

	Specification	Technology
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Auxiliary Engineering System Engineer	Auxiliary Engineering Manager	Engineering Manager
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1. INTRODUCTION

This document contains the Technical Specification for the Installation of New Chlorine Dosing Systems and Plant Safety Upgrade Project at Eskom's Camden Power Station.

Camden Power Station is obliged to comply with all applicable regulatory requirements, such as SANS 10298:2009 for small to medium sized chlorine gas installations and Occupational Health and Safety Act 85 of 1993. There are two Chlorine dosing systems on site i.e. at the Water Treatment Plant (WTP) and at the Sewage Treatment Plant (STP) which do not comply with aforementioned standards. Furthermore, there are several other upgrades that are required at the STP to ensure safe working conditions for personnel.

2. SUPPORTING CLAUSES

2.1.1 Purpose

The purpose of this document is to outline the minimum scope of work for Camden's Installation of New Chlorine Dosing Systems and Plant Safety Upgrade project and the scope of activities required from the appointed Contractor for the execution of the project.

2.1.2 Applicability

This document applies to Camden Power Station only.

2.1.3 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.1.4 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy
- [3] Occupational Health and Safety Act No. 85 of 1993,
- [4] The National Water Act, 1998 (ACT NO. 36 OF 1998)
- [5] Environmental Management System Policy/Procedures
- [6] Risk Management
- [7] SHEQ Policy/Procedure
- [8] 240-106628253 Standard for Welding Requirements on Eskom Plant
- [9] 240-83539994 Standard for Non-Destructive Testing (NDT) on Eskom Plant
- [10] 240-106365693 - Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
- [11] 240-101712128: Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with linings
- [12] 240-86973501 - Engineering drawing Standard – Common Requirements

- [13] 240-71432150 - Plant Labelling Standard
- [14] 240-109607736 - Eskom KKS Key Part Standard
- [15] 240-55864764 - Chemistry Standard for Potable Water

2.1.5 Informative

- [16] 240-53114002 Engineering Change Management Procedure

2.2 DEFINITIONS

2.2.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

<u>Term</u>	<u>Definition</u>
Disinfection	The process of cleaning something, especially with a chemical, in order to destroy bacteria
Potable Water	Water fit for drinking, being free from contamination
Sewage	Sewage is the waste matter carried off by sewer drains and pipes
Sewage Treatment	Sewage treatment is the process of removing contaminants from wastewater, primarily from sewage. It includes physical, chemical, and biological processes to remove these contaminants and produce environmentally safer treated wastewater (or treated effluent)
Sewerage	Sewerage refers to the physical facilities (e.g., pipes, lift stations, and treatment and disposal facilities) through which sewage flows
System	An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a define objective. These pieces include people, hardware, software, firmware, information, procedures, facilities, services and other support facets

2.3 ABBREVIATIONS

Abbreviation	Meaning given to the abbreviation
CAD	Computer-Aided Design
C&I	Control and Instrumentation
COC	Certificate of Compliance
DCS	Distributed Control System
DB	Distribution Board
ECSA	Engineering Council of South Africa
ISO	International Organization for Standardization
kg/hr	Kilograms per hour
KKS	Kraftwerk-Kennzeichen-System
LED	Light Emitting Diode
MCB	Miniature Circuit Breaker
MCC	Motor Control Centre
mg/l	Milligrams per litre
MPa	Mega Pascal
N/A	Not Applicable
NDT	Non-destructive testing
OHS	Occupational Health and Safety
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QAP	Quality Assurance Programme
SANS	South African National Standard

SHE	Safety, Health & Environmental
SHEQ	Safety, Health, Environmental and Quality
SS	Stainless Steel
STP	Sewage Treatment Plant
UPVC	Unplasticized Polyvinyl Chloride
WTP	Water Treatment Plant

2.3.1 Roles and Responsibilities

N/A

2.3.2 Process for monitoring

N/A

2.3.3 Related/Supporting Documents

N/A

3. WORKS INFORMATION

3.1 EXECUTIVE OVERVIEW

Camden Power Station is obliged to comply with all applicable regulatory requirements, such as SANS 10298:2009 for small to medium sized chlorine gas installations and Occupational Health and Safety (OHS) Act 85 of 1993.

The Sewage System consists of an integrated set of constituent pieces that are combined in an operational / support environment to accomplish the treatment of sewer waste water and allow safe removal of sludge. The Chlorine dosing plant in the STP forms part of this system with the sole purpose to disinfect the final effluent prior to discharge to the Reclamation Dam inlet.

Drinking water, also known as potable water, is water that is safe to drink or to use for food preparation, without risk of health problems. Potable Water is produced at the WTP through a series of filtration and chemical dosing processes. Chlorine is used to disinfect water by killing pathogens such as bacteria and viruses thereby making the water safe for human consumption.

The Chlorine dosing systems at the STP and WTP do not comply with the relevant health and safety standards. Furthermore, there are several other upgrades that are required at the STP to ensure safe working conditions for personnel. The main objective of this project is therefore to outline the necessary refurbishment of existing plant/infrastructure required to ensure compliance to regulatory requirements.

The Contractor is responsible for the supply, installation, testing and commissioning of two new chlorine dosing systems for the STP and WTP and the additional safety upgrades required at the STP as per the detailed Mechanical and Civil designs in Appendix A and B respectively.

3.2 EXISTING SYSTEM

The works applies to disinfection at the STP and WTP. Below is an overview of each plant and a description of the deficiencies:

3.2.1 Sewage Treatment Plant:

The Sewage System consists of an integrated set of constituent pieces that are combined in an operational / support environment to accomplish the treatment of sewer waste water and allow safe removal of sludge. The Chlorine dosing plant forms part of this system with the sole purpose to disinfect the final effluent prior to discharge to the Reclamation Dam inlet.

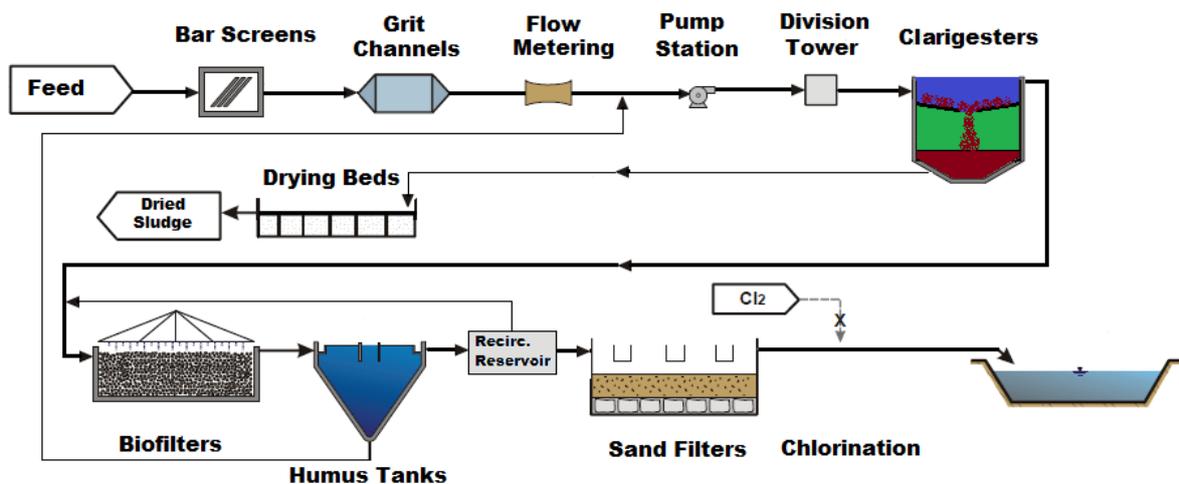


Figure 1: Process Flow Diagram for the Waste Water Treatment Plant (STP)

During the rain readiness assessment, it was found that the chlorine dosing system at the STP is not compliant with SANS 10298:2009 for small to medium sized chlorine gas installations and OHS Act 85 of 1993. Some of the findings from the assessment were as follows:

- The dosing pump and the cylinder have been placed in the same chamber
- There is no leak warning system at the Chlorine dosing station
- There is no emergency breathing apparatus available
- There is no standby bottle
- Also, there is no contact tank installed to allow 40 minute contact time between the chlorine gas and final effluent before discharge into the reclamation dam inlet

After further assessments with the Operating staff of the STP, other safety requirements were also identified in need to be addressed namely:

- Unsafe working conditions when working around the tanks (ground floor and on elevated tanks) – risk of falling inside
- Unsafe working surfaces during heavy rainfall, also contributing to water ingress into the humus tank and sand filters specifically.
- Lack of information when starting raw sewage pumps – no flow indication

3.2.2 Water Treatment Plant:

Drinking water, also known as potable water, is water that is safe to drink or to use for food preparation, without risk of health problems. Potable Water is produced at the WTP through a series of filtration and chemical dosing processes. Chlorine is used to disinfect water by killing pathogens such as bacteria and viruses thereby making the water safe for human consumption.

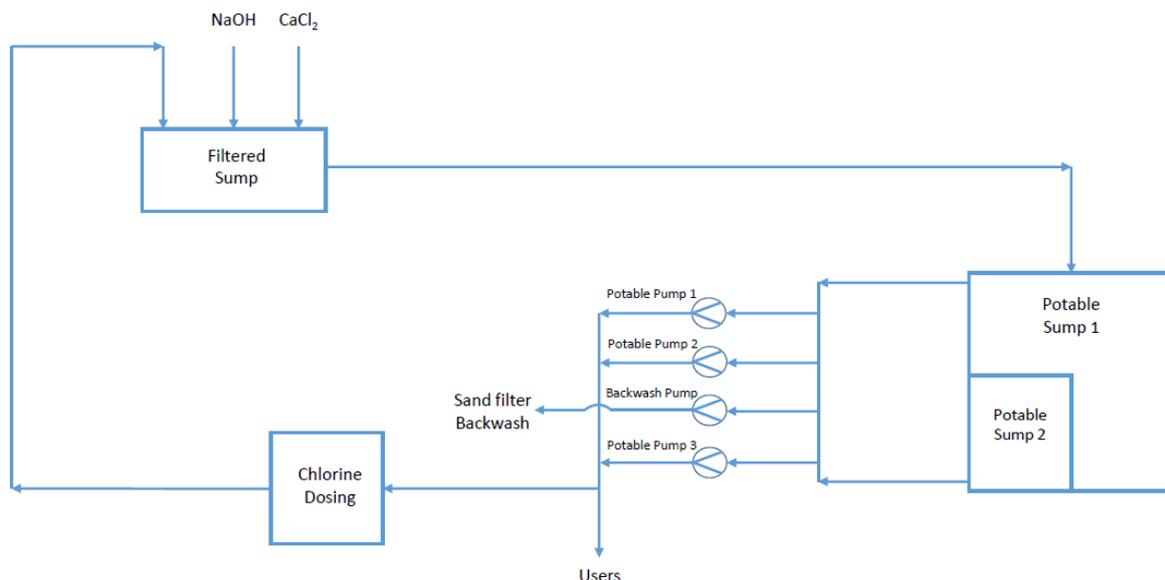


Figure 2: Process Flow Diagram for the Potable Water Production (WTP Plant)

The Chlorine storage room at the WTP was also found to be non-compliant with SANS 10298:2009 for small to medium sized chlorine gas installations and OHS Act 85 of 1993. The findings were as follows:

- The storage room is not gas tight as the walls and doors are fitted with louvres
- The room is fitted with a manually operated extraction fan which is not connected to the leak detector. Furthermore, the outlet of the extraction fan discharges into a below ground level valve pit which is frequently used by operators
- There is no safety shower available
- Empty and full cylinders are stored in the same room

3.3 SCOPE OF WORK

- The Contractor ensures that the chlorine dosing systems are upgraded to dose chlorine for disinfection at the Sewage Treatment Plant and Water Treatment Plant as per the requirements of 3.5
- The Contractor will be responsible for supplying all equipment and plant necessary for execution of the Mechanical (including Electrical and C&I) and Civil scopes as detailed in Appendix A and B respectively

3.4 DETAILED REQUIREMENTS

3.4.1 Mechanical:

- Both Chlorine Dosing Systems at the WTP and the STP has been designed according to SANS 10298:2009 for small to medium sized chlorine gas installations
- The STP has been designed to produce final effluent with a minimum residual Chlorine of 0.1 mg/l as per Government Gazette 18 May 1984 NO. 9225, Regulation No. 991 18 May 1984 - Requirements for the Purification of Waste Water or Effluent
- The WTP has been designed to produce final potable water with a maximum residual Chlorine of 5 mg/l as per Eskom document 240-55864764 - Chemistry Standard for Potable Water
- The Contractor ensures that the material of construction used for all equipment forming part of the scope of the Chlorine dosing systems is compatible and suitable for the environment it is housed in and the fluids it comes into contact with.
- The Contractor ensures that the arrangement of the equipment is such that any equipment can be operated, serviced, or maintained without removal or disruption of any nearby piping, tubing or fitting.
- In executing the works, the Contractor takes due cognisance of existing plant and equipment as well as safety and housekeeping constraints.
- It is the responsibility of the Contractor to overcome any issues that may arise due to space constraints with prior consent from project management and no extra payment or claim of any kind will be allowed on account of difficulties of access to the works or for the requirements of working adjacent to or in the same area as others.
- Adequate working space is to be provided by the Contractor for all new plant and existing plant for inspection, testing, operating and maintenance purposes
- The Contractor is fully responsible for integrating the new installations with the existing installed plant and equipment. The works is to comply with professional engineering practice and standards for fossil fuel power plants.
- All chlorine dosing pipework shall be manufactured from UPVC. The use of any other material in contact with the chlorine solution shall be subject to approval.
- Plastics to conform to the appropriate national or international standard published by an institution acceptable to Eskom, but where none exists, the approval of Eskom shall be obtained
- Surfaces shall be finished to the requirements of the corrosion protection specification associated with the particular plant, where applicable. Paint shall be removed or excluded from the threads of tapped holes, the bores of clearance holes, bearing housings, interference holes and mating faces

- All corrosion protection must be in accordance with Eskom's corrosion protection standards i.e. 240-106365693 - Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings and 240-101712128: Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with linings.
- All welding to be done by qualified welders in accordance with 240-106628253 Standard for Welding Requirements on Eskom Plant
- The Contractor provides all relevant welding procedures for acceptance by the Employer prior to commencement
- All final welds must be tested as per 240-83539994 Standard for Non-Destructive Testing (NDT) on Eskom Plant. NDT's to be conducted by an Eskom approved NDT company
- The integrity of the current motive water and dosing lines to be tested to verify if the pipework can be utilized in the new Chlorine dosing systems
- Pipe Routing:
 - The routing of the pipe will be proposed by the Contractor for acceptance by Eskom. The Contractor develops layout drawings, isometrics along with surveyor profile.
 - All pipelines to be neatly routed to an Eskom approved route.
 - Care to be taken to ensure that the lines are not obstructed, particularly where joined by COC or where the lines are bent on site
- Valves:

Isolation valves shall be mounted in accessible locations. If normal access is not available along the relevant section of piping, the access shall be ensured by the provision of a suitable, permanently fixed access ladder and platform. All valves to be material suitable for use on Chlorine plants and of suitable temperature and pressure rating

3.4.2 Civil:

- All new plant ancillary equipment and machinery, including pipes, valves and analysers to be equipped with adequate structural supports
- All structural supports to cater for the imposed loading due to the new equipment and to ensure proper load distribution to the ground without compromising the structural integrity of the surrounding equipment and affecting the operability of the plant

3.4.3 Electrical:

Detailed works information and drawings related to electrical plant scope of work are listed in APPENDIX A.

As per Classification of Hazardous Locations at Camden Power Station, all equipment must comply with the requirements of SANS 10108, 1489, 1654, 10119, 60079 and 10142-1 and relevant Eskom Standards dependent upon design and location of equipment. If equipment is not located in a Hazardous Location as per classification, the electrical requirements of SANS 10142-1 shall apply noting that the requirements of SANS 10142-1 alone may not be sufficient dependent on design. The Contractor shall adhere to Generation Plant Safety Regulations for all Electrical Works. The Contractor shall assess the impact on the electrical network with implementation of project requirements. The electrical scope of work envisaged consists of the following:

3.4.3.1 General requirements

- The Contractor shall supply and install power supply to all containers and relevant equipment as per mechanical design (listed in APPENDIX A). Power supply shall include all relevant distributions boards, cabling, switchgear equipping and labelling requirements as per Eskom Plant Labelling Standard - 240-71432150
- All the cabling shall be executed in accordance with “Requirements for Control and power cables for power stations standard”
- The electrical wiring system will be in accordance with “The wiring of premises Part 1” and “Requirements for Control and power cables for power stations standard”
- The metal conduit and supports (bosal) shall be utilised and both the conduits and supports shall be earthed to prevent any exposed conductors livening the conduits
- Metal conduit (bosal) shall be used on all external surfaces exposed to the elements and weather
- A cable schedule shall be provided that indicates the routes of the cables from the incoming supply to the terminating electrical equipment, describing the protection devices and rating
- Electrical equipment shall be on standard and of good quality. Defective equipment shall be replaced by the Contractor on the Contractors account

3.4.3.2 Cable Routes:

- a. The Employer shall provide drawings detailing the main routes provided for cables. The Contractor shall verify the routes and scan for services (power cables, obstructions, sewage lines, pipelines, water services) and issue the scan report to the Employer. The Contractor shall provide the detailed cable route proposal including the cabling requirements, cable rack requirements and earthing that shall comply to the applicable Eskom and SANS standards. The Employer shall review the proposal and approve before any cabling, material or relevant equipment is ordered or supplied by the Contractor. Electrical equipment shall be on standard and of good quality. Defective equipment shall be replaced by the Contractor on the Contractors account
- b. Cables schedules of the cable types, sizes, source, destination earthing requirements and unique identification alpha numeric number shall be provided by the contractor to the employer
- c. Cables schedules detailing the main power supply source, destination, earthing requirements and unique identification alpha numeric number shall be provided by the employer. The information shall be used for labelling purposes
- d. All necessary diligence should be exercised when preparing the trench as unidentified services may be scattered along the selected route and the requirements of SANS and OSHA shall be strictly followed
- e. Cable calculations shall be performed by the Contractor and verified by Camden Electrical Engineering to ensure compliance to SANS 10142-1
- f. Prospective cable route to be determined by contractor and all methods of installation to be approved by Electrical Engineering and be in accordance with SANS and Eskom standards
- g. Cable shall be made from stranded copper conductors and shall be 600/1000V rated at the minimum
- h. Cables shall be PVC insulated, single wire armoured and PVC sheathed
- i. The Contractor to determine cable size and number of cores as per Contractor design required for the interface, electrical supply and operation of the entire electrical AC and DC plant
- j. Separate green and yellow earth cables shall be installed from point of supply to load
- k. Cable trench excavations and backfilling shall comply to Eskom standards
- l. Any damage to the Eskom plant by the Contractor while cable trench excavations or backfilling are performed by the Contractor, shall be indicated to the Employer by the Contractor. The Contractor shall be responsible to repair the damages on his/her cost
- m. Cable joints shall not be permitted unless prior approval is obtained (Cable joining methodology and installation shall be approved by Electrical Engineering and perform by qualified personnel). Cables to be firmly affixed to assembly and (or) support structure to which they are mounted to prevent damage from any reasonable or foreseeable forces that may act upon them

- n. The Contractor issue COC for the electrical installation and the electrical works performed.

3.4.3.3 Panels and Distribution Boards

- Be purpose built and ensure all components are able to fit
- Manufactured from folded sheet steel
- Have IP rating that is appropriate to all possible environmental exposure. An IP rating of IP 65 as a minimum will be accepted
- Be able to isolate components without interruption of other equipment during a maintenance activity (lock out facility fitted)
- Standalone or wall mounted panel will be acceptable dependant on location of installation no more than 1.5m above floor level to the top of the panel
- Access to the interior of the panel shall be from a single front door leaf type, with handles capable of being padlocked
- Latches to be capable of accepting a standard 9mm lock hole, or be secured using 2 square keys in which at least 1 is capable of locking preventing access to the square cam
- All components to be mounted using din rail clip-on type and shall be fitted with end clips to keep equipment aligned
- Panel to be powder coated electric orange as per SANS 1091
- Panel size is to ensure sufficient space is available for manoeuvring and connection of cables
- Board labelling shall be determined and required to be mounted on the front face of the panel inclusive of interior component labelling with applicable equipment legend
- Panel to have labels indicating the manufacturer, dimensions, standards complied with, date of manufacturing and have rated fault level of 5kA
- MCB's shall be rated 5kA
- Panel to be sized to ensure possible expansion of 30% for all MCB's and Cable entries
- Spares to be blanked appropriately
- Contractor to assess current power supply available at 380V boards identified by the Employer in the vicinity and determine if modifications are required and implement as such with approval from Employer

3.4.3.4 Cables

Reference shall be made to Eskom cable standard (240-56227443 Requirements for Control and Power Cables for Power stations Standard).

The Contractor will be responsible for the cable sizing and volt drop shall be less than 5%. The Contractor utilises the existing cable racks. Should modifications via extensions of cable racks present themselves the following specification is adhered to: 240-53114214 – Cable and Racking.

- Must be made from stranded copper
- Halogen free low smoke flame retardant sheathed
- Resistant to flame propagation
- Have a separate green and yellow covered earth cable
- Ensure earthing is done as per Eskom and SANS standard
- No cable joins permitted unless approved by Employer
- To be firmly affixed to assembly and (or) support structure to which they are mounted to prevent damage from any reasonable or foreseeable forces that may act upon them
- No more than 2 lugged or otherwise cables shall be permitted to be connected on one side of a terminal with approval from Employer
- Cable labelling shall be done as per Eskom standard with details to be provided
- Wire colouring to be:
 - Red, White and Blue for phases (Yellow may be used to replace white phase provided appropriate tag is placed on both ends of cable)
 - Black for neutral
 - Green with yellow tracer for earth
- Glands and Shrouds
 - Shrouds and Glands to be fitted to all cables rated according to environmental conditions (engineer to be consulted upon placement position is identified)
 - Glands to be threaded type
 - Any blanks used are to be of the threaded type and ensure they maintain IP rating of the enclosure
 - All cables to be fitted with glands and shrouds. Glands to be of the threaded type. Blanks shall be utilised to maintain IP rating of enclosure
 - Bosal steel conduit shall be used
- For the cabling and cable racking Works, the Contractor shall:
 - Ensure interfacing with all the other system requirements of the plant/installation according to the design documentation provided in Appendix A
 - Ensure that the works are implemented as prescribed in the corresponding Eskom standards
 - Optimised and perform cable routing
 - Perform exact cable routing of all the cables

- Produce all documentation and drawings

3.4.3.5 Motors and Actuators

- Have IP rating that is appropriate to all possible environmental exposure. An IP rating of IP 65 as a minimum will be accepted
- Be compliant to hazardous locations if required
- Have highest possible efficiency rating
- Terminal box to ensure the same IP rating
- Be supplied from a nominal 230/400V supply at 50Hz
- Ignition temperature of hazardous area to be verified for motor specification if applicable

3.4.3.6 Low Voltage Electrical System:

A single 380V AC power supply point will be allocated to the Contractor at the relevant switchgear by the Employer. Contractor to assess if switchgear needs to be additionally equipped with the approval from the Employer. The dosing stations equipment requires 220V AC Power Supply, the contractor shall supply and fit the LV electrical distribution boards in order to meet the power supply requirements of all the loads according to the project and as identified and listed in Appendix A. The contractor shall ensure that the electrical supply phases are electrically balanced as reasonably possible by distributing the loads accordingly between the main distribution board and sub distribution boards.

There are existing boards per plant location that can provide 380V (three phase plus neutral) power supply, the circuits in these boards will need to be equipped by the Contractor as necessary to ensure successful project completion. The Contractor shall fit and commission three phase and single phase electrical installations that meets the requirements of Appendix A.

The Contractor shall include new cables to provide power to each container in the design.

The power supply will be made available at the respective container by the Contractor and the Contractor shall ensure that all equipment in the container is supplied accordingly.

3.4.3.7 LV Switchgear Design requirements:

The required power supply should be taken from any available spare three phase MCB's for the Containers noting that the equipping of the switchgear shall be done by the Contractor. Main supply points shall be identified and supplied to the Contractor.

All material shall comply with Eskom standards 240-56227516 - LV Switchgear Control Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard. The requirements of SANS 10142-1 must be complied additionally.

The preparations and terminations of the LV power supply cables are done in accordance with 240-56227443 (Requirements for Control and Power Cables for Power Stations Standard).

The requirement for creating the independence between the power supply of the containers and the power supply of the chillers and sockets outlets is created by the Contractor in the DB board.

Contractor to ensure connection is done according to SANS 10142-1 and 240-56227516 – LV Switchgear Control Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard.

Any preparations required on the cable (i.e. termination kit) for the purpose of proper termination on the container distribution board are the responsibility of the Contractor.

3.4.3.8 Lighting and small power

For the lighting works, the Contractor shall:

- Supply, Install and Commission the lighting and small power circuits (distribution boards, plug sockets, etc. as required in Appendix A
- Ensure the compliance of the required layout in Appendix A, with the SANS 10114-1 and SANS 10142 requirements
- Ensure that interfacing with all the other system requirements of the plant/installation
- Produce all documentation and drawings
- Issue COC as per SANS10142-1

3.4.3.9 Earthing and Lightning protection

Earthing shall be in accordance with Eskom standard (240-56356396-Earthing and Lightning Protection standard).

For the earthing and lightning protection works, the Contractor shall:

- Ensure compliance to SANS 10142-1
- Perform earth resistance and earth continuity tests and ensure compliance to SANS1042-1
- Supply, Install and Commission lightning protection
- Supply, Install and Commission the earthing and lightning protection system and its components, in line with the relevant Eskom standards
- Ensure interfacing with all the other system requirements of the plant/installation
- Produce all documentation and drawings

3.4.3.10 Distribution Boards (DB):

There shall be a Main DB located in each Container connected to the LV cable feeding to that Container and the Contractor will be responsible to make all power available for the equipment inside the Containers.

Cable from the LV switchgear shall feed Main DB in each Container located on each floor outside the Unit.

The preparations and terminations of the power supply cables is done in accordance with 240-56227443 (Requirements for Control and Power Cables for Power Stations Standard)

The independence between the power supply of the container and the power supply of the new analysers is created by the Contractor through the connection on the supply side of the container distribution board.

3.4.3.11 Hazardous Areas:

The standard, SANS 10108, “The classification of hazardous locations and the selection of electrical apparatus for use in such locations”, shall be used for classifying hazardous locations and selecting electrical Plant for use in such locations. Table below indicates where power is supplied from for each unit.

3.4.3.12 Power Supply Available at the LV Switchgear Rooms:

Power supply for the containers shall be supplied from the 380V boards listed in the table below. The switchgear shall be equipped with MCB’s and cabling from the busbars to the MCB’s. DIN rail shall be fitted. Terminal blocks shall be fitted, and the installation shall comply to SANS 10142-1 and Eskom standards. The boards have available space for the MCB’s fitment. Equipment types and sizing, fitted, shall be similar to the existing equipment in the switchgear. Cable installation and trenching shall comply to Eskom standards. COC’s shall be issued as per SANS 10142-1. Earthing and shall comply to SANS 10142-1. Earth continuity shall be tested with micro Ohm testers and shall comply to SANS 10142-1.

Table 1: Power Supply

Equipment Name	Supply Point (Switchboard)	Circuit No	Voltage Bulk supply	Load Rating	Power Rating	Cable type
Sewage Treatment Plant						
Container	380V Sewerage Plant Board 00BJL	00BJL +04 DA001	380V, 1PH+N	25A MCB 20A Load	4.6kW max Single Phase	SWA PVC 16mm2 3 core 203 meters
Water Treatment Plant						
Container	380V Water Plant Board 3 03 BHA	03BHA +02 BA001	380V, 1PH+N	25A MCB 20A Load	4.6kW max Single Phase	SWA PVC 10mm2 3 core 111 meters

3.4.3.13 Applicable Eskom and SANS Standards

Parties using this document shall apply the most recent edition of the documents listed below and shall be read in conjunction with this document. In cases of conflict, the requirements of this specification shall take precedence upon consultation with the Employer or the duly authorised engineering representative.

The latest revision and amendments of the listed documents shall apply and is the responsibility of the Contractor to ensure that these are applied to all works.

All reference documents are obtainable from the Employer’s documentation centre except for:

- The OHS 85 of 1993
- All relevant SANS standards
- The SABS Codes of Practice
- Relevant International Standards

Item No.	Document or Specification Number	Document or Specification Description
1.	240-56227516	LV Switchgear Cntr Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard
2.	240-56227443	Requirements for Control and Power Cables for Power stations Standard
3.	240-56227426	Management of Power Station MV and LV Protection and Settings Standard
4.	240-56360387	Storage of Power Station Electric Motors Standard
5.	240-56361435	Transport of Power Station Electric Motors Standard
6.	240-55714363	Coal Fired Power Stations Lightning and Small Power Installation Standard
7.	240-56535964	Management of Power Station MV and LV Protection Standard
8.	240-56536505	Hazardous Locations Standard
9.	240-56535950	Electrical Plant Information Files Standard
10.	240-56356396	Earthing and Lighting Protection
11.	240-56356510	Definitions of Terms Applicable to DC Emergency Supplies Standard
12.	240-56357424	MV and LV Switchgear Protection Standard

Item No.	Document or Specification Number	Document or Specification Description
13.	Act 85 of 1993	Occupational Health and Safety Act
14.	SANS 152	Low-voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse-combination units
15.	SANS 156	Moulded case circuit breakers.
16.	SANS 1019	Standard voltages, currents and insulation levels for electricity supply
17.	SANS 1091	National colour standards for paint
18.	SANS 1274	Coatings applied by the powder-coating process
19.	SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1900/3300 V)
20.	SANS 9000 to 9004	Quality management systems and standards.
21.	SANS 10108	The classification of hazardous locations and the selection of electrical apparatus for use in such locations
22.	SANS 10142-1	Wiring of premises Part 1: Low-voltage installation
23.	SANS 10198	Part 13 - The selection handling and selection of electric power cables of rating not exceeding 33 kV
24.	SANS 60439	Low-voltage switchgear and controlgear assemblies
25.	IEC 60071	Insulation Co-ordination
26.	IEC 60034-1	Rotating electrical machines Part 1: Rating and performance
27.	IEC 60034-5	Rotating electrical machines Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines
28.	IEC 60044-1	Instrument transformers Part 1: Current transformers
29.	IEC 60044-2	Instrument transformers Part 2: Inductive voltage transformers
30.	IEC 60051	Direct-acting analogue electrical measuring instruments and their accessories
31.	IEC 60269	Low-voltage fuses
32.	IEC 60529	Degrees of protection provided by enclosures (IP code)
33.	IEC 60898	Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations
34.	IEC 60947	Low voltage switchgear and controlgear - Part 2 (circuit-breakers)

3.4.4 C&I:

- (1) All field equipment installations are required to comply with Field Instrument Installation Standard, 240-56355754.
- (2) All field equipment installations IP ratings are to be at least IP65, and are required to comply with the hazardous classifications as listed in the Camden Power Station Classification of Hazardous Areas , 0044 593. Sewage plant is classified as zone 02 which require instrumentation with Flameproof (Exn IIC T1) rating.
- (3) All cabling installations are required to comply with 240-56227443 requirements for Control and Power Cables for Power Stations Standard.

3.4.5 Plant Interfaces and Battery Limits:

3.4.5.1 Sewage Treatment Plant:

3.4.5.1.1 Mechanical

The mechanical battery limit is the chlorine dosing system from the sand filter outlet to the Reclamation Dam inlet including pipework, injector, non-return valves, isolation valves and a customised container to house the Chlorine dosing system.

3.4.5.1.2 Electrical

The electrical scope boundary of the Works to be executed by the Contractor includes the 380V LV Switchgear, the new supply point and its auxiliaries, and the interface and connection to the 380V LV Switchgear up to and including the 230V Distribution Boards and the termination points of the electrical dependant equipment to be installed. The Contractor is responsible for to the electrical requirements of the Employer stated in the Works Information and Scope of Work. The Contractor ensures that the electrical requirements are made known to the Employer. The Contractor to equip the LV Switchgear.

3.4.5.1.3 C&I

C&I scope of work entails the supply and installation of the field instruments, power cabling and associated racking as indicated in Limit of Supply and Services (LOSS) diagram in Appendix E.

3.4.5.1.4 Civil

The Civil Scope entails installation of safety hand railings, ground grading for storm water channelling away from the tanks, ground preparation for the dosing unit and truck off-loading bay.

3.4.5.2 Water Treatment Plant:

3.4.5.2.1 Mechanical

The chlorine dosing system from the tap off from the potable pump discharge line i.e. supply line to the Chlorine storage room to the inlet to the Filtered Sump i.e. outlet of the Chlorine Storage room including pipework, injector, non-return valves, isolation valves and a customised container to house the Chlorine dosing system.

3.4.5.2.2 Electrical

The electrical scope boundary of the Works to be executed by the Contractor includes the 380V LV Switchgear, the new supply point and its auxiliaries, and the interface and connection to the 380V LV Switchgear up to and including the 230V Distribution Boards and the termination points of the electrical dependant equipment to be installed. The Contractor is responsible for to the electrical requirements of the Employer stated in the Works Information and Scope of Work. The Contractor ensures that the electrical requirements are made known to the Employer. The Contractor to equip the LV Switchgear.

3.4.5.2.3 C&I

C&I scope of work entails the supply and installation of the field instruments, power cabling and associated racking as indicated in Limit of Supply and Services (LOSS) diagram in Appendix E.

3.4.5.2.4 Civil

The Civil Scope entails ground preparation for the dosing unit and truck off-loading bay.

4. ADDITIONAL REQUIREMENTS AND PREREQUISITES

4.1 SKILLS DEVELOPMENT

The Contractor allows secondment of the Employer's staff to benefit from the technical and/or project management services to be provided by assigning its' staff full time to the project. The Employer's personnel are assigned to the Contractor to actively mentor the Employer's personnel and allow for skills transfer. The assigned Employer's personnel shall perform as much as possible of the specific tasks under the guidance of the Contractor and in line with the scope of work.

4.2 HEALTH AND ENVIRONMENTAL

The Contractor is required to act in accordance with the Employer Health and Safety requirements stated in the SHE pack provided.

In carrying out its obligations to the Employer in terms of this contract; in providing the Works; in using Plant, Materials and Equipment; and while at the Site for any reason, the Contractor complies, procures and ensures the compliance by its employees, agents, Subcontractors and mandataries with:

- the provisions of the Occupational Health and Safety Act 85 of 1993 (as amended) and,
- all regulations in force from time to time in terms of that Act (“the OHSA”); and Employer’s “Safety, Health and Environmental Requirements for Contractors” document attached to the Works Information (as amended from time to time) and such other Employer Safety Regulations as are applicable to the works and are provided in writing to the Contractor (collectively “the Employer Regulations”). The Employer Regulations may be amended from time to time by the Employer and all amendments will be provided in writing to the Contractor. The Contractor complies with the provisions of the latest written version of the Employer’s Regulations with which it has been provided; and the health and safety plan prepared by the Contractor in accordance with the SHEQ Requirements

4.3 DOCUMENTATION AND CONFIGURATION MANAGEMENT

4.3.1 Documentation Management System:

The Contractor plans the supply of the documentation during the various project stages and provides the documents in accordance with the key scheduled project milestone dates. A comprehensive documentation management system is provided. The Contractor submits all documentation on a formal transmittal form in triplicate to the Project Manager. All manuals, documents and engineering documentation shall be presented in British English.

4.3.2 Drawings Format and Layout

- The creation, issue and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 - Engineering drawing Standard – Common Requirements
- Drawings issued will be a minimum of one hardcopy and an electronic copy in DWG/DGN format
- Issued drawings will not be “Right Protected” or encrypted

4.3.3 Plant Codification and Labelling:

Plant codification is done according to the KKS system as used at Camden Power Station. The Employer assists the Contractor in identifying suitable codification descriptions for new equipment and signals. The KKS plant position codes are identified in the documentation. KKS codes, down to third level, are to be used. The format of all documents is submitted to the Project Manager for acceptance.

The following standards should be adhered to:

- 240-71432150 - Plant Labelling Standard
- 240-109607736 - Eskom KKS Key Part Standard

4.3.4 As-built Drawings, Operating Manuals and Maintenance Schedules

- The Contractor provides all updated as-built drawings
- The Contractor supplies a complete list of components supplied and installed with technical description, model number and other technical detail as required by the SAP system
- Documentation complies with 240 - 86973501 Engineering Drawing Standard - Common Requirements

4.4 SPECIALISED TOOLS

The Contractor Supplies any specialised tools that are required for regular maintenance and operation of the Chlorine dosing plant as part of the works.

5. PROCUREMENT

5.1 PEOPLE

5.1.1 Minimum requirements of people employed on the Site

- All people employed to Provide the works shall have South African Citizenship
- If international employees will be employed to Provide the works they shall have official work permits
- All people employed to Provide the works shall be trained on health and safety
- All people employed to Provide the works shall be trained on doing risk assessment
- CV's of the key personnel involved in the construction and commissioning phases is to be provided with the Tender. Their related experience in Water and Waste Water Treatment Plants must be clearly stated with references

5.2 SUBCONTRACTING

5.2.1 Preferred Subcontractors

- (1) It is required that the Contractor demonstrates evidence of projects worked on which are applicable to systems affected by this project
- (2) In the event of the Contractor not having the necessary experience required on these systems, the Contractor shall subcontract the work to a third party company who complies to these requirements
- (3) It would be beneficial for the Contractor to provide as much as possible evidence of projects where he or she had worked on the same systems

5.2.2 List of Proposed Sub-Contractors

The Contractor indicates on a list as shown below, the names of any sub-contractors whose services may be used to provide the works. The Contractor provides a short description of the work it is proposed to sub-contract to each, together with an approximate value of the work to be executed by each.

Where the sub-contractor will be required to do physical work on site the Contractor provides details on the experiences of the mentioned sub-contractor as well as a list of references involving work of a similar nature.

Notwithstanding the inclusion of a sub-contractor's name below, the Contractor obtains the written acceptance of the Project Manager prior to the employment of such sub-Contractor on the Site.

The Contractor will provide details of previous works and references of work done by the intended.

5.2.3 List of Proposed Sub-Contractors

Sub-Contractor	Description of work	Approximate value	Accepted by <i>Project Manager</i>

5.2.4 Subcontract documentation, and assessment of subcontract tenders

It is required that the Subcontractor shall attend all technical meetings as and when required.

The Contractor and subcontractor submits detailed CV's showing previous work experience in the field of Chlorine dosing systems.

5.3 PLANT AND MATERIALS

5.3.1 Quality

Please refer to specific sections in Section 6.4.2 for Quality requirements. In addition,

Warranties

- (1) All warranties for the equipment provided are included as part of the works.
- (2) All warranties are in the name of Camden Power Station.

5.3.2 Plant & Materials provided “free issue” by the Employer

None

5.3.3 Spares and consumables

The Contractor supplies a list of critical spares.

5.4 TESTS AND INSPECTIONS BEFORE DELIVERY

Before the equipment is delivered to site, Factory acceptance tests (FAT) will be required where both the Contractor and Eskom is present. The FAT test shall be conducted in compliance with IEC 62381. The purpose of the FAT is to confirm that the plant will operate as per the functional requirements.

These will include the following as a minimum:

- Dosing flowrates
- Dosing concentrations
- Leak detection system
- Inspection and testing of all the signals if possible
- Inspection and testing of the control system to confirm it is in accordance with Eskom requirements
- Inspection and testing of the electrical system to confirm it is in accordance with Eskom requirements

The Contractor must compile a FAT testing procedure for acceptance by Eskom prior to the FAT being done.

6. CONSTRAINTS ON HOW THE CONTRACTOR PROVIDES THE WORKS

6.1 MEETINGS

Regular meetings of a general nature may be convened and chaired by the Employer as follows:

Title and Purpose	Interval	Location	Attendees
Progress and Feedback		Site	Employer, Contractor, Supervisor, others as required
Risk Reduction		Site	Employer, Contractor, Supervisor, others as required
Safety		Site	Employer, Contractor, Supervisor, Safety representatives of Employer and Contractor

6.2 CONSTRUCTABILITY CONSIDERATIONS

1. The Contractor takes full professional accountability and liability for all items required for the execution of the Works.
 - a. The Contractor conducts a constructability assessment for the installation and constructability of the Chlorine dosing systems and plant safety upgrades.
2. The schedule milestones will be determined by the Employer and the Contractor post contract award.
3. The Contractor must provide a dosing system that is compliant with SANS 10298:2009 for small to medium sized chlorine gas installations and Occupational Health and Safety Act 85 of 1993. The Contractor will interface with Camden Power Station to ensure that adequate interface management is adopted.

6.3 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

The Contractor will make provision for all temporary accesses and utilities required to ensure completion of the Works.

6.4 EXECUTION BY THE CONTRACTOR

The Contractor assumes full responsibility for the execution of the whole and every portion of the works. Where the Employer has provided design requirements and a contradiction occurs, the most stringent applies.

6.4.1 General

The Contractor is required to:

1. Take full professional accountability and liability for all changes made to the existing dosing systems and plant structures.
2. Provide the following to the Employer for review and acceptance:
 - A Level 3 schedule (schedule with defined activities) for the design scope clearly highlighting all activities involved and major milestones
3. Provide detailed drawings Issued for Construction. Drawings are submitted in PDF and CAD formats (DWG).
4. Identify and note discrepancy or ambiguity between the Employer's Specifications or requirements. These variations are brought to the attention of the Employer for clarification within an effective allowable timeframe.
5. Adhere to the South African Environment Protection Act, the Waste Management Code of Practice and the South African Occupational Health and Safety Act No. 85 of 1993, the regulations promulgated thereunder and Eskom Safety, Health, Environment and Quality (SHEQ) Policy 32-727 for all works.
6. Adhere to the South African National Water Act 1998 (ACT NO. 36 OF 1998)
7. Submit all deliverables, to be reviewed by the Employer, prior to moving on to the next phase of the project.
8. Manage access to the working areas and the Site.
9. Allow adequate interface management to ensure that the activities contained within the Works does not obstruct or impose on interface projects and/or cause hindrances to general operations on site.
10. Maintains and promotes labour harmony on the Site and in the working environment.
11. Immediately report any potential labour disharmony to the Supervisor.

6.4.2 Quality Management

The Contractor responsibilities include but are not limited to the following:

- The Contractor is accountable for the quality of the output and liable for any failures
- Implementation of their QMS on site
- Administration of their QA/QC systems on site
- Verification of approval status of Subcontractor's Quality programmes, that is, CQP's, QCPs, NC's (where required)
- Defects and all their operational procedures and works instructions
- On-and-off site inspections
- Weekly and monthly progress reporting on quality performance (where required)
- The Contractor is responsible for defining the level of intervention of QA/QC or inspections in line with the Employers requirements
- The Contractor is responsible for defining the level of intervention of QA/QC or inspections to be imposed on his Subcontractor, suppliers and sub-suppliers and must ensure that these are in line with the Employer's requirements (where required)

The Employer's Supervisor will be responsible for the following:

- Reviews of the quality submissions
- Verification of the Contractor's intervention points
- Reviews the Contractor's ITP/QCP documents (procedures, test results)
- Reviews the data book

Where Non-Conformance (NC) notifications are issued, the Contractor acknowledges receipt within the period of reply and proposes corrective and preventive actions to the Employer's Supervisor. The corrective and preventive actions will include the implementation and completion dates. Progress on all NCs notifications issued to the Contractor must be reported to the Employer's Supervisor on weekly basis.

- The Contractor's Quality Manager keeps a register of all NC notifications issued
- Records of NCs notifications are kept and form part of the data book records

7. CONSTRUCTION

7.1 TEMPORARY WORKS, SITE SERVICES & CONSTRUCTION CONSTRAINTS

7.1.1 Employer's Site entry and security control, permits, and Site regulations

The Contractor complies with the following:

- Camden Power Station Health and Safety Standards as per Camden Power Station Safety, Health and Environmental Specification 004/4830
- Compliance with Eskom Smoking Policy (32-1126)
- Adhere to the OHS Act 85 of 1993
- All staff will undergo Safety Induction, presented by Camden Risk Management Department
- Adhere to Eskom Cardinal Rules at all times
- The Contractor must conform to the access control requirements as set out in the document called Camden Power Station Safety, Health and Environmental Specification 004/4830
- The Contractor must conform to the requirements set out in the document called Safety, Health, Environmental and Quality (SHEQ) Policy 32-727
- Names and Identity numbers are required seven working days before the contract starts. Photo copies of identity documents are also required. This must be arranged with the Employer's Representative
- Lost permits will be paid for by the Contractor to Protective Services at a cost of R100-00 per lost permit
- Only work vehicles with an approved permit will be allowed on site. No private vehicles will be allowed on site
- Arrangements must be made with the Employer's Representative well in advance to allow sub-contractors on site
- The transport of any equipment onto site must be declared and documented at Protective Services in order to facilitate the future removal thereof
- Eskom may at its discretion provide any spare parts, materials or equipment as may be required for the execution of the contract works
- At least one supervisor shall be authorized as a Responsible Person in terms of the Generation Plant Safety Regulations 36-681

7.1.2 Health and safety facilities on Site

- The Medical Station is available on site during normal working hours. The afterhours emergency telephone number is 017 827 8471 or from a Camden phone the extension is 7911 that can be phoned for assistance
- Fire protection and rescue services are available on site 24 hours per day

7.1.3 Publicity and progress photographs

Camden Power Station is a National Key Point. The Contractor adheres to all the requirement of the National Key Points Act 102 of 1980. Cameras and publishing of progress photographs is prohibited.

7.1.4 Contractor's Equipment

The Contractor shall register all their equipment and declare all their belongings at the security gate upon arrival. Unregistered belongings upon arrival will not be allowed to be removed offsite.

7.1.5 Equipment provided by the Employer

Where it needs be the Employer shall erect scaffolding for the purposes of executing projects tasks.

7.1.6 Facilities provided by the Contractor

- All transport i.e. Tractors, Trucks, LDV's (Light Duty **Vehicle**)
- Accommodation is for the Contractor's own account
- All tools must be provided by the Contractor for the works
- All workshop machinery must be provided by the Contractor for the works
- All office equipment must be provided by the Contractor for the works
- Telephone bills will be paid by the Contractor
- The Contractor must provide working procedures for each activity to the Employer's Representative at least 2 weeks prior to outage before work may proceed. This procedure will include "Safe working procedures"
- The Contractor must provide all the material needed for the works. The safeguarding, care and security of all equipment and materials while the Contractor is performing the works is the responsibility of the Contractor
- If the Contractor uses portable two-way radios, the Employer's Representative must approve the type and make
- At least one person in the service of the Contractor shall be certified competent to inspect scaffolding needed by the Contractor for the works. Certificates as proof of this will be handed to the Employer's Representative after contract award before the starting date
- All redundant Contractors' material must be moved to allocated sites. No scrap shall be stored in the Contractor's yard. Scrap must be cleared of site daily

7.1.7 Excavations and associated water control

An excavation permit is required before any excavation is carried out. The permit will be issued by the Employer provided that all necessary criteria are met.

7.1.8 Underground services, other existing services, cable and pipe trenches and covers

The Contractor ensures that the necessary tests are done to identify whether there any underground services before digging any trenches or excavations can be done. A risk assessment shall be conducted with the inclusion of Project Manager and the relevant Eskom Supervisors before and groundwork can be started.

7.1.9 Sequences of construction or installation

The Contractor shall provide an implementation strategy and procedure for the decommissioning and installation of the new Chlorine dosing systems at the STP and the WTP taking into account the lack of redundancy in the current system and the requirement of continuous dosing.

7.1.10 Hook ups to existing works

Hook up drawings to be provided by the Contractor.

7.2 COMPLETION, TESTING, COMMISSIONING AND CORRECTION OF DEFECTS

7.2.1 Work to be done by the Completion Date

On or before the Completion Date the Contractor shall have done everything required to Provide the works except for the work listed below which may be done after the Completion Date but in any case before the dates stated. The Project Manager cannot certify Completion until all the work except that listed below has been done and is also free of Defects which would have, in his opinion, prevented the Employer from using the works and Others from doing their work.

Item of work	To be completed by
As built drawings of the new Chlorine dosing systems at the STP and the WTP	Within 14 days after completion
Performance testing of the works in use as specified in paragraph 5.2.6 of this Works Information.	See performance testing requirements.

7.2.2 Commissioning

This is defined as bringing into service all items of the works as specified, meeting the requirements of the functional Works Information, as well as the control system and plant performance including all necessary testing and verification of the stated performance. The equipment covered by the Works Information is installed and complete in all respects by the dates stated in the Accepted Programme.

The Contractor provides sufficient personnel for the satisfactory and timely commissioning of the equipment. Before equipment is placed in service, the Contractor certifies that it is in a suitable and safe condition. Prior to the time when cold commissioning commences, the Project Manager nominates a representative to co-ordinate the commissioning of all equipment forming an integral part of the plant being commissioned. The Contractor co-operates fully with the Project Manager's Representative/s in the work of commissioning the whole of the plant for which the Employer supplies the portion of equipment specified. The Employer uses the works, without taking over the works, before Completion for the commissioning, optimisation and capability testing of the works and associated plants.

7.2.2.1 Site Integration Test (SIT)

SIT is done to ensure the correct performance of the control systems and equipment, and ensure compliance with the Works Information before commissioning of plant commences. The proposed test procedure, together with test dates, is prepared by the Contractor and submitted to the Project Manager for acceptance during the system engineering stage. The final test procedures are prepared by the Contractor and submitted to the Project Manager for acceptance at least 10 working days prior to the scheduled test date. The Contractor shows these dates in the Accepted Program.

The Contractor provides all the test equipment for testing the individual systems. Records are to be kept of each SIT in a log book defining the test to be undertaken, time and date of the commencement of the test, duration of the test, criteria that need to be met and results entered of the tests. These records are submitted to the Project Manager. In the event of an error of any test (hardware/software) the fault is logged and analysed. The Project Manager determines if the item is of a minor nature, the Contractor is allowed to rectify the fault and the item re-tested for the full duration. Major faults such as power supply failures, system stall, bus failure, etc. terminates the SIT. The Contractor rectifies the fault and re-starts the SIT after proving the rectified piece of equipment by carrying out the appropriate diagnostic tests. When the test is successful, the system is classified 'ready for use'. The dosing system is then deemed ready for cold commissioning.

The Contractor provides a sample of the type of tests that forms part of the site integration tests and the duration of these tests during the detail design phase.

7.2.2.2 Cold Commissioning

The Contractor submits a method statement prior to commissioning indicating the process and plan to be followed. The Contractor takes note that the downtime of the dosing system is critical and the time for which there is no Chlorine dosing needs to be minimised.

7.2.2.3 Functional Tests

The functional tests form part of the cold commissioning of the monitoring and protection system and include the checking of all measurement loops, interlocks and analogue controls. These tests are conducted in conjunction with the Supervisor and others. Special care is taken to safety aspects, special function limits, and position indication.

The Contractor, at tender stage, provides a sample of the type of functional test forming part of the cold commissioning with typical durations.

7.2.2.4 Hot Commissioning

The Contractor notifies the Project Manager that cold commissioning is complete and requests the commencement of hot commissioning. Hot commissioning is where the plant processes are placed into operation in conjunction with the control system. The commissioning activities are carried out in conjunction with the Supervisor. The Contractor is responsible for the hot commissioning of all the equipment forming part of the works to satisfy the requirements of the Works Information. The Employer is responsible for plant preparation for hot commissioning. However, for that portion of the equipment, which cannot be commissioned separately from other plant, the commissioning is at the discretion of the Project Manager for the particular stage of commissioning. In cases where various components (existing or new) are connected to form an integrated system, the Contractor, at the time of commissioning, carries the responsibility for the correct functioning of the whole of the system. If a defect is identified in the equipment interfacing or external to the Contractor's scope the Contractor directs the Project Manager's Representative/s to rectify the defects.

The Contractor provides a sample of the type of functional test forming part of the hot commissioning with typical test durations.

7.2.2.5 Operational Acceptance Tests

On completion of the optimization and testing phase the Contractor requests the commencement of operational acceptance tests from the Project Manager. The Contractor produces a detailed operational acceptance test procedure twenty working days in advance for acceptance by the Project Manager. This is shown on the Accepted Program.

On completion of the operational acceptance test the Employer runs the works for an unbroken period of 72 hours without hardware or software malfunctions. During this period any or all functions may be exercised. In the event of any hardware or software fault, the Contractor remedies the fault and the 72 hour test shall be restarted.

7.2.3 Start-up procedures required to put the works into operation

Start-up procedure for both Chlorine dosing systems to be supplied by the Contractor.

7.2.4 Take over procedures

Takeover will be done after full compliance and demonstration of the following:

- Successful Commissioning of all plant components
- Submission and acceptance of all documents as listed in the Work Info
- Successful testing of the operation of the plant as per the manuals produced
- Successful testing of the control system as per the control narrative

7.3 TRAINING WORKSHOPS AND TECHNOLOGY TRANSFER

7.3.1 General

The Contractor provides training on the equipment and systems included as part of the works to the various categories of the Employer's technical staff for the duration of the works.

Training provided by the Contractor is directly applicable to the actual equipment supplied for the works. Generalised training based on similar equipment is not acceptable. All training will consist of both theoretical and practical training. The training is to be structured such that competency tests are done at the end of the training sessions on all the training participants.

Training is scheduled such that full scope training courses are provided for all five Operating shifts.

7.3.2 Training Documentation

The Contractor provides all course material including manuals. All course material is in English and includes all third party documentation. A copy of the training documentation is supplied to each trainee with an additional 3 master sets for the Employer's library and training department. All training material is also supplied in an electronic format for easy reference.

Training manuals are continuously updated by the Contractor up to the date of issue of the Defects Certificate for the whole of the works.

7.3.3 Operating, Maintenance and Engineering Training Manuals

The Contractor provides 4 hard copies of the Operating, Maintenance and Engineering Training Manuals.

All documentation is also to be handed over in an electronic format (PDF) for easy reference.

8. PLANT AND MATERIALS STANDARDS AND WORKMANSHIP

8.1 INVESTIGATION, SURVEY AND SITE CLEARANCE

8.1.1 Survey of proposed location

1. The Contractor is responsible for the complete surveying and setting out of the works including establishment of any benchmarks required to complete the works.
2. The Contractor confirms the available space in the proposed area for the design of the proposed facilities taking note of all existing services, structures and any obstructions to the works.
3. The Contractor is required to consult the Surveyor-General's office to obtain information on available registered beacons near Camden Power Station to use for the establishment of any required benchmarks close to the works.
4. The Contractor ensures that the site where the works is to be conducted is cordoned off to ensure safe working conditions during the project execution.
5. The Contractor ensures a clear working space is accessible at all times by removing all debris and unused materials/equipment.

8.2 CIVIL ENGINEERING AND STRUCTURAL WORKS

8.2.1 General

1. The Contractor is required to confirm all site dimensions, levels and cast-in items positions on site prior to any fabrication of steel or casting of concrete.
2. The Contractor is required to submit a comprehensive method statement of the works to the Project Manager for acceptance prior to the start of the works.
3. The Contractor is responsible for the design, erection, maintenance and removal of all temporary bracing or propping required for the execution of the works.

8.2.2 Scope of Work

8.2.2.1 Structural steel

1. The Contractor conducts the complete structural design of the dosing system upgrade in accordance with the specifications and standards indicated herein.
2. All structural steel used is required to be grade S355JR in accordance with SANS 50025.
3. Welded connections if required to be welded all around with a minimum of 6 mm fillet welds or the appropriately designed fillet weld size. Butt welds are required to be full penetration welds.
4. Grade 8.8 bolts are used throughout, as a minimum.
5. The minimum thickness of gusset plates is 10mm.
6. Reinforced concrete foundations are designed in accordance with SANS 10100. The minimum cover to reinforcement for below ground elements is 60mm, and 40mm for above ground elements.
7. All details and drawings of any buildings and civil works which are not explicitly included in this contract but which, in the opinion of the Contractor, will be necessary for the completion and proper execution of the project is included by the Contractor and submitted to the Project Manager for acceptance. The Contractor clearly indicates his proposed scope regarding these additional items. The Contractor identifies and specifies all work and tests to be conducted prior to construction.
8. The Contractor accepts full responsibility for all ground conditions and provides adequate foundation and plinth designs where required.

Services provided by the Contractor in the design phase include:

- a. Perform ground scans and bearing tests to determine if the designed solution will be suitable.
- b. Design and provision for diverting any storm water drainage affected by the implementation of this project.
- c. The Contractor ensures that the implementation of this project does not compromise the structural integrity of the existing plant or cause any disruptions to plant operability.
- d. Sizing and optimizing the different components.

8.2.2.2 Prior to Fabrication and Construction

1. The Contractor's programme allows two weeks for the Project Manager's acceptance and at least one revision following the Project Manager's initial comments.
2. A detailed Construction Work Programme, broken down to specific tasks and time allocations for the completion of each task is submitted.

8.2.2.3 Fabrication and Construction

The works to be provided by the Contractor include:

1. Provision of all embedded anchor bolts, sleeves, anchors and other miscellaneous embedded parts required for the installation of all plant and structural steel work, including if necessary setting templates required for the placement of anchor bolts/embedment.
2. Excavations and casting of all foundations and plinths for the plant.
3. Construction of the supporting structures.
4. Grouting of structural steelwork. The Contractor is to provide details of materials and method of grouting including epoxy type non-shrink materials for acceptance by the Project Manager.
5. Testing of the welding work is to be conducted in accordance with SANS 1200H Section 7.3 and allowance also has to be made for Magnetic Particle Inspection testing.
6. Corrosion protection of the steel supporting structures and embedded parts.
7. The Contractor ensures that all concrete works are of suitable strength, the minimum strength of structural concrete and blinding concrete is to be 35MPa and 15MPa, respectively.
8. Finishing are to be off-shutter or wood float. All corners to be chamfered 20x20mm. Jointing design and materials is to be suitable for the generally high and low temperature conditions that exist on site in order to minimize shrinkage and joint failure.
9. Concrete may be produced from an on-site batching plant or, if available, from a local ready mix plant. Concrete is to be placed promptly after batching.
10. All reinforced concrete structures are to be designed in accordance with SANS 10100.
11. The construction of all reinforced concrete structures, including manufacturing, transportation, placement, sampling, curing and testing of concrete as well as the design, cutting, bending/fixing of reinforcement, erection of structures, stripping and quality of formwork is to be governed by the requirements of the relevant sections of SANS 2001-CC1.

8.2.2.4 Reinforced Concrete

1. All concrete work is required to be in accordance with SANS 2001-CC1 and SANS 10100-2 unless otherwise stated.
2. All concrete surfaces and cast-in items is required to be inspected and accepted by the Project Manager in writing before casting of concrete may commence.
3. The Contractor is required to obtain written acceptance from the Project Manager for the use of any add-mixture or the use off ready mixed concrete, to pump concrete, or to use cement or cement blends other than ordinary Portland cement (OPC).
4. Compaction of concrete is required to be done by means of mechanical vibrators only.
5. The Contractor is required to submit the concrete mix design to the Project Manager for acceptance.
6. The Contractor is required to demonstrate, by means of a report from an approved laboratory, that the aggregates do not exhibit excessive shrinking properties in accordance with SANS 1083 and is also required to demonstrate that the aggregates do not have a potential alkali silica reaction.
7. All concrete is required to have a maximum water/cement ratio of 0.45 with a minimum cement content of 420 kg/m³.
8. The Contractor is required to perform a slump test on the same batch of concrete every time a sample is taken and the result recorded.

The table below indicates particular specifications pertaining to SANS 2001-CC1 and must be read in conjunction with the code.

Table 1: SANS 2001-CC1 Code

Clause	Particular Specification
4.2	Materials
4.2.3.5	The following tests are required: <ul style="list-style-type: none"> drying shrinkage on fine and coarse aggregates; drying shrinkage of concrete; flakiness index of the stone; alkali-aggregate reaction.
4.2.7	In general, one of the following types of non-shrink grout are required to be used: <ul style="list-style-type: none"> Cement-based non-shrink grout, not less than 50 MPa; Special proprietary non-shrink or expansive grout, not less than 50 MPa.
4.2.6	Concrete Grade is required to be: <ul style="list-style-type: none"> Class 15 MPa/ 19 mm for Blinding Concrete (28 days), Class 35 MPa/ 19 mm for Structural Concrete (28 days).
4.3	Formwork
4.3.1.8	<ul style="list-style-type: none"> Tolerances on all concrete work is required to be a level II degree of accuracy as specified in SANS 2001-CC1 with and is to be carefully maintained throughout the construction.
4.4	Reinforcement
4.4	Add the following: All reinforcement is stamped with a SANS quality assurance mark.
4.4.3.1	Cast in-situ concrete cover is required to be a minimum of: <ul style="list-style-type: none"> 60 mm for exposed to earth or water; 40 mm for above ground or not in contact with soil.
4.7	Quality of Concrete
4.7.1.1	<ul style="list-style-type: none"> <i>Contractor</i> submits to the <i>Supervisor</i> full details and samples of all materials which he proposes to use for making concrete at least 28 days before the concreting of the works is due to commence.
4.7.10	Add the following: <ul style="list-style-type: none"> A layer of blinding concrete of 50 mm minimum thickness is required to be placed under foundations. A polyethylene sheet with a minimum thickness of 250 microns is required under ground slabs

Clause	Particular Specification
4.7.12.2.3	<ul style="list-style-type: none"> All angled corners are chamfered 20 mm x 20 mm, unless such other larger size is detailed on the Drawings.
4.7.19.3	<ul style="list-style-type: none"> <i>Contractor</i> submits a detailed procedure for acceptance by the <i>Supervisor</i> on how he intends to carry out the repairs of structural concrete defects
4.7.22	<ul style="list-style-type: none"> For concrete pour records, the <i>Contractor</i> submits a detailed Quality Control Plan to the <i>Supervisor</i> for acceptance. In addition the <i>Contractor</i> supplies the <i>Supervisor</i> with two copies of these records each day covering works carried out the preceding day.
5.1	Testing
5.1.1.4	<ol style="list-style-type: none"> Eight 150 mm cube samples taken from each batch or place of concrete deposition, four cubes are tested at 7 days and four at 28 days. Strength at 7 days is required to be at least two thirds of 28 day strength.
5.1.2.1	<ol style="list-style-type: none"> Any of the cube samples tested indicating a result more than 3 MPa below the specified strength is disregarded.
5.1.3.3	<p>Add the following:</p> <ol style="list-style-type: none"> ..., unless no more than three batches of concrete is being mixed.
5.2	Tolerances
5.2.1.1	<ol style="list-style-type: none"> Tolerances on all concrete work is required to be a level II degree of accuracy as specified in SANS 2001-CC1 with and is to be carefully maintained throughout the construction.
5.2.2.1 Table 11	<p>Add the following under “Location of holding-down bolts”:</p> <ol style="list-style-type: none"> 3) The permissible deviation between any two bolts that share the same base-plate is limited to 2mm for bolt sizes up to and including M24, and 3mm for bolts larger than M24.

8.2.2.5 Structural Steelwork

- All work is required to be in accordance with the latest edition of SANS 2001-CS1.
- The Contractor is responsible for the stability of the entire structure and all structural elements during all the erection stages.
- All dimensions are required to be verified on site by the Contractor before any fabrication of steelwork commences.
- All welding is required to be conducted by coded welders. Supporting documentation is also required to be submitted to the Project Manager for acceptance. All welding is required to comply with AWS D1.1.
- All welds are required to be inspected using visual aids.
- The Contractor is required to supply all bolts, washers, nuts etc. for the structural steelwork.

The table below indicates particular specifications pertaining to SANS 2001-CS1 and must be read in conjunction with the code.

Table 2: SANS 2001 - CSI Code

Clause	Particular Specification
4.1	Materials
4.1.1	Add the following: <ul style="list-style-type: none"> All structural steelwork is required to be grade S355JR
4.1.4.1	<ul style="list-style-type: none"> Electrodes for electric welding are required to be E7018.
4.1.5.1	<ul style="list-style-type: none"> Bolt grade 8.8 is required as a minimum
4.6	Workmanship - Erection
4.6.5	<ul style="list-style-type: none"> On site welding is not permitted
5.3	Non-destructive testing of welds
5.3.3	<ul style="list-style-type: none"> Fillet welds are required to undergo magnetic particle inspection (20 % of welds)
5.3.4	<ul style="list-style-type: none"> All butt welds and full penetration welds are required to undergo ultrasonic non-destructive testing (100 % of welds)

8.2.3 Corrosion protection

Corrosion protection is required for all steelwork in accordance with the following:

- 240-106365693 - Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
- 240-101712128: Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with linings

8.2.4 Construction

8.2.4.1 General

The Contractor:

1. Adheres to the South African Environment Protection Act, the waste management code of practice and the South African Occupational Health and Safety Act No. 85 of 1993, the regulations promulgated thereunder and Eskom Safety, Health, Environment and Quality (SHEQ) Policy 32-727 for all works.
2. Submits a comprehensive method statement of the entire works to the Project Manager for acceptance prior to the start of the works.
3. Submits a project specific safety file to the Employer for comments / acceptance.
4. Submits a detailed level 3 schedule for the works to the Project Manager for acceptance after contract award.
5. Takes all necessary precautions to ensure that none of the existing structures / facilities not forming part of the works is damaged during construction.
6. Prepares earthworks to create access to the working areas. The Contractor disposes of all rubble at a waste disposal site to be approved by the Employer. The waste disposal site is selected to suit the classification of the materials to be disposed of. Certificates of disposal are required to be submitted to the Employer.
7. Stores salvaged plant/materials/components elevated off the ground to protect from ingress of dust and rainwater, etc.
8. Continuously monitor the condition within the working and surrounding areas for any hazardous substances or situations, and in such case, the Contractor is required to take necessary precautionary measures.
9. Manages his access to the working areas and the Site.
10. Manages his activities on Site to ensure that no interference takes place between his work and that of others.
11. Completes "Contract Activities Daily Reports".
12. Liaises with the Supervisor regarding utilities and telephone facilities required for his Site establishment.
13. Liaises with the Supervisor regarding the location of waste disposal sites and rubbish dumps.

8.2.4.2 Construction and Erection

1. The Contractor is responsible for the construction of the facility and all associated services in accordance with the accepted detailed drawings and specifications.
2. The Contractor disposes of all construction waste at a licenced waste disposal site to be accepted by the Project Manager. The waste disposal site is selected to suit the classification of the materials to be disposed of. Certificates of disposal are required to be submitted to the Employer.

8.2.4.3 Civil Quality Management

1. The Contractor submits a fully detailed Quality Control Plan (QCP) for acceptance within one week of the Contract Date.
2. The Contractor submits a schedule of unpriced orders to be placed and this is updated regularly.
3. The Contractor is responsible for defining the level of QA/QC (intervention Points) or inspection to be imposed on his Subcontractors and suppliers of material in the Quality Control Plans (QCPs). This level is based on the criticality of plant and materials, and is submitted to the Employer for acceptance.
4. Product data sheets and product samples are submitted for review and acceptance by the Project Manager after contract award and prior to the commencement of work.
5. The Contractor submits on a monthly basis, the following QA returns:
 - A register of Defects with those older than 30 days being flagged and an explanation attached
 - Register of accepted Defects
 - A register of Non Conformance Report
 - Monthly Project Quality Report
 - Monthly updated Site and pre-site programmes
 - Inspection dates
 - Site Acceptance Tests
 - Inspections completed / outstanding
6. All quality control documentation is submitted to the Project Manager within 7 days of Contract Date.

9. REQUIREMENTS OF THE PLANT

9.1 PLANT SPECIFIC PERFORMANCE

1. The designed dosing systems must be compliant with relevant governing legislation.
2. The integrity of the dosing systems must remain for the remaining life of the power station and must not be subject to degradation.

9.2 OPERATIONAL

1. Operating documentation / philosophy with OEM recommendations will be required for the new Chlorine dosing systems.
2. Awareness Training of the upgraded systems will be required.
3. Alarm and event handling: The new system will be supplied with an alarm and siren and the event handling process will remain the same as for the existing system.

9.3 MAINTENANCE

1. The maintenance strategy is to be aligned with the current plant maintenance strategy for Camden Power Station.
2. The design of the new dosing systems and plant safety upgrades must be done to ensure ease of maintenance.
3. All plant equipment must be installed, operated and maintained in a manner that will provide maximum useful life and best life cycle cost.

9.4 WASTE MANAGEMENT

1. The waste management procedure for Camden power station shall be complied with.
2. Liaise with the Supervisor regarding the location of waste disposal sites and rubbish dumps.

9.5 ENTERPRISE POLICIES

Compliance with all legislation and Eskom policies is compulsory. Health and Environmental procedures shall be adhered to at all times.

- OSH Act
- Eskom Safety Standards

10. SERVICES AND OTHER THINGS PROVIDED BY THE EMPLOYER

- A connection point for potable water, service air and electrical power at normal voltage for the execution of the scope
- The necessary isolations for tie-in to the existing systems
- All scaffolding if required
- Lay Down Area for Site Establishment
- All NDT’s will be carried out by an Eskom approved on-site company and the cost will be excluded from this SOW

11. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Sumayyah Sulliman	Chief Engineer

12. REVISIONS

Date	Rev.	Compiler	Remarks
January 2024	1	N. Naidu	Original Issue

13. DEVELOPMENT TEAM

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14. ACKNOWLEDGEMENTS

N/A

APPENDICES ISSUED WITH THE WORKS INFORMATION:

Folder	Contained information
APPENDIX A – Mechanical Design	Detailed Mechanical Design (including Electrical and C&I)
APPENDIX B – Civil Design	Detailed Civil Design
APPENDIX C – BOQ	Detailed BOQ
APPENDIX D – Instrumentation Schedules	List including all proposed field instrumentation to be installed as part of this project
APPENDIX E – LOSS	Specifies the scope of work along with its boundaries for all C&I equipment
APPENDIX F – List of Applicable Standards	List of Applicable Eskom Standards
APPENDIX G – VDSS	Vendor Document Submittal Schedule (VDSS)
APPENDIX H – Applicable Eskom Drawing Temples	List of Applicable Eskom Drawing Templates