• Evaluate depth of water, height above water that work takes place, whether workers can swim or not and then determine safety precautions required: these may include such measures such as barriers, signage, life belts, safety harnesses, etc. • When working on water edge - erect life saving devices and barriers to protect workers and vehicles (stop blocks may also be required). Only trained and competent persons to be used.

[redacted]

[redacted]

ANNEXURE D – SAFETY SPECIFICATION AND BASELINE RISK ASSESSMENT ISSUE REGISTER

Date of Original Safety Specification Compilation	Compiled By	Issue Date
July 2023.	[redacted]	3rd July 2023.

Revision Summary	Revised By	Revision Date
Minor updates and asbestos included	[redacted]	8th September 2024

Acknowledgement:

I, _____ representing

_____ (Contractor), have satisfied myself with the content of this Health and Safety Specification and shall ensure that our employees and contractors on site comply with the requirements of this document, our safety documentation and health and safety legislation.

_____ _____

Signature of Contractor Date

Comments:

_____

_____

_____

_____

_____

_____

[redacted]

ANNEXURE D

GUIDELINE FOR SAFE WORKING PROCEDURES FOR PIPELINES CLOSE TO POWERLINE SERVITUDES

[redacted]

Job Title Muldersvlei WTW Connecting Pipes: AC Interference Study

Document Ref 2221528-Rep-Muldv-ACIM : Appendix D

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6 GENERAL SAFE WORKING PROCEDURES REGARDING WORK WITHIN OR NEAR TO A POWERLINE SERVITUDE
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8 CAPACITIVE COUPLING
9 INDUCTIVE COUPLING

[redacted]

Metallic Pipeline Construction: Safe Working Procedures for Pipeline Construction Close to MVAC, HVAC, EHVAC and HVDC Servitudes

1 Introduction

Attention!

This is not a comprehensive safety procedure. This Procedure provides some of the general safe practices and is not a comprehensive manual. The intention of this procedure is to raise the awareness of potential dangers to the pipeline construction team caused by nearby electrical circuits and to define some minimum safety requirements.

This document may only be used for this specific project.

When construction activities occur within electrical power line servitudes, there are a number of issues that need to be considered that are influenced by the relative localities of the pipeline and overhead power line or power cable.

Unsuspected voltage can be present on a pipeline (and pipes ready for constructing a pipeline) through Conductive, Inductive as well as Capacitive coupling between a pipe or pipeline and the nearby electrical circuits.

During a power line fault or lightning strike, very high voltages can be induced in the pipeline, which can damage the cathodic protection systems, rupture the coating, and present a significant safety hazard for any person close to or in contact with the pipeline and its appurtenances. During normal operation the induced pipeline voltages are lower, but could still present a safety hazard and can result in accelerated corrosion of the pipeline.

Any raised electrical potentials found on a pipeline should be reported to a competent person so that the cause is understood and that appropriate mitigation measures can be implemented. This section should not be viewed as a restriction to use better methods and it should be understood that a generalized account does not make provision for unpredictable or un-expected circumstances.

Abbreviations:

AC	Alternating Current
DC	Direct Current
ESA	Electrical Supply Authority

[redacted]

HVDC	High Voltage Direct Current
LVAC	Low Voltage Alternating Current : <1 kV
MVAC	Medium Voltage Alternating Current : 1 kV to 33 kV carried on Distribution Lines (Dx)
HVAC	High Voltage Alternating Current : 44 kV to 132 kV carried on Distribution Lines (Dx)
EHVAC	Extra High Voltage Alternating Current : >132 kV carried on Transmission Lines (Tx)

Note: Direct connection (including arcing danger) is relevant for all overhead powerlines regardless of the system normal voltage it is known for (it therefore includes low voltage system as well).

2 Normative/Informative Documents

The latest edition at time of project commencement of all the normative documents shall be regarded as forming part of this document and shall have equal standing. In case of a conflict this document shall take precedence.

The Contractor is to obtain its own copy of these publication(s) and shall have a copy available at the construction site.

2.1 Normative Documents

2.1.1 NACE standard SP0177 titled "Mitigation of Alternating Current and Lightning Effect on Metallic Structures and Corrosion Structures"

Attention is drawn to section 5.3: "Construction".

The minimum protective measures for AC influence are provided in the NACE SP0177 standard, and this should be followed on the site of Works.

This document is available from the National Association of Corrosion Engineers (NACE) International and can be purchased online from their web site (*www.nace.org*).

2.1.2 Eskom guideline titled "Guideline on the Electrical Co-ordination of Pipeline and Power Lines" with unique reference number 240-66418968

A copy of this document can be downloaded from the Corrosion Institute of Southern Africa website (www.corrosioninstitute.org.za under the TAB Core Knowledge – Publications).

The normative and informative documents listed in this Eskom guideline form part of the suite of documentation that shall be applied to the construction activities where applicable.

[redacted]

3 Electrical Safety Officer

An Electrical Safety Officer (ESO) shall be appointed for the site of Works prior to any work commencing close to or within an electrical powerline servitude.

The ESO shall have sufficient training to understand basic electricity as well as specialist training on steel pipe construction close to electrical powerlines.

The ESO shall have the following minimum qualifications:

- Completed the Eskom's Operating Regulations for High Voltage Systems (ORHVS) responsible person training course
- Be authorised by an ORHVS authorised person (GMR2.1) to work without constant supervision in a power line servitude
- Completed the South African Electrolytic Corrosion Committee (SAECC) Electrical Safety Officer training course
- Experience in the supervision and management of temporary mitigation measures during pipeline construction

(Qualification requirements as per Eskom Guideline on the Electrical Co-ordination of Pipeline and Power Lines).

The ESO must be furnished with the authority and equipment required to implement and maintain safe working conditions. The ESO shall have the required measurement instruments and equipment to measure AC and DC potentials with respect to adjacent ground and remote earth.

The ESO shall keep a record of any non-compliance and advise the construction manager (site agent) and the project safety officer.

4 General Safety Requirements

4.1 All construction personnel and visiting persons entering the site of Works shall be made aware of and able to recognize the potential shock hazards and be trained in appropriate safety measures. The awareness shall be for electrostatic (capacitive), electromagnetic (inductive) and conductive coupling (resistive) conditions.

4.2 All overhead electrical power lines should be regarded as being "live" (ie connected to a power supply causing a carrying potential (voltage) which is dangerous.

4.3 The Contractor shall determine and have available on site the local representative name and contact details of the electrical supply utility(s). The Contactor shall have local liaison with the electrical utility to know when planned switching, outages, load changes or any changes that may affect the pipeline induced or capacitive voltages. Work involving contact with the pipe and

[redacted]

pipe sections shall be stopped during scheduled switching and re-closing of the electrical power system.

4.4 Qualified personnel shall measure and record the pipeline voltage to earth to verify that conditions are safe to work (ie Vac < 15 V rms.), on all sections and on each day prior to the commencement of any construction or other activity involving contact with the pipeline.

For pipeline voltage measurements, a voltmeter of suitable range and impedance shall be used. Low resistance earth connections shall be used to avoid induction or capacitive pickup on test leads and related items that could result in erroneous readings on a high impedance instrument.

Test leads shall be attached to the instrument first and then to the pipeline. After measurement, the leads shall be removed from the pipeline first and from the instrument last.

Each time a voltage measurement is made, the following minimum data shall be recorded:

i. location,
ii. time,
iii. date, and
iv. pipe-to-earth voltage.

4.5 An adequate record keeping systems shall be developed and kept up to date by the Contractor. This record keeping shall include all daily recorded measurements and readings in an orderly manner.

5 Arrangements Regarding Work Within and Near to a Powerline Servitude

Note: This section is relevant when working near to or within all overhead powerlines and underground cables with a system normal voltage >1 kV (ie all MVAC, HVAC, and EHVAC as well as any DC overhead powerlines).

5.1 No work may commence within a powerline servitude unless the Electrical Supply Authority (ESA) (Eskom or other institution) has issued a letter of consent and the Contractor has submitted a letter of acceptance to the conditions of the ESA. The application, letter of consent and acceptance letter from the Contractor must be available on site at the site offices at all times.

If permission has been granted, the Contractor must give at least 7 working days prior notice of the commencement of work.

5.2 The Electrical Supply Authority (ESA) (Eskom or other institution) shall at all times have unobstructed access to and egress from its servitude areas.

5.3 The construction of temporary (or permanent) metallic fences can be extremely hazardous and is prohibited without written approval from the relevant ESA.

[redacted]

5.4 The use of explosives of any type within 500m of a powerline or cable servitude is not permitted without the written consent from the relevant ESA.

5.5 Changes in ground level may not infringe the statutory ground to conductor clearances or the statutory visibility clearances.

5.6 The Contractor is to report any damage to the ESA property, private property or public facilities to the relevant authority. Repair measures are to be agreed upon and a signed off completion inspection release is required from the relevant authority for each case.

5.7 No excavations are permitted within the following distances of ay above ground powerline structure (includes tower structure, guy wires, anchors and any other attachment):

- MVAC & HVAC : 6m
- EHVAC : 20m.

5.8 No above ground buildings or temporary structures are allowed within the servitude areas and the following additional distances from the centre line of a MVAC & HVAC (ie up to 132 kV) powerline applies:

- all voltages < 22 kV and 22 kV : 9 m
- From >22 kV to 88 kV : 11 m
- From >88 kV to 132 kV : 18 m

5.9 No above ground buildings or temporary structures are allowed within the servitude areas and the following additional distances from the centre line of an EHVAC (ie >132kV) powerline applies:

- From 220 kV to 275 kV (delta) : 18 m
- From 220 kV to 275 kV (horizontal) : 23.5 m
- From 132 kV to 400 kV (self-supporting): 23.5 m
- From 132 kV to 400 kV (stayed) : 27.5 m
- From >400 kV to 765 kV : 40 m

5.10 The ESO must be in contact with the electrical utility to know of planned switching, outages, and load changes that may affect pipeline voltage. Work involving contact with the pipeline shall be stopped during scheduled switching of the electric power system.

5.11 When the AC. mitigation measures agreed upon by the Eskom and the Pipeline Operator have been installed, an Eskom representative must be requested to inspect all the components of this installation and to perform necessary measurements according to the inspections required.

Final approval of the CP and AC mitigation installation is subject to the outcome of this inspection by Eskom.

[redacted]

6 General Safe Working Procedures Within and Near to a Powerline Servitude

6.1 No person, equipment or machinery shall enter the HVAC, EHVAC or HVDC servitude without the approval of the ESO. All affected areas shall be suitably demarcated and access restricted to those personnel who have been advised of the hazards and requirements when working underneath or adjacent to HVAC, EHVAC or HVDC power lines.

6.2 All personnel shall be made aware of and be able to recognize the potential shock hazards and be trained in the approved safety procedures.

6.3 Pipeline construction personnel shall avoid contact with HVAC, EHVAC or HVDC structures and supports. No mechanical equipment shall come closer than 5 m from any power line tower.

6.4 Direct connections to the power line tower structures or buried counterpoise earthing system are not permitted under any circumstances. The earthing systems of the power line and the pipeline must be kept separate.

6.5 Temporary construction sheds, trailers, living quarters, pipe sections, storage areas or vehicle fuelling facilities are not permitted in the HVAC, EHVAC or HVDC servitude.

6.6 Vehicles such as mobile cranes with extendable members that can potentially exceed the minimum vertical clearance height shall be identified and the operators issued with specific instructions with regard to the maximum permissible extension, prior to doing any work in the HV/EHV servitude.

If for any unforeseen reason, the life-threatening situation occurs where a construction vehicle comes into contact with a live HV/EHV conductor or a flash-over occurs, the operator(s) shall remain inside the vehicle and attempt to get it out of the contact situation using ONLY the vehicle's own power. On NO account shall the operator(s) leave the vehicle and on NO account shall any person approach the vehicle, until the contact situation has been reversed, or until the ESO has received confirmation from the electricity utility that the power line has been de-energized. Arcing may temporarily stop due to the action of the protection, however this in itself shall NOT be taken as an indication that the line is safe, since the line may automatically attempt to re-energize. Effective assistance in this situation entails ensuring that all persons present maintain a safe distance from the vehicle (>10 m) and alarming the electricity utility's operational centre.

6.7 Any foreign metal structures exposed during trenching inside or alongside HVAC, EHVAC or HVDC servitudes shall be treated as a live electrical conductor, until measurement proves otherwise.

The pipeline shall not be bonded any foreign structures without an assessment by a qualified engineer and written permission from the owner.

[redacted]

6.8 The use, storage, disposal, treatment or generation of any hazardous substances shall not be permitted in the power line servitude.

7 Direct Connection (Conductive coupling)

Note: This section is relevant for all overhead powerlines regardless of the system normal voltage it is known for (it therefore includes low voltage system as well).

7.1 When a power system with a grounded neutral has unbalanced conditions (eg during a power transmission tower fault) current may flow to the earth. Substantial currents in earth may result from phase-to-phase-to-ground or phase-to-ground faults. The following conditions may result from such faults:

- A metallic structure (eg a steel pipe) in the earth may form part of the current path
- A metallic structure (eg a steel pipe) in the earth that is coated with a dielectric material (ie insulated from the ground) may develop a significant AC potential across such coating.

Such an unbalance situation on medium and high voltage systems (ie >1kV) usually seen as a short and the power supplier's equipment should automatically cut the power supply to that faulted system. Faults on low voltage power systems (ie 1kV and lower) might go undetected for extended periods of time [*SANS10280-1Sec 11.1*]. Although the raised soil potential is concentrated within the immediate vicinity of the short, the hazardous electrical potential can be transported over long lengths in the metallic structure (eg pipe). Touching the metallic structure during the duration of the short can cause fatal electrical shock.

7.2 All persons on site of Works shall avoid contact with MVAC, HVAC, EHVAC or HVDC powerline structures and its supports. No mechanical equipment shall come closer than 5m from any powerline structure and associated element.

7.3 Upon entering or crossing a LVAC, MVAC, HVAC, EHVAC or HVDC powerline servitude, appropriate warning signage shall be erected. Such warning sign shall have the electrical hazard sign with the wording warning against overhead powerlines, viz:



A minimum or four (4) signs are to be erected – two facing the approaching direction (one on each side of the pipe route) and the other two the opposite direction (one on each side of the pipe route). The signage shall have reflective markings yellow with black lettering and symbol

[redacted]

on steel plate. The overall signage size shall at least be 600mm wide. The signage shall be erected at a suitable height on treated wooden poles (100mm minimum diameter) planted in the ground. The signage shall be maintained in good condition throughout the Contract period and removed upon completion of the project.

7.4 The minimum vertical clearance between construction equipment and bare overhead conductors shall be in accordance with SANS 10280. The actual height of the conductors at their lowest point shall be measured by means of optical measuring equipment and during a hot day to ensure that this minimum clearance is achieved. The following are minimum clearances for the nominal rms. Voltages:

- Up to 11kV : 3.0m
- Over 11kV up to 44kV : 3.0m
- Over 44kV up to 66kV : 3.2m
- Over 66kV up to 88kV : 3.4m
- Over 88kV up to 132kV : 3.8m
- Over 132kV up to 220kV : 4.5m
- Over 220kV up to 275kV : 4.9m
- Over 275kV up to 400kV : 5.6m
- Up to 533kV DC : 6.1m
- Over 400kV up to 765kV : 8.5m
- Over 765kV : to be obtained by Contractor from the power utility.

(From Regulation 15 of the Electrical Machinery Regulations 1998 of the OHS Act)

Vertical clearance is the open air distance between the top most part of a construction equipment or vehicle and the electrical wire conductor.

7.5 All work on a pipeline is to be stopped when lightning (electrical storm activity) is imminent or present at the site of Works. Any heavy weather with threatening lightning is sufficient cause to stop the works. Any heavy weather with threatening lightning or actual lightning along any remote part of an electrically continuous pipe shall result in immediate stopping of all works on the pipeline. In his case an electrically continuous pipe includes both sides of the pipe that is joined by means of an isolated joint as such a joint is not necessarily sufficient to block the voltages generated from lightning strikes.

8 Capacitive Coupling

8.1 Capacitive coupling is typically a hazard during construction with respect to electrical shock or arcing when the structure (eg a pipe section) is on isolated supports (eg wooden chocks) prior to being installed into the ground. Although generally not dangerous, it may cause involuntary movements when electrical discharge happens through a person which can cause secondary harm or damages. Monitoring of voltages on pipes stored in this manner within 1km of an overhead electrical servitude is advised. Appropriate grounding of these sections are recommended.

[redacted]

8.2 On pipelines paralleling AC powerlines and for pipe routes crossing powerlines, temporary electrical grounds shall be installed and maintained up to backfilling at 300m intervals, commencing from 1km from the powerline coming close to the pipeline or when the AC potentials rise as the pipe approaches the vicinity of the powerline. Sufficient temporary grounds are to remain until adequate permanent grounding connections are made. Temporary ground can be done with adequately sized cables (35mm² insulated stranded copper wire) and a simple driven ground rod. Grounding to any existing semi-conductor may not be done unless authorized by the ESO.

8.3 In all servitude areas of HVAC and EHVAC and HVDC power lines, machinery and vehicles with rubber tyres should be equipped with a heavy duty steel chain fixed to the chassis with a length to allow 1m of chain to freely drag along the ground to discharge any electrostatic build-up.

9 Inductive Coupling

9.1 Inductive coupling from overhead high voltage powerlines can result in dangerous AC voltages and current flow in the adjacent metallic structure (eg the pipe). Induced voltages may increase during power fault conditions. Pipeline voltage measurements are required on installed pipelines from 2 km of the overhead powerline or if the project specifications require it. These measurements are to be taken with a voltmeter of suitable range and impedance. A low resistance ground shall be established by means of a metal rod driven into the ground. Low resistance connections shall be used to avoid induction or capacitance pickup on test leads and related items that would result in erroneous readings on a high impedance instrument. Voltages more than 15 Vac are considered dangerous and work on pipelines must be stopped if this condition occurs. If AC voltages more than 5 V are measured, mitigation measures should be planned for implementation should an AC voltage of 15V be reached.

9.2 A suitable recording instrument should be installed to measure AC voltages over a period of 7 days to determine peaks, anomalies and cyclic events if any meaningful presence of AC induced voltages are measured. The frequency of a repeat of the 7 day measurement should be determined in consultation with the powerline representative.

9.3 At every section of pipeline that experiences a voltage >15 Vac, electrical shock warning signage shall be erected. Such warning sign would have the electrical hazard sign with the wording "Danger – Electric Shock Risk", viz:



[redacted]

Two signs per every 500m of pipeline are to be erected adjacent to the pipeline – the signs are to be affixed back-to-back on one pole facing opposite directions. The signage shall have reflective markings yellow with black lettering and symbol on steel plate. The overall signage size shall at least be 600mm wide. The signage shall be erected at a suitable height on treated wooden poles (100mm minimum diameter) planted in the ground. The signage shall be maintained in good condition throughout the Contract period and removed upon completion of the project.

9.4 Pipelines exhibiting voltages greater than 15 Vac rms shall be earthed by means of temporary earth rods of at least 1,8m in length and connected to the pipeline by means a green insulated stranded copper conductor with a cross sectional area of at least 35mm^2. Prior to connecting the earth rod to the pipeline, the earth resistance of the earth rod shall be measured and if the earthing resistance is higher than 10Ω additional rods shall be installed in a crow's-foot configuration with a spacing of 2m.

Pipelines parallel to AC power systems shall be earthed opposite the midpoint of each span, maximising the distance to the nearest HVAC or EHVAC structure.

The temporary connections to the pipeline shall be made with earthing clamps that apply firm pressure at the contact point with a mechanically sound connection, and with the coating at the contact point removed down to the bare metal.

Temporary ground rods shall be installed at intervals of 300m or less (the evaluation and optimum solution is to be determined for each site),

Temporary earths shall be left in place until immediately prior to backfilling. Sufficient temporary earths shall be maintained on each section until adequate permanent grounding connections have been made.

9.5 When the pipeline voltage remains above 15 Vac rms in spite of the temporary earth rods, temporary earth mats that extend a minimum of 1 m outside the work area shall be used. The connection between the pipeline earthing clamp and the temporary earth mat shall be made with 25 mm^2 or larger stranded copper cable. There shall be no contact between persons over the earth mat and those not over the mat, including the handing over of tools or materials.

9.6 To prevent the risk of personal injury or arc burns, the connection and disconnection of temporary earths shall be carried out in the following order:

a) connection:
   (i) the earthing clamp is connected to the pipeline,
   (ii) the earthing cable is connected to the earth rod,
   (iii) the earthing cable is connected to the earthing clamp.

b) disconnection:
   (i) the earthing cable is disconnected from the earthing clamp,

[redacted]

(ii) the earthing cable is disconnected from the earth rod,
(iii) the earthing clamp is removed from the pipeline.

9.7 The above measures shall be provided when any activity takes place where contact with the pipe is required, eg for welding pipes together, cutting of pipe, surface preparations and coating operations, coating applications at field joints, coating repairs, bolting fittings onto flanged ends of the pipe, etc.

When cutting pipe, adequate bonding across the location of the cut shall be ensured irrespective of the AC voltage measured between the pipeline and earth The AC potential on the pipe shall be measured and additional earthing installed if this voltage exceeds 15 V AC rms before the cutting commences.

9.8 For lowering pipe into the trench that is to be connected to the installed pipeline, the coated pipe section shall be handled with non-conductive slings. All contact with the bare part of the pipe shall be avoided until the pipe is connected with the grounded pipe.

9.9 Bonding cables should be provided to bridge any gap between two pipe sections (eg where a valve is to be installed).

9.10 Work over isolation joints, flanges or couplings may only proceed after the AC voltage status has been measured. A temporary bond across the flange or the use of a properly sized temporary earth mat shall be used to protect personnel while they work on the pipe.

9.11 Where coating is to be applied at field joints or for any other reason (such as repairs), precautions shall be taken to ensure that equipment contacting the bare pipe is adequately bonded and earthed.

[redacted]