Eskom	Technical Specification	Lethabo Power Station

Title: **Lethabo PS Loading of SRO CIP Chemicals Technical Specification**

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1. INTRODUCTION

This document provides the technical specification that would form part of the contract for Lethabo Power Station. It provides the necessary detail to outline the scope of work for the design, manufacture, and construction, commissioning of the system required for Loading of CIP Chemicals on the Spiral Reverse Osmosis (SRO) System.

There are 3 main aspects that make up the entire scope and each of these sections will be detailed in the sections that follow. The major aspects are:

1. Chemical handling, storage
2. Mechanical Design & installation
3. C&I and Electrical – Power requirements

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the applicable work to be done on Lethabo SRO System, as well as the requirements and specifications regarding the work.

2.1.1 Purpose

The purpose of this document is to provide the *Contractor* with all the relevant details required to perform work as defined in the scope.

2.1.2 Applicability

This document applies to Lethabo Engineering, Projects, Configuration, Operating and Maintenance Departments and all other stakeholders involved in planning and execution of the Lethabo Loading of SRO CIP Chemicals Project.

2.2 NORMATIVE/INFORMATIVE REFERENCES

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

2.2.1 Normative

[1] 375-LET-BEEC-D00035-32: Lethabo Power Station Loading of SRO Plant CIP Chemicals Required Operational Capability (ROC) Report

[2] 24338866: Lethabo Power Station Loading of SRO Plant CIP Chemicals Project specific Engineering Work Request

[3] 375-LET-FBBB-D00139-1: Lethabo Power Station Loading of the SRO CIP Chemicals System Upgrade Engineering Management Plan (EMAP)

[4] 375-LET-ADDB-D00180-2: Stakeholder Requirements Definition for the Lethabo Power Station SRO chemical system upgrade

[5] 375-LET-AABB-D00139-93: End-of-Phase Design Review Report for Loading of the SRO CIP Chemicals

[6] T369/OP-01: Keyplan Lethabo Power Station Desalination Plant System Technical Description Manual Volume 1

[7] 375-LET-MDDD-D00185-9 Lethabo Power Station Loading of SRO CIP Chemicals Concept Report Rev 1

[8] 375-LET-MDDD-D00185-9 Lethabo Power Station Loading of SRO CIP Chemicals Concept Report Rev 1

[9] 375-LET-AABB-D00138-105 Lethabo Power Station Loading of SRO CIP Chemicals Concept End of Phase Report Rev 1

[10] 240-56356396: Earthing and Lightning Protection Standard

[11] 240-56355754: Field Equipment Installation Standard

[12] 240-53113685: Design Review Procedure

[13] 240-53665024: Engineering Quality Manual

[14] 240-56227443: Requirements for Control and Power Cables for Power Stations Standard

[15] 240-56355815: Control & Instrumentation Field Enclosure and Cable termination Standard.

[16] 240-56355754: Field Equipment Installation Standard.

[17] LBT00081 – Drawing Office Procedure

[18] 15ENG MN-676 – AKZ Coding Manual

[19] 240714321-50 – Plant Labelling Standard

2.2.2 Informative

[20] ISO 9001 Quality Management Systems

[21] 240-53114002: Engineering Change Management Procedure

[22] 240-53114026: Project Engineering Change Management Procedure

[23] 240-76931045: Financial Fixed Assets Components Listing Generation Division

[24] 240-109607332 – Eskom Plant Labelling abbreviation standard.

[25] LIM103 – Lethabo Information Manual.

[26] 36-681 General Plant Safety Regulations

[27] LBS00067 Lethabo Health, Safety and Environmental Specification for *Contractor's*

2.3 DEFINITIONS

2.3.1 Stakeholder

Is considered to be anyone that has an interest in the outcome of the project.

2.3.2 Inspection

Activities, which by means of examination, observation or measurement, determine the conformance of material, parts, components etc., to predetermined specifications and quality requirements

2.3.3 Maintenance

All activities required retaining an item of plant in, or to restore it to acceptable condition, including the examination and evaluation of the actual condition;

2.3.4 Maintenance Philosophy

The principle approach decided upon for performing maintenance, such as pro-active or reactive maintenance.

2.3.5 Maintenance Strategy

The type of maintenance selected for specific plant and equipment, such as time or condition based maintenance, corrective or preventative maintenance

2.3.6 System

An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a defined objective.

2.3.7 Testing

All activities required determining the actual performance or condition of an item.

2.3.8 Unit

A boiler, turbine and generator set and all its dedicated auxiliaries.

2.4 DISCLOSURE CLASSIFICATION

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

2.5 ABBREVIATIONS

Abbreviation & Acronyms	Description
AS	Authorised Supervisor
CIP	Cleaning in Place
C&I	Control and Instrumentation
CAD	Computer Assisted Drawing
COSP	Control and Instrumentation Outside Plant
DCS	Distributed Control System
ECP	Effluent Concentation Plant
ECSA	Engineering Council of South Africa
EDWL	Engineering Design Work Lead
EE	Electrical Engineering
EMAP	Engineering Management Plan
EMS	Electrical Maintenance Section
EOP	End-of-Phase
FAT	Factory Acceptance Test
IO	Input / Output
IP	Ingress Protection
LDE	Lead Discipline Engineer
LOSS	Limits of Supply and Services
LPS	Low Pressure Services
MMS	Mills Maintenance Services
MSDS	Material Safety Data Sheets
MWTP	Mechanical Maintenance Water Treatment Plant
O&M	Operating and Maintenance
OEM	Original Equipment Manufacturer
OPE	Outside Plant Engineering
P&ID	Piping and Instrumentation Diagram
PS	Power Station
QC	Quality Control
QCP	Quality Control Plan
RCA	Root Cause Analysis
RO	Reverse Osmosis
ROC	Required Operational Capability
RP	Responsible Person
SHE	Safety, Health & Environmental
SRD	Stakeholders Requirements Definition
TSV	Thermal Shut-off Valve

UCLF	Unplanned Capability Loss Factor
UF	Ultrafiltation
USB	Universal Serial Bus
VDSS	Vendor Document Submittal Schedule
W	Weekly
WTP	Water Treatment Plant

2.6 ROLES AND RESPONSIBILITIES

The following roles and responsibilities apply:

Eskom EDWL: The role of the EDWL is to co-ordinate the design work provided by the discipline design engineering roles and integrates this work into a final integrated design product. He/she is the custodian of the requirements set and the interface register between packages and part of his/her role is to maintain this information. He/she remains responsible for the integrity of the engineering product and is accountable for the overall management of interfaces and delivery of an integrated product.

Eskom Engineering LDE: The role of the Eskom Engineering LDE is to manage the technical integrity of the design and be accountable for the management of the interfaces within their specific engineering domain.

Client (Lethabo Power Station Team): Client is responsible for verifying that the requirements captured in the SRD are met by the concept design.

Functional Responsible Person: The functional responsible person determines if the document is fit for purpose and approves the document content and therefore takes responsibility and accountability for the document content.

Authoriser: The document authoriser authorises the release and application of the document and is accountable for document implementation.

Contractor: The Contractor is responsible for the final design and construction according to the provided Eskom specification.

3. BACKGROUND AND HIGH LEVEL SCOPE

3.1 PROJECT BACKGROUND AND SYSTEM DESCRIPTION

The desalination plant at Lethabo Power Station is designed to desalinate 500 m^3/h of cooling water with the feed to the plant coming from the effluent concentration plant (ECP) sump. The desalination process consists of an ultrafiltration (UF) process, and a reverse osmosis (RO) process.

During UF and RO operations, the membranes can foul or scale which results in deterioration of the performance of the plant. Consequently, chemical cleaning of the membranes is required to periodically remove foulants/scale from the membrane surface, and thus restore the performance of the membrane as close as possible to its original performance. The Clean In Place (CIP) system is utilized for this purpose.

The CIP system consists of a CIP tank in which the CIP chemicals are made up by plant personnel. The plant operators carry the bags of dry CIP chemicals up a flight of stairs in order to offload at the top of the CIP tank.

During the process of ascending and descending the stairs, the plant personnel risk getting injured while carrying the hazardous CIP chemicals. The CIP makeup system needs to be upgraded in order to assist the operators to operate the system in a safe manner with as little manual handling as possible.

3.2 PROJECT PURPOSE AND HIGH LEVEL SCOPE

The purpose of this project is to design, supply and install a chemical system that is safe and requires minimal manual intervention. The high level scope of this project is applicable to the SRO Plant and its associated chemical cleaning systems and will take account of the following:

(1) The *Contractor* will be responsible for the detail design, manufacturing, supply, installation, quality assurance, commissioning and handover associated to this project as stated in the scope of work.

(2) Detail design to be reviewed and accepted by the *Employer*.

(3) *Contractor* site establishment to commence once the detail design is accepted and the project is ready for execution.

(4) The *Contractor* will ensure that all waste generated during the execution phase of the project will be managed in accordance with Lethabo Power Station's existing waste management process.

(5) The *Contractor* will be responsible alongside the *Employer's* representatives for, Factory Acceptance Testing (FAT) (only applicable in the event that pumps are required), Site Integration Testing (SIT) and Commissioning of the new plant installations.

a. The *Contractor* conducts a FAT in the event that a pump is required to fulfil the *works.* The FAT will be conducted before installation in the presence of the *Employer's* representatives.
b. The *Contractor* conducts a SIT (upon successful completion of the FAT) at Lethabo Power Station in order to prove the plant provided prior to connecting to the process. The *Contractor* provides a SIT procedure (including all tests to be performed) to the *Employer* for acceptance prior to the SIT.
c. The *Contractor* continues with commissioning after successful completion of the SIT.
d. The *Contractor* provides all procedures, test/commissioning reports and certificates as per Appendix 1 – VDSS.

(6) The *Contractor* will provide the *Employer* with all relevant documentation applicable to the new installations as stated in this document.

(7) The *Contractor* will provide training on the new installations to the *Employer's* maintenance, operating and engineering staff. Training will take place before installation and commissioning of the analysers. The training includes both theoretical and practical training. Training for operating staff will be focused on operating and troubleshooting of the associated mechanical equipment. Training for maintenance and engineering staff will be focused on operating, troubleshooting and maintenance of the associated equipment. Training for MMS and OPE personnel must focus on operating, mechanical troubleshooting and maintenance of the associated equipment. Training for EMS and EE personnel must focus on operating, electrical troubleshooting and maintenance of the associated equipment. Training for C&I maintenance and engineering personnel must focus on operating, C&I troubleshooting and maintenance of the associated equipment. Operating and maintenance trainees must receive certificates upon successful completion of the training. Training will be done on site and the *Contractor* will provide the training material. The minimum number of people that will require training from each department are as follows:

a. Operating – 8
b. Maintenance – (2 Electrical, 2 C&I, 2 Mechanical)
c. Engineering – (2 Electrical, 2 C&I, 2 Mechanical)
d. Chemistry – 6 (3 Chemical, 3 Chemistry)

3.3 CODES AND STANDARDS

The *Contractor* adheres to the following codes and standards:

3.3.1.1 South African Legislation

- OHSACT Occupational Health and Safety Act of 1993
- SANS 10108 The Classification of Hazardous Locations and the Selection of Equipment or Use in Such Locations
- SANS 10142 Code of practice for wiring of premises
- SANS 347 Categorization and conformity assessment criteria for all pressure equipment
- SANS 10227, Criteria for the operation of inspection authorities performing inspection in terms of the Pressure Equipment Regulations.

3.3.1.2 *Employer's* Standards

- 240-89147446 Instrument Piping for Fossil and Hydro Power Plant Standard
- 240-48197042 Procedure for the Management of Technology Obsolescence

3.3.1.3 Electrical Standards

- 240-56227443 - Requirements for Control and Power Cables for Power Stations Standard
- 240-56356396 - Earthing and Lightning Protection Standard

3.3.1.4 Control and Instrumentation Standards

- 240-56355754 Field Instrument Installation Standard
- 240-56355815 Control & Instrumentation Field Enclosures and Cable Termination Standard
- 240-56227443 Requirements for Control and Power Cables for Power Stations Standard
- 240-56356396 Earthing and Lightning Protection Standard

3.3.1.5 Civil and Structural Standard

- 240-56364545 Structural Design and Engineering Standard

3.3.1.6 Environmental Standards

- 240-56031741 Environmental Procedure Waste Management Procedure
- 240-56031742 Environmental procedure

3.3.1.7 Drawings and Procedures

- 240-86973501 Engineering Drawing Standard – Common Requirements.
- 240-56030537 Review of Piping and Instrumentation Diagrams.
- 240-109607332 Eskom Plant Labelling Abbreviation Standard.

- 240-61227631 Piping and Instrumentation Diagram (P&ID) Standard.
- 36-943 Engineering Drawing office and Engineering Documentation Standard.
- 240-105658000 (QM 58) Supplier Quality Management Specification.
- 15ENG MN-676 – AKZ Coding Manual
- 240714321-50 – Plant Labelling Standard

3.3.1.8 Mechanical Standards

- 240-89147446 Instrument Piping for Coal Fired Power Stations Standard
- 240-105020315 Standard for Low Pressure Valves
- 240-106628253 Standard for Welding Requirements on Eskom Plant
- 240-108079430 Power Plant Water Systems Design Guideline
- 240-123801640 Standard for Low Pressure Pipelines
- 240-56356376 On-Site Commissioning for Low Pressure Systems Standard

3.3.1.9 Environmental and Waste Management

- Eskom SHEQ Policy
- 32-245 Eskom Waste Standard
- LBE22004 Lethabo Waste Management Procedure
- LBA00174 Control in handling, storage and usage of hazardous chemical substances.

3.4 SAFETY REQUIREMENTS

(1) The *Contractor* complies with the latest revision of the Eskom Generation Plant Safety Regulations, site specific procedures and stipulations of the OHS Act [28].

(2) The *Contractor* provides authorised supervisors to oversee their work at all times. This will be explained in the contract Works Information (Part C4).

3.5 GENERAL REQUIREMENTS

(1) The *Contractor* is to consult with the *Employer* on the scaffolding requirements for the project as scaffolding will be project by others.

(2) Unless otherwise stated (for example, items that are to be relocated), the *Contractor* is responsible for the removal of all items and material that are redundant (items that are removed) as part of the *Works*. These are removed from the plant area and are laid down on site at a location to be indicated by the *Employer*.

(3) Where this document is not clear about the location of an item to be installed or work to be done, it is the *Contractor's* responsibility to determine the correct location from the *Employer's* engineering representatives, and the *Contractor* will only act upon

confirmation by receipt of an Engineering Instruction via the *Employer's* Project Manager. Incorrectly positioned items, or incorrect work done (where Engineering Instructions were not issued) will be moved / removed / replaced / changed / reinstalled by the *Contractor* at his cost unless it can be explicitly proven that this document unambiguously shows an incorrect position/arrangement.

(4) The *Contractor* will be responsible for all interfacing, functionality and compatibility of the C&I and electrical installations.

(5) All flanged connections loosened as part of the *Works* is fitted with new gaskets (All gaskets to be supplied by the *Contractor*). Non-asbestos type gaskets to be used and MSDS for gaskets should also be provided. Bolts to be used must be torqued to 60% of the yield strength. All bolts to be torqued (not flogged) in the "star" sequence in increments as sound engineering practice dictates. All bolts and nuts to be lubricated. After final tightening of the bolt at least two threads will protrude behind the nut. All flanges drilling to be according to EN 1092 PN 16 for 150NB and below and EN 1092 PN10 for flanges above 150NB.

(6) The *Contractor* provides the *Employer* with a method statement and project schedule together with the tender submission.

(7) The *Contractor* to appoint its own AS to execute project scope

3.6 MATERIAL REQUIREMENTS

(1) The *Contractor* is responsible for supply, delivery, installation and commissioning of all equipment specified in the scope, inclusive of connection brackets (if any), and all consumables required, C&I and electrical cabling, miniature circuit breakers, gaskets, pipe supports as well as bolts and nuts if required.

(2) All material and equipment supplied by the *Contractor* is designed to operate in the required operating philosophy unless otherwise indicated in the *Works*.

3.7 QUALITY REQUIREMENTS

(1) No work will be done without a QCP that is approved by the *Employer*. A QCP must be submitted to the *Employer* for the *Works* 14 days before that part of the work is to commence.

(2) QCP's and related documentation are subject to comment and acceptance by the *Employer's* Quality Control personnel as well as Engineering. QCP's will make provision for signatures for interventions by at least the *Contractor's* QC

Representative, the *Employer's* QC Representative and the *Employer's* Engineering Department.

(3) Each QCP will have a page for proof signatures, so that any signature can be traced to the individual who has endorsed any activity on QCP.

(4) Intervention points will be signed as the work progresses and no back-dating will be allowed.

(5) Notification for hold and witness points are in writing and are done at least 24 hours in advance.

(6) The following minimum hold points must be included for the *Employer's* Quality Control Department:

a. Approval of QCP.
b. Review specifications for all C&I and electrical consumables purchased/to be used during installation.
c. Review and assist with the commissioning of the new installations.
d. Final Sign off and Acceptance.
e. Final data book Review.

(7) The following points to be included as a minimum on the *Contractor's* QCP:

a. Approval of QCP's by the *Employer's* Engineering representative, *Employer's* QC and the *Contractor's* representative.
b. Intervention points for the *Employer* during manufacturing, installation and commissioning. These intervention points will be based on the agreement between the *Contractor* and *Employer*.
c. Ensure that all permits are established before work can commence.
d. The *Employer* provides the *Contractor* with AKZ codes for the plant. The *Contractor* labels the plant in accordance with 240-71432150 Plant Labelling Standard and 15ENG MN-676 AKZ Plant Coding Manual.
e. Visual inspection of consumables, nuts and bolts.
f. and functionality testing by the *Contractor* and *Employer's* representatives.
g. Final approval of QCP and plant handover to the *Employer's* engineering representative.

3.8 DRAWING REQUIREMENTS

(1) The *Contractor* updates all plant drawings, increasing the revision number by 1 for the final version. The complete plant drawings must be updated to reflect the plant

changes made by the *Contractor*. The preferred format is Microstation for soft copy drawing submission.

(2) In cases where the plant drawings are not sufficiently clear, the *Contractor* contacts the *Employer* for clarity.

(3) All Drawings to be provided are in accordance with the Engineering Drawing Standard – Common Requirement (240-86973501).

(4) The following general requirements apply to all the drawings:

a. Space is provided for *Employer* approvals.

b. All drawing revisions must be provided as paper copies in original (as per Engineering Drawing Standard – Common Requirement (240-86973501), but in all cases, at least A3 size) as well as provided in pdf format and original micro station format.

(5) All C&I drawings will be updated by the *Contractor* as per VDSS (refer to Appendix B) to reflect all changes made to the plant – refer to Appendices for the applicable drawings. The drawing standards stated in section 3.4 will apply with regards to updating mechanical, C&I, civil and electrical drawings.

3.9 DOCUMENTATION REQUIREMENTS

(1) All documents supplied by the *Contractor* are subject to the *Employer's* acceptance. Documents such as detail design report, QCP's, method statements and other documents impacting the *Works* must be accepted by the *Employer* at least 14 working days prior to commencement of the *Works*.

(2) Each revision of a document or drawing is accompanied with a list of the comments made by the *Employer* on the previous revision if applicable and the response/corrective action taken by the *Contractor*. Changes will be recorded in a revision table contained on/in each drawing/document.

(3) Documents and drawings indicate the *Employer's* reference number as allocated by the *Employer*. The *Contractor* may have their own document or drawing number on the document or drawing, but where reference is made among documents or drawings, the *Employer's* number is used.

(4) The *Contractor* compiles a complete data book for all *Works* done containing the following as per VDSS:

a. Scope of work.

b. Detail design report.

c. Approved QC

d. Inspection reports and procedures.

e. As built drawings.
f. Material summary that gives full traceability between components used, assembly drawings, material certificates and complete ordering information.
g. Maintenance, operating and troubleshooting documentation of all new plant equipment installed (as a minimum).
h. Updated wiring drawings of the panels (junction box and JD panels)
i. Cable test results.
j. As built Cable Schedules as per the *Employer's* 240-56176097: Electrical Cable Schedule Template.
k. Electrical load list as per the *Employer's* 240-56227927: Electrical Load List Template.
l. Updated switchgear schedules, cable schedules and cable block diagram (drawing 0.63/5057) where necessary.
m. Earthing test results and drawings indicating earth connection points for the new equipment.
n. All NCR's and corrective actions (Contractual Defect Notifications).
o. All NCR's and corrective actions (Contractual Defect Notifications).

3.10 CONFIGURATION MANAGEMENT AND DOCUMENT MANAGEMENT

Transmittal letters are provided with each document submittal. The transmittal letter includes the *Contractor's* document/drawing number, revision number, and title for each document/drawing attached. Each document/drawing title is unique and is descriptive of the specific document/drawing content.

3.11 PROCESS *WORKS* TO BE EXECUTED BY THE *CONTRACTOR*

(1) The *Contractor* is to design the system as per the design criteria listed below:

a. A system is required so as to minimize manual handling of the CIP chemicals during the offloading process

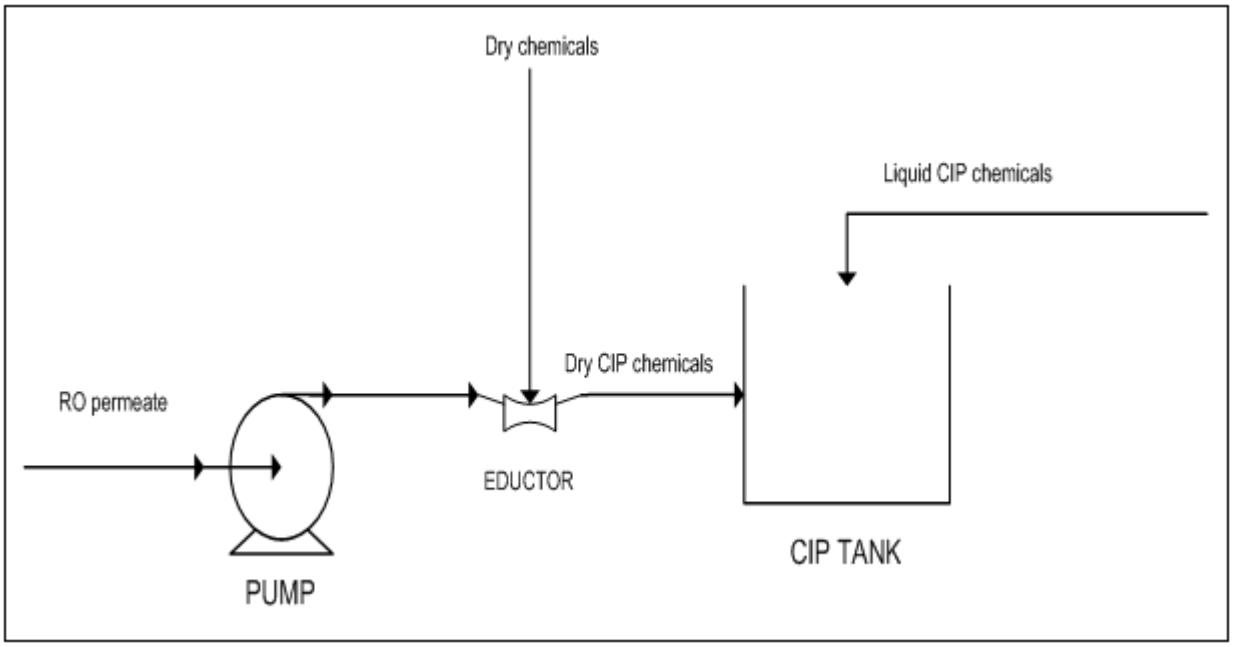

Figure 1: Schematic of Eductor System Design

3.11.1 Process plant operating philosophy

According to the red-lined P&ID 23.63/54809, the operating philosophy of the CIP offloading and cleaning will not change as much as there are no major changes in the process. The CIP solution is pumped to the RO membranes with supply from the product side, and exits the modules on the filter feed side and back to the CIP tank (00UN40G001). Apart from dissolving foulants on the surface of the membranes and in the shell, this procedure has the added advantage of being a back wash and CIP in one, thus resulting in a more effective cleaning of the system.

Before the offloading and preparation of the CIP chemicals, the educator has to be flushed by running the RO permeate through the educator. This will ensure that any leftover chemical particles from the previous CIP are flushed out to the drain. This flushing procedure can be done at any time during the makeup process if blockage issues are encountered.

Ensure that the skid to undergo CIP is offline and that no other UF or RO skid is currently in CIP mode. A level transmitter (00UN40L003) prevents overfilling of the CIP tank. The mixer on the CIP tank (00UN40D002) ensures complete mixing of the CIP chemicals and water, and stops on low level when the CIP tank has been pumped empty at the end of a CIP sequence. On high level (for the selected CIP) the CIP tank makeup water inlet valve (00UN40S201) closes, while on very high level level an alarm shows up on the SCADA. The filling up of the CIP tank with water will be done together with the dry CIP chemicals by the aid of the educator.

Once the water has been filled in the tank, the liquid CIP chemicals are added to the solution in the tank while the mixer stirs the CIP solution. A sample may be taken after complete mixing of the chemicals & water, to adjust pH etc. at the CIP tank drain valve (00UN40S001).

3.12 MECHANICAL *WORKS* TO BE EXECUTED BY THE *CONTRACTOR*

3.12.1 General Mechanical Requirements

The Mechanical requirement follows the process requirement and ensures that all components are within acceptable limits.

3.12.2 Mechanical Design

The *Contractor* is required to carry out detail design and installation based on the *Employer's* Concept Design (below) for acceptance. The *Contractor* is to carry out this work in accordance to the requirements and standards indicated in the document and with the required legal and statutory requirements. The *Contactor* is permitted to use best practice engineering solution and make reasonable assumptions to complete the *Works*. The *Contractor* may supply alternatives from the *Employer's* Concept Design (below) provided the main option is also provided.

(1) The detailed design report including the following:
- a. Detailed design report signed off by ECSA registered engineer
- b. Hydraulic Analysis of the system (preferred Flownex calculations)
- c. Operating and Control Philosophy
- d. Design drawings
  - i. Piping & Instrumentation Drawings
  - ii. Isometrics
  - iii. General Arrangements
  - iv. As Built Drawings

(2) The installation includes:
- a. Construction management
- b. Engineering
- c. Supply (All equipment for the design at worst case condition)
- d. Workshop fabrication and assembly
- e. Testing
- f. Signage
- g. All the consumables required for commissioning
- h. Cold Commissioning
- i. Hot Commissioning

3.12.2.1 *Employer's* Design Concept

(1) The Mechanical concept follows the process concept and ensures that all systems and subsystems are catered for.
- a. This includes but is not limited to
  - i. Tapoff RO- Permeate line to CIP tank
  - ii. Piping from Eductor System
  - iii. Piping to the CIP Tank

(2) The *Contractor* is responsible for all other systems that are required but are not listed above in order to achieve a fully functional Analysis System

3.12.2.2 Pumping and Piping Design

A pumping system is required to pump the RO permeate motive water to the educator. The CIP pump are envisaged to operate continuously by means of a bypass line to accommodate the batch CIP process. The pump is to operate on remote activation by means of an operator.

The existing pump that is to be utilised has the following flow and pressure characteristics:

Table 1: RO Permeate pump characteristics

Flowrate	162m^3/hr
Head	325 kPa
Duty	1
Standby	0

Envisaged Pipe size is a nominal size of 150mm. The route of the pipeline is to be determined by the contactor for optimal efficiency. Pressure drop that is permissible is a maximum of 50kPa/100m. The maximum permissible velocity is 2.5m/s. The pipeline is design generally in accordance with EN 13480. The size of the pipeline is to ensure the pipeline does not negatively affect the pump and the pump is to run as close to the best efficiency point as possible to ensure the flow. Ideally the pump is to run 5% forward and 10% back from its best efficiency point. The pump and piping system is to cater for an expansion of at least 20%. Temperature influence along the pipe is negligible; however the site conditions are known to experience sub-zero temperatures.

Valves utilised are:

- Butterfly Valves for isolation
- Non – Return Valves for Pump Protection
- Air Release Valves
- Ball/Gate/Butterfly Valves for bypass

3.12.2.3 Eductor Design

The Eductor is required to be design in the configuration depicted below.

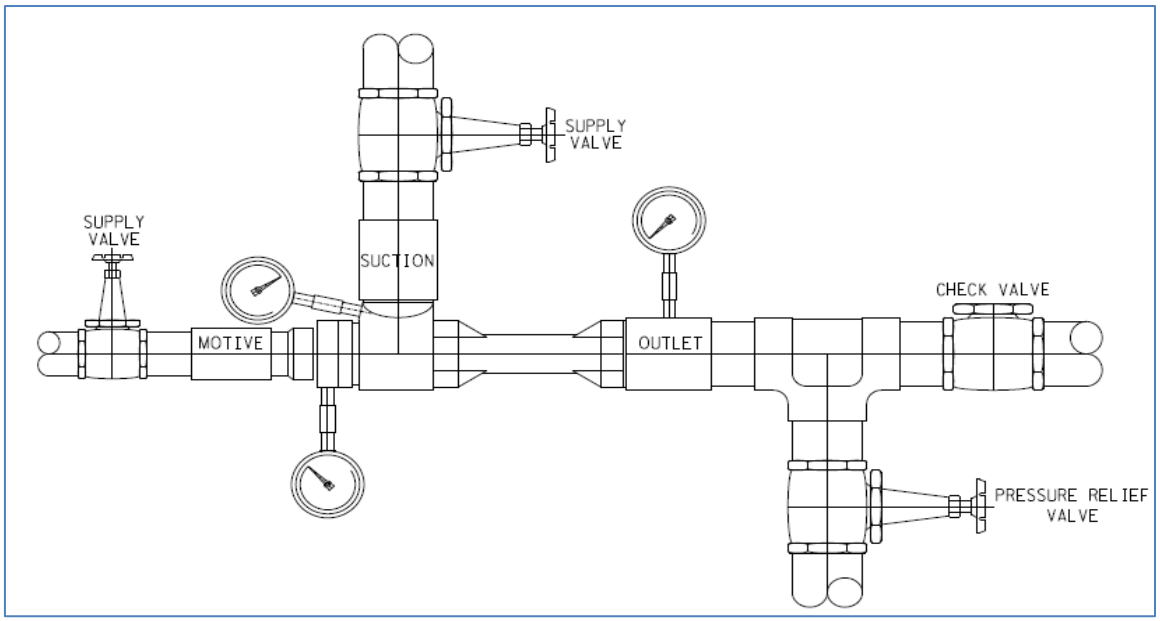

Figure 2: Eductor design

The following table contains the design inputs to be used for the design of the educator.

Table 2: Eductor design inputs

Design Inputs	
Maximum Pressure Rating	PN 10
Maximum Design Pressure	500kPa
Maximum Motive Water Flowrate	162m^3/hr
Maximum Suction Feed	25×25kg bags = 625 kg/hr
Solution Outlet Velocity	1.25 ×Settling velocity

3.12.2.4 Dry Chemical Eductor Feeder Design

The feeder is to be designed in accordance with the eductor and pump capabilities in mind and thus the maximum flowrate for the dry chemicals is to be 25×25kg bags =625 kg/hr

3.12.2.5 Bund requirements

A Bund requirement is to cater for the containment of all chemical tank storage and associated water in the event of a spill. The bunded wall is to be adequately distanced from the tank (typically 1m away were possible) from any equipment and is required to have an slope and fitted with a scour valve. The bund design requirements are generally in accordance to SANS 10089 or SANS310. The bund should house tank contents, pump system and loading area. A drainage system will be

included from the bund to be routed to the chemical containment area. The Contractor is to complete a risk assessment inline with chemical bund requirements inclusive of any possible incident that may result.

The Contractor is to ensure the chemicals (dry and wet) can enter the bunded CIP dosing system area with ease and minimal manual intervention from operators. The Contractor is to note that the bund will induce a tripping hazard and offloading difficulties and is therefore required to provide a risk assessment to mitigate any risks and present this to the project engineering manager for acceptance prior to execution.

3.12.3 Mechanical Technical Requirements

3.12.3.1 Pipework

(1) All the pipework supplied in one contract and complying with this specification is designed, manufactured, fabricated, erected and tested to comply with the contractually defined latest edition of a single national or international code and its associated standards. Mixing of codes from different countries of origin is not acceptable.

(2) All pipes are to be sized to ensure that the process requirement is met with an economically viable and energy efficient solution. Pipe supports must be provide.

(3) The pipeline conforms to environmental regulation. Pipes are to follow best practices and be generally in accordance to Code BS EN 13480

(4) The design should incorporate the provision for meaningful in-service non-destructive testing during periodic overhauls of the pipeline. The provision and installation of the primary measuring elements for the control and instrumentation will all be required. The provision of all isolating valves and the necessary actuators will be required.

(5) All pipes are required to be suitable material with regards to the chemical compatiibilty, the *Contractor* determines the required pressure rating of the pipe based on the equipment and pumping system selected.

(6) All pipes are required to be compatible for use with the temperature unit.

(7) Pipes are required to be sloped and include drain valves to cater for drainage during maintenance, and includes isolation valves.

(8) The pipes are required to include all fittings (bends, expansion joints, etc.) and supports where needed.

(9) Pipe supports are to be according manufacturer specifications and design code EN 13480

(10) Pipe sizes are to be selected so that the following maximum permitted velocities or pressure differentials are not exceeded by design, or maximum upset conditions.

Table 3: Pipeline Design Conditions

System	Velocity Guideline (m/s)	Pressure Drop - Range kPa/100m	Pressure Rating	Material
Motive Water pipework	0.5-2.5m/s	5 to 50	PN16	Compatible to RO Permeate
Solution Pipework	1.25 * Settling velocity	5 to 50	PN16	Compatible to Solution

(11) The *Contractor* submits the pipe data sheets and complete design to the *Employer* for acceptance.

(12) The *Contractor's* design verifies and ensures the integrity of all pipe work. The materials of construction for the pipework is suitable for the water and environment it is in contact with.

(13) The *Contractor* performs corrosion protection in accordance to 240-101712128: Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings.

(14) All pipes are painted at minimum in accordance to SANS 10140: Identification Colour Marking.

(15) Data books, to include all necessary material and test certificates maintained as part of the QA documentation and made available for inspection if so requested by the *Employer.*

(16) All welding is done in accordance to 240-106628253 Standard for Welding Requirements on Eskom Plant

3.12.3.2 Valves

(1) All valves are required to be manually operated.

(2) All valves are required to be new and compatible for use with the pipes that are used.

(3) The materials of construction of all valves are required to be compatible to content of the pipelines.

(4) Valve sizes in the following increments are preffered (excluding sample valves): 25NB, 50NB, 80NB, 100NB, 150NB, 200NB etc.

(5) Valve connections: 50NB and above: Wafer type butterfly valves; Below 50NB: BSP threaded connections.

3.12.3.3 Eductor

The Eductor is required to be designed in the configuration depicted below**.**

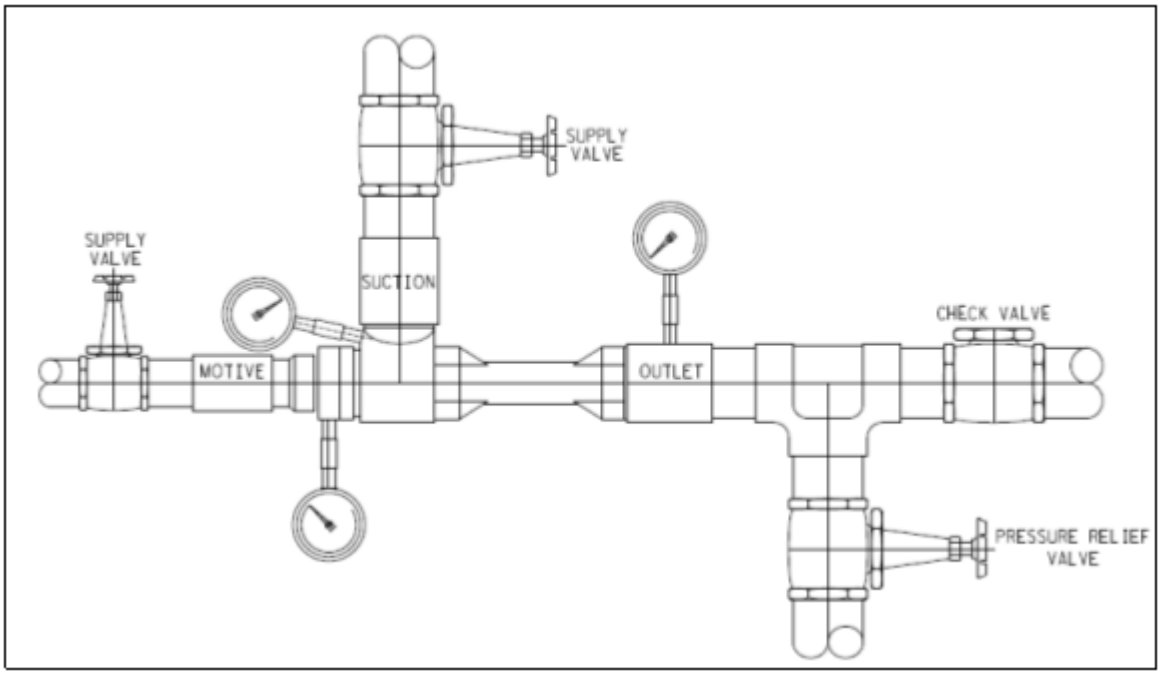

Figure 3: Eductor Configuration

The following table contains the design inputs to be used for the design of the educator.

Table 4: Design Inputs for Eductor Design

Design Inputs	
Maximum Pressure Rating	PN 10

Maximum Design Pressure	500kPa
Maximum Motive Water Flowrate	162m3/hr
Maximum Suction Feed	25*25kg bags = 625 kg/hr
Solution Outlet Velocity	1.25 * Settling velocity

1. Dry Chemical Eductor Feeder Design

The feeder is to be designed in accordance with the eductor and pump capabilities in mind and thus the maximum flowrate for the dry chemicals is to be 25×25kg bags =625 kg/hr

2. Wet Chemical Design

The feeder is to be designed with the educator and pump capabilities in mind and thus the maximum feed flow rate for wet chemicals is 2x210L per hour.

3.12.4 Mechanical Standards/Codes and Specifications

- 240-123801640 Specification for Low Pressure Pipelines
- 240-56030558 Centrifugal Pumps Specification
- 240-105020315 Standard for Low Pressure Valves
- 240-56356376 On-Site Commissioning for Low Pressure Systems Standard

3.13 C&I WORKS TO BE EXECUTED BY THE CONTRACTOR

The *Contractor* provides the whole of the C&I Works as defined in section 3.13 of this document except where explicitly stated as otherwise.

3.13.1 General

1. The *Contractor* will provide all equipment and services and execute all *works* to fulfil all requirements specified in this document.
2. The *Contractor's* Works complies with professional engineering practice and standards for fossil fuel power plants, and is designed for the environmental conditions prevailing at the Power station site.
3. The *Contractor* will include the engineering, design, procurement, manufacturing, factory acceptance testing, delivery, off-loading at site, storage, installation, testing, commissioning, optimisation, and as-built documentation for provision of the C&I Works.
4. The *Contractor* provides the C&I *works* to meet the requirements that are defined in this document and also in the following documents:

a. Appendix A1 - Instrumentation Schedule.
b. Appendix A2 - Limits of Supply and Services (LOSS) Diagrams.

5. The *Contractor* provides the designs and documentation that are defined in this document and also in the following documents:
    a. Appendix B - Vendor Document Submittal Schedule (VDSS).

3.13.2 Quality & Performance

3.13.2.1 Design Codes, Guidelines and Standards

1. The Works will be provided in compliance with design codes, guidelines and standards referenced in this document.
2. The *Contractor* will obtain his own copies of International and National standards.
3. The *Contractor* will report any conflict within this document, with any referenced standards, specifications or technical guideline.
4. This document will take precedence over differences existing between this document and any document referenced within this document, except for statutory requirements.
5. Substitutions of any standard will be approved by the *Project Manager*. Additional standards proposed by the *Contractor* will be submitted to the *Project Manager* for approval.
6. Only the most recent versions of the relevant standards, guidelines, or codes will be used with this Works.

3.13.2.2 Safety

1. The earthing concept applied by the *Contractor* will be based on recognised best engineering practices and will ensure the safe and reliable operation of the C&I systems.

3.13.2.3 Reliability

1. All C&I system equipment will be earthed to the station earth point.
2. The station earth point will be provided by the *Employer*.
3. All metal instrument casings will be properly earthed (grounded) to the earth mat to avoid any electromagnetic interference which may arise from portable RF transmitters, cell phones and other equipment used on the plant.
4. All earthing required to eliminate any interference will be provided.
5. All earthing will as a minimum be in accordance with the following standards and specifications:

a. 240-56356396 - Earthing and Lightning Protection Standard.

3.13.2.4 Maintainability

1. All field equipment will be available in South Africa as commercially-off-the-shelf (COTS) products.
2. All field equipment is supported by its OEM and maintainable by resources from South Africa until the end of the year 2041 for:
    a. Technical services and support
    b. Repair of faulty equipment
    c. Supply of spare or replacement parts
3. All field equipment provided will be standardised to the maximum extent possible.
4. Instrumentation and supports are protected against corrosion and other harsh or hazardous environmental conditions that prevail at the Power station site.
5. Any special tools (i.e. not presently owned by the *Employer*) required for access to and maintenance of the field equipment is provided.

3.13.3 C&I System

3.13.3.1 Plant Operating and Control Philosophy

1. The P&ID in Appendix C indicates that no additional final elements (i.e. valves/pumps/sensors) are required for control of the Eductor system. Hence the Eductor system will not be automated.
2. The CIP plant will be operated as per the existing operating procedures.
3. Local pressure gauges will be added for the local indication as shown in section 3.12.3.3.
4. The Contractor will recommend any changes to the existing CIP plant operating and control philosophy based on the existing final elements as per the P&ID in Appendix C.
5. The existing philosophy is defined in section 3.11.1

3.13.3.2 Control System

6. The *Employer's* control system for the CIP plant is the Siemens S7-300 Programmable Logic Controller (PLC).
7. The *Employer* implements the software for CIP control in accordance to the required operating and control philosophy in section .

3.13.3.3 Human Machine Interface (HMI)

1. The *Employer's* HMI for the plant is the Wonderware InTouch SCADA system.
2. The *Employer* implements the functionality for the operators to start/stop the CIP plant from the control room.

3.13.3.4 Field Equipment

3.13.3.4.1 General

1. All field equipment listed in the Instrumentation Schedule in Appendix A1 are interfaced to or provided by the *Contractor* according to Limits of Supply and Services diagrams provided in Appendix A2, respectively.
2. The *Contractor* provides field equipment in accordance with the Limits of Supply and Services diagrams provided in Appendix A2.
3. The LOSS diagrams are not to be considered as detail design documents; for their purpose is to demarcate the responsibilities for the various stages of the project from basic engineering up to and including commissioning; with the aim of indicating the physical interface point between the *Contractor*, *Employer* and *Others*.
4. Only the main field equipment is shown on the LOSS diagrams provided in Appendix A2 (e.g. instrument, etc.). Equipment or components not shown but required for the Works are provided as part of the Works (e.g. chemical seals, snubbers, fittings, etc.).
5. The physical interface points may include termination into cubicles, junction boxes, instrumentation, impulse piping and other interface points as defined in Appendix A2 required for completion of the Works.
6. The *Contractor* is responsible for managing, designing, clarifying, and finalising the physical interface points and physical interface requirements at the demarcation point when interfacing to equipment supplied by the *Employer* or *Others*.
7. All field equipment installations are provided in accordance with the requirements specified in the standard, 240-56355754 – Field Equipment Installation standard.
8. All field equipment operates over an ambient temperature range of: -10°C to 70°C.
9. All field equipment is installed in a suitable location ensuring that it operates in an environment within the parameters stipulated by the manufacturer.
10. Where harsh environmental conditions are not avoidable, field equipment designed for operation in that environment is used.

11. All field equipment are rated IP 67 or better, in accordance with IP rating requirements specified in IEC 60529 standard.
12. The equipment layout is such that when mechanical or civil work is performed, no field equipment is damaged.
13. All gauges and manifolds are mounted on suitable instrumentation stands.
14. All instrumentation stands provided are durable, sturdy and suitable for the environment in which they are installed.
15. Where angle iron is used for instrument stands, a minimum wall thickness of 3mm is provided.
16. Where instrumentation cannot be mounted on instrumentation stands the *Contractor* obtains clearance from the *Project Manager* for alternative installation.
17. The instrumentation stands are supplied complete with all holding down bolts and equipment to make a complete assembly.

3.13.3.4.2 Pressure Measurement and Installations

1. All pressure measurements and installations are provided in accordance with the requirements specified in the standard, 240-56355843 – pressure measurement systems installation standard.
2. Equipment/components required for the following process applications are parts of the Works and are specified in the standard, 240-56355843 – pressure measurement systems installation standard:
    a. Sealing for viscous liquids or pressures of corrosive fluids or where plugging is possible.
    b. Pressure systems or equipment subjected to vibration.

3.13.3.4.3 Impulse Piping

1. Impulse piping is provided for each measurement between the instrument and the existing impulse piping.
2. Impulse piping is provided in accordance with standard, 240-89147446 – Instrument Piping for coal Fired Power Plants Standard.
3. All pipe work provided is inclusive of supports, valves, fittings, transition pieces and drains to provide complete impulse, equalising and blow-down lines for all instruments.
4. All impulse pipe supports are such that galvanic corrosion is completely avoided. Clamp type supports are preferred.

3.13.3.4.4 Welding

1. All welding is provided in accordance with standard, 240-106628253 – Standard for Welding Requirements on Eskom Plant.
2. Non-destructive testing will be conducted on welds.
3. The result of all non-destructive testing on welds is accepted by the *Employer*.
4. Dye penetrant to detect surface defects such as cracks is performed on all welds.
5. In addition to the above mentioned requirements, the *Contractor* provides specifications for the following, to be approved by the *Project Manager*:
    a. Weld Defect Classification and Reporting.
    b. Non-destructive testing.

3.13.4 Configuration Management

1. The *Contractor* codes and labels the instrumentation according to the latest revisions of:
    a. 240-131050729 Hybrid Coding Standard
    b. LIM103A Notes on Alpha-Numeric Plant Codification
    c. 240-71432150 Plant Labelling Standard
2. All documentation defined in section 3.13.6 will make reference to the coded plant equipment.

3.13.5 C&I Execution Strategy and Procedure for Submission and Acceptance of the Contractor's design

3.13.5.1 General

1. During all project execution phases, the *Contractor* will:
    a. Be responsible for carrying out all activities and supplying everything to provide the Works;
    b. Conduct clarifications with the *Employer*, and *Others*;
    c. Identify and resolve any discrepancies, ambiguities and errors encountered with the C&I input documentation;
    d. Submit and update all engineering deliverables as defined in the VDSS in Appendix B.
2. All activities forming part of the project execution shall be reflected on, and scheduled according to the Approved Programme. As a minimum, the following phases of activities reflect in the Approved Programme:
    a. Detailed Engineering.

b. Erection and Installation.
c. Commissioning.
d. As-built.

3.13.5.2 Detailed Engineering Phase

1. The objective of detailed engineering will be to translate the scope and requirements of the C&I Works into a fully functional C&I system.
2. A detailed implementation plan must be accepted by the *Employer* before the design freeze. The detailed engineering design freeze shall be indicated as a milestone in the Approved Programme.
3. The scope of detailed engineering will include, but not be limited, to the following:
    a. Field engineering including mechanical hook-ups, GA drawings, etc.;
    b. Design liaisons: during which the detailed engineering designs will be presented and clarified.
4. Detailed Engineering will include design clarification meetings with the *Employer*.
5. Erection and installation work will not continue until the detailed engineering phase is complete and accepted by the *Employer*.
6. The field work cannot commence without official access from the *Employer*.
7. During detailed engineering phase, the detailed engineering design freeze deliverables defined in the VDSS will be developed and clarified.
8. Detailed engineering will only be considered complete when the detailed engineering design freeze package defined in the VDSS has been submitted and approved.

3.13.5.3 Erection and Installation Phase

1. The objectives of erection & installation phase will be to erect, install and perform on-site inspection and testing the C&I system.
2. During erection & installation deliverables defined in the VDSS will be updated and submitted.
3. Erection and Installation work will include the following:
    a. Installation of instrument stands.
    b. Installation of gauges.
    c. Impulse piping (if applicable) up to the interface point.
4. Erection & installation will include hold and witness points, whose participants will include the *Employer*.
5. Erection & installation will include, but not be limited, to the following hold and witness points:

a. Quality and inspections and tests;
    i. Quality inspections and tests will be carried after erection to verify the compliance of the installation with the approved design.
    ii. The *Employer's* authorised representatives can inspect all parts during erection and may be present at any of the quality inspections and tests.
    iii. All parts and equipment may be inspected at any stage during its erection. To this end, additional hold and witness points may be specified.
    iv. All test equipment will be provided for any inspections and tests.

6. For on-site inspections, preliminary notification of readiness for hold and witness points will be given at least weeks in advance.
7. Erection and installation will only be considered complete when:
    a. The quality inspections and tests for field equipment concerned have been approved by the *Employer*.

3.13.5.4 Commissioning Phase

1. The objectives of commissioning phase will be to bring into service all equipment such that requirements and performance criteria of the specification are met.
2. Commission procedures will be provided by the *Employer*.
3. Commissioning will be performed in active cooperation with the *Employer*.
4. All test equipment and spares required for commissioning will be provided.
5. Commissioning will include, but not be limited, to the following hold and witness points:
    a. Cold commissioning checks;
    b. Hot commissioning checks;
6. Cold commissioning will include, but not be limited, to the following tests and inspection:
    a. Documentation checks;
    b. Visual inspections;
    c. Function checks;
        i. Measurement loop checks;
        ii. Interlocks, feedbacks, commands and protections of drives;
    d. Calibration sheets will be provided for all instruments.
7. The objective of hot commissioning will be to test and verify the plant while systematically starting up the process such that at completion of hot commissioning, the plant is deemed available for safe plant operation.
    a. In preparation for plant production, hot commissioning will include functional and safety testing while the process is active.

b. The individual control loops will be pre-tuned to allow for initial loading.
c. The C&I system equipment will be hot commissioned to demonstrate that the requirements of the specification are achieved.

8. Commissioning will be considered complete when:
    a. The commissioning report has been approved by the *Employer.*

3.13.5.5 As-built Phase

1. The objectives of As-Built phase will be to verify the As-built documentation baseline of the C&I Works.
2. For the As-Built phase, the As-Built documentation package defined in the VDSS will be updated and submitted.
3. Approval of the ‘As Built’ documentation will be a pre-requisite for the completion of the C&I Works.

3.13.6 Design and As-Built Documentation

3.13.6.1 General

1. The *Contractor* provides the following documentation as defined in the VDSS in Appendix B:
    a. Field equipment design functional specification.
    b. Earthing & lightening protection design functional specification.
    c. Mechanical hook-up drawings.
    d. Instrument stand GA drawings.
    e. Instrument stand location drawings.
    f. Instrument schedule.
    g. Instrument datasheets.
    h. Instrument O&M manuals.
    i. LOSS diagrams.
    j. P&IDs.
    k. Detailed engineering design freeze documentation.
    l. Erection and Installation documentation.
    m. Commissioning documentation.
    n. As-built documentation.
    o. Warrantee certificates.

3.13.6.2 Field Equipment Functional Specification

1. The field equipment functional specification describes the following points as a minimum:
    a. General description of equipment, materials and installation requirements or standards for all field equipment including:
        i. Instrumentation.
        ii. Instrument stands
        iii. Instrument manifolds
        iv. Instrument piping
        v. Instrument piping supports
        vi. Material specification
        vii. Field equipment labels
    b. Instrument installation and measurement principle.
    c. Methodology for measuring long term drifts requirements.

3.13.6.3 Earthing and Lightning Protection Functional Specification

1. The earthing and screening functional specification details the following as a minimum:
    a. Equipment connections to earth.
    b. Earthing connection of cable racking to earth.
    c. Measures that will be taken for lightning protection Field Equipment.

3.13.6.4 Mechanical Hook-up Drawings

1. It is a detailed mechanical hook-up drawing per instrument which shows all of the elements used to mechanically connect an instrument to the plant process.
2. All detailed mechanical hook-ups generated are based on the defined templates.

3.13.6.5 Instrument Stands GA Drawings

1. Instrument stand GA drawings for each type of instrument stand available for use are to be provided showing dimensions, structural supports etc.

3.13.6.6 Instrument Stand Location Details

1. Location drawings are provided showing the location of all instrument stands on a plant arrangement drawing.
2. The location detail drawings are produced and grouped by applicable plant area.

3.13.7 Warranties

1. All warranties for the equipment provided will be included as part of the Works.
2. All warranties will be in the name of the Power Station site.

3.14 ELECTRICAL *WORKS* TO BE EXECUTED BY THE *CONTRACTOR*

The *Contractor* shall design/size, source/manufacture, test, supply, install, quality assure, commission and handover of all the electrical *Works* where/if required specified in the following subsections.

3.14.1 Description for electrical scope of work

- The *Contractor* shall design, source/ manufacture, supply, install, test, commission and handover the power supply to the educator loads.
- The point of supply to be used is a 3 phase or 1 phase MCB feeder (depending on the load requirements) from 380 V Effluent Concentration Plant Board (51GD or 51GE). The *Contractor* shall ensure that protection is adequately rated and graded.
- The associated cabling inclusive of all necessary accessories and termination kits, related to the *Works* shall be provided.
- The cabling *Works* shall adhere to the Eskom Standard 240-56227443 - Requirements for Control and Power Cables for Power Stations Standard.
- The new equipment shall be electrically bonded to the existing station earth mat and associated tests conducted in accordance to 240-56356396 Earthing and Lightning Protection Standard.

3.14.2 Compliance to electrical standards

- 240-56227443 - Requirements for Control and Power Cables for Power Stations Standard
- 240-56356396 - Earthing and Lightning Protection Standard

3.15 CIVIL WORKS TO BE EXECUTED BY THE *CONTRACTOR*

3.15.1 *Employer's* Design

The CIP tank is located within the water treatment plant of the power station. The tank is supported on four steel columns which are connected to four concrete stubs. The stubs are cast monolithically with the concrete ground floor slab/base (5 900 mm x 2 750 mm). The concrete slab/base also provides support for an installed pump and other pipe components. Figure 4 illustrates the associated civil infrastructures for the CIP tank and other equipment's.

Figure 4: Overall layout of the civil infrastructure

The *Employer* has conducted a concept design to determine the feasibility location and foundation requirements for the installation of the mechanical components associated with educator. The area located in front of the CIP tank was identified as an ideal location to install the educator as there is sufficient space to construct, operate and maintain the mechanical equipment. The available space identified is 3 000mm x 5 900 mm. Refer to 4, which illustrated the proposed location to install the pump and educator.

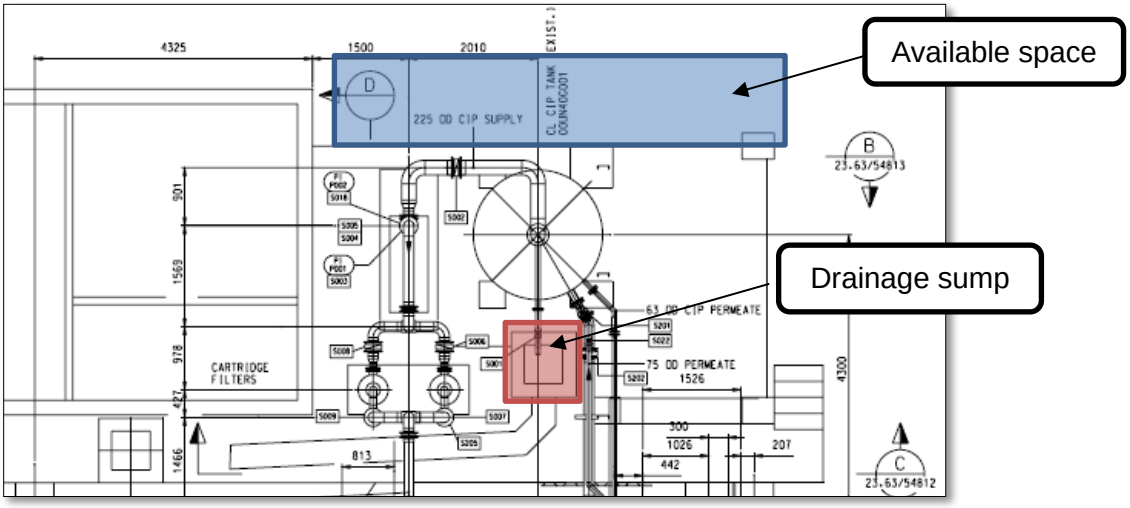

Figure 5: Proposed area to install the mechanical equipment/components

3.15.2 *Contractor's* Design

3.15.2.1 General Requirement

1. The Contractor takes full professional accountability and liability for the works as described in the *works* information.
2. The Contractor adheres to all design requirements, codes of standards and regulations stated in this *works* information.

3. Any discrepancy or ambiguity between the *Employer's* Specifications or requirements is to be immediately brought to the attention of the *Project Manager* for clarification.
4. Where the *Contractor* requires additional information to design or install certain components of the Plant, the *Contractor* notifies the *Project Manager* of the *Contractor's* requirements a minimum of one (1) week before continuing with the works.
5. All documentation, as specified in this *works* information, forms part of the *works* and is supplied to the *Project Manager* by the *Contractor*. The *Employer* reserves the right to issue the *Contractor's* design or drawings to other *Contractors* for purposes of maintenance, spares, verifications, modifications in future or any other purposes required by the *Employer*. The *Employer* has total rights to use the design as the *Employer* requires. The *Contractor* notes that all drawings and other documentation supplied to the *Employer* become the property of the *Employer* upon completion of the works.

3.15.2.2 Structural Design of Foundation/Plinth

The *Contractor* is required to assess the proposed location in terms of available space required for the installation of the mechanical equipment/components. If the proposed location is insufficient, as illustrated above in Figure 5 ,the *Contractor* proposes a new location, with guidance from the *Project Manager* for review and acceptance.

1. The final position of the concrete foundation/plinth is not to obstruct the maintenance of the existing equipment and access to a nearby staircase.
2. The *Contractor* is required to size and design a new concrete foundation/plinth for the installation of all mechanical components required for the project. The size of the foundation/plinth will be dependent on the dimensions and clearance distance required to operate and maintain the mechanical equipment/components.
3. The *Contractor* accounts for all loads that will be imposed onto the new concrete foundation/plinth.
4. The concrete plinth/foundation is to be bunded with masonry bricks, or similar approved, to contain the spillage of chemical during the operation of the mechanical equipment. The height of the bund wall will be designed to contain the volume of liquid spilled, , which is estimated at 12m^3 and filled to approximately 75% capacity. The risk assessment and spillage to be verified at detailed design phase in line with the NEMA (National Environmental Management Act Guidelines).
5. The *Contractor* ensures that the hight of the bund wall does not restrict the manual movement of chemicals (dry and wet) entering the CIP dosing system area.
6. The *Contractor* is to install a scouring valve within the bund wall to allow for the removal of any spilled chemical/liquid that would be contained within the bunded area.
7. The final elevation of the plinth/foundation is to allow for gravity flow of spilled liquids from the scouring valve to the drainage sump as illustrated in Figure 5.
8. The surface of the plinth/foundation is to be graded, by means of a concrete screed or similar approved, towards the scouring valve.
9. The Contractor is to include the drain pit within the sump. This is to include the existing drain point as well.
10. An epoxy coating, or similarly approved, is to be applied onto the interior surface of the bunded area (i.e. concrete and masonry surfaces). The aim is to prevent any chemical attack or

deterioration on the civil infrastructure. The proposed material is to comply with the *Employer's* specifications (240-106365693: Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings).

11. The *Contractor* designs all layer works that are required for the new concrete foundation/plinth.
12. Backfill material must be homogeneous and must be compacted in 150mm layers to 93% Modified AASHTO density.
13. Density tests is to be carried out on all backfill materials used.
14. During the construction of the foundation/plinth, the existing concrete paving bricks are to be remove and stored. The location for storing the removed paving bricks will be as per the instruction of the *Project Manager*.
15. The gap between the new concrete foundation/plinth and the remaining paving bricks is to be sealed with a non-shrink grout. This will prevent the existing paving bricks from being dislodged.
16. All proposed materials, including datasheets, are to be submitted to the *Project Manager* for review and approval prior to being used.

3.15.3 Construction

3.15.3.1 General

The *Contractor*:

1. 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 and Waste Management Procedure, as well as the National Building Regulations and SANS 10400 for all works.
2. Submits a comprehensive construction method statement (including a comprehensive risk assessment) detailing the proposed methods for 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 *Project Manager* 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 the assessment/inspection. The *Contractor* is liable for all damages that may occur and repairs are to be done at no additional cost to the *Employer*.
6. The *Contractor* disposes of all waste material at a waste disposal site (as confirmed by the Project Manager) to be approved 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 *Project Manager*.
7. Continuously monitors the conditions 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.

8. The *Contractor* ensures that a complete QCP, risk assessment, method statement and ITP's, where applicable are submitted to the *Project Manager* for review and acceptance before the works can commence. During reviews of the ITP's, the *Employer* provides the necessary intervention points.
9. All items that are assembled and constructed off site are listed and provided to the *Project Manager*. From this, an ITP is developed between the *Project Manager* and the *Contractor* to determine the intervention points.
10. Manages access to the working areas and the Site.
11. Manages activities on Site to ensure that no interference takes place between the *works* and that of others.
12. Liaise with the *Project Manager* regarding utilities and telephone facilities required for his site establishment.
13. Liaises with the *Project Manager* regarding the location of waste disposal sites and rubbish dumps.
14. The *Contractor* is responsible for the design and erection of all the temporary supports required for the *works*. In addition to the aforementioned, the *Contractor* adheres to the following:
    - The *Contractor* is restricted to the designated working areas
    - The *Contractor* is not to enter any other areas and ensures that his employees abide by the applicable regulations
    - The *Contractor* performs all hoisting and lifting by qualified riggers
    - The *Contractor's* Equipment does not impair the operation or access to the plant/building
    - The *Contractor* provides any temporary or expendable materials required for the storage of materials
    - The *Contractor* safeguards and secures all items whilst in the *Contractor's* custody and control, until completion of the works;
    - Plant and equipment not forming part of the *works* are not to be modified without written permission from the *Project Manager*. Modification in this sense includes, but is not limited to the following:
        - Welding onto existing plant,
        - Drilling into structural steel or concrete,
        - Cutting or removing
        - Loading adjacent structures.

3.15.3.2 Construction and Monitoring

1. The *Contractor* is responsible for the construction of all *works* in accordance with the accepted designs, drawings and specifications.

2. The *Contractor* is responsible for the safety of all personnel involved in the *works* as well as the safety of all personnel at Lethabo Power Station affected by the construction of the *works*.
3. The *Contractor* notifies the *Project Manager* of any defects that have occurred or are foreseen in order to reduce further damages that may occur.
4. The *Contractor* is responsible for the design, erection, maintenance and removal of all temporary works required for the execution of the *works*.
5. The Contractor provides the required level of construction monitoring in order to ensure that the construction is completed in accordance with the approved designs, drawings and specifications.
    - Technical quality assurance during construction to ensure that the construction is executed as per the approved design, specifications and procedures
    - Witnessing and approval (by signature) of intervention points where applicable to Engineering
    - Review and acceptance by signature of construction data books, as-built drawings and Operations and Maintenance manuals (where applicable) developed by the Contractor
    - Review and acceptance by signature of Contractor's Welding Procedure Specifications, Welder Qualification papers, NDT testing reports, Visual Inspection reports, Fall Protection Plans, Working at Heights Plans
    - Responding to technical queries and clarifications from the Contractor utilising documentation templates provided by the Employer
6. The *Contractor* takes full professional accountability and liability for all temporary items required for the execution of the works.

3.15.3.3 Construction Programme

1. As part of the Method Statement and as a tender returnable, the *Contractor* submits a Level 3 construction programme considering all the interfaces and time constraints.
2. This programme does not omit key activities. Timing of the activities is consistent with the Construction Work Method Statement.
3. The programme is to show that the *Contractor* has a clear understanding of the full scope of works, including the accompanying risks. The programme is to be logical and realistic.
4. The Contractor submits a Programme for all the phases of the *works* to the *Project Manager* for his acceptance.
5. This programme is accompanied with the following:
    - A comprehensive narrative which describes the basis of the programme;
    - A list of assumptions that the programme was based on;
6. The programme clearly indicates the following:
    - Activities of all the project work to be done by the *Contractor* and the other work covered by the contract that is being done by the sub-contractors;

- Logical links/ sequence/ relationships that connect the various activities together (showing all hold points);
- Master schedule is to show Links/logic, the CPM (Critical Path Method) technique is used for programme and planning. The critical path is clearly illustrated.
- The works is completed within accepted durations that are in consistence with key dates provided in the Contract Data. Milestone dates in line with Key Date/Contract Data shown on the schedule.
- Schedule Work Package Classifications (Deliverable, Engineering, Procurement, Manufacturing, Supply, Construction and Installation Work Packages)
- The amount of shifts planned per day for each section of the works.
- The way in which the *Contractor* plans to interface with Others. Interface points with Others are identified in the programme;
- A comprehensive description of each activity, including the name and designation of the responsible person;
- Full details of all terminal point release requirements;
- Any erection or commissioning activities that may affect other maintenance and construction activities on Site;
- Identifies when services are required for commissioning purposes;
- Sufficient information with regard to the activity duration and a description to enable measurement of the progress of the activity within the required update period;
- Each description in the programme explains and represents the performance of the activity, including tangible deliverables or products;
- Resources required to perform an activity for each activity that requires resource assignment;
- Single source of responsibility or ownership per activity.

3.15.4 Documentation and Configuration Management

a. Document identification

All documents supplied by the *Contractor* are subject to the *Employer's* approval. The language of all documentation is required to be in English.

b. Document Submission

- All project documents must be submitted to the delegated *Employer's* Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). In order to portray a consistent image it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction.
- The *Contractor* is required to submit documents as electronic and hard copies and both copies must be delivered to the *Employer's* Representative with a transmittal note.

In addition, the *Contractor* adheres to the following standards:

- Documentation Management Review and Handover Procedure for Gx Coal Projects (240-66920003).
- Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014)

c. Email Subject

The *Contractor* submits all documentation to the *Employer's* Representative in the following media:

- Electronic copies are submitted to Eskom Documentation Centre through generic email address (drmsharedservices@eskom.co.za). The email subject as a minimum has the following: ***(Station_Project Name_Discipline_Subject)***. Electronic copies that are too large for email are delivered on CD/DVD, large file transfer protocol and/or hard drives to the Project Documentation Centre. In a case where CD has been submitted, a notification email, with the transmittal note attached, is sent to the project generic email address. The Representative is copied on the email as well.
- Hard copies are submitted to the *Employer's* Representative accompanied by the Transmittal Note.

3.15.5 Drawings Format and Layout

1. The *Contractor* ensures that creating, issuing and control of drawings are in accordance with the *Employer*'s Engineering Drawing Standard (240-86973501).
2. The *Contractor* submits editable electronic drawings in DGN format and in PDF format. Drawings issued to the *Employer* are not "Right Protected" or encrypted. Drawings issued will be a minimum of one hardcopy and an electronic copy in both pdf and DGN. format.
3. Electronic drawings have a watermark indicating the approval phase of a drawing and hardcopies are to be stamped to indicate the approval phase i.e. preliminary, issued for review, issued for construction, etc.
4. The *Contractor*'s drawings are complete in every respect (including welding details which are fully described) and are checked by the *Contractor* prior to submission to the *Project Manager* for acceptance. All drawings show full endorsement by a professionally registered engineer/technologist with ECSA (including the ECSA registration number and signature on all drawings).
5. Any drawing prepared or made for the purpose of carrying out the works is the property of the *Employer* and may be used by the *Employer* as the *Employer* deems fit.
6. Each drawing set have an overview drawing which shows the overall layout of the system relevant to the drawing, with references to drawings where the details of the components depicted in the overview drawing can be found.
7. A design drawing package is issued with one drawing number and multiple sheets, instead of multiple drawing numbers. The breakdown of the drawing packaging is sent to the *Project Manager* for acceptance.

8. Drawings containing references to interfacing systems and to other applicable/relevant drawings includes the *Employer*'s drawing number as well.
9. All dimensions are provided. No dimensions are obtained from a drawing by scaling.
10. Tolerances for the design are clearly indicated on the drawings.
11. The final detailed engineering drawings that are issued for construction are on revision 0. Drawings submitted prior to that, have revisions of 0.1, 0.2 or a, b, c etc.
12. All cells in the drawing title block needs to be populated and completed before the drawing is signed off.

3.15.6 *Contractor*'s responsibilities during the *Employer*'s Design Review Process

1. The *Project Manager* conducts Design Reviews as per the *Employer*'s design review procedure; Participation of the *Contractor* in the *Employer*'s Design Reviews consists of:
    - The *Project Manager* conducts design reviews as per the *Employer*'s design review procedure and the *Contractor* presents (the design developed by him) and participates in the design review.
    - If any fundamental errors are found in the designs or further actions are required, the *Contractor* addresses all concerns raised and revises the designs.
    - The *Contractor* submits the documents for another design review once all designs are revised according to the concerns raised by the *Project Manager*.
    - If no fundamental errors are found in the designs during the design review session, the *Project Manager* compiles the design review minutes and report.
    - The *Contractor* reviews the report and minutes. If the report/minutes are not acceptable, the *Contractor* submits comments to the *Project Manager*.
    - The *Project Manager* accepts the *Contractor*'s design once the design review report is accepted and signed by the *Employer*'s project team.

3.15.7 Time required for acceptance of designs

1. Not later than 21 days after receipt, the *Project Manager* returns a comment log to the *Contractor* that contains the review comments for the *Contractor*'s design.

3.15.8 Engineering Change Procedure

1. The *Contractor* takes note of the *Employer*'s Engineering Change Procedure (240-53114026). An engineering change includes any proposed engineering change originating from the *Contractor* or *Employer* from an established design baseline in the design review procedure

3.15.9 Professional Engineering Certification

The *Contractor*'s professional civil engineer/technologist who is registered with the Engineering Council of South Africa provides design certification in accordance with SANS 10400-A, declaring the design "fit for purpose" in terms of the relevant design codes and the OHS Act. The *Contractor*

will be required to provide a 2-part certification, one after completion of the design and a separate certification upon completion of the construction in accordance with SANS 10400_A declaring that the construction was carried out in accordance with the approved design and the OHS Act.

3.15.10 Quality and project handover requirements

3.15.10.1 Quality Management

1. The *Contractor* submits a fully detailed Quality Control Plan (QCP) for acceptance, which details all the aspects of the quality management system to be applied. It includes the methods that will be utilized to ensure quality assurance, control and improvement of the identified activities as stated in the Scope of *Works*.
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 *sub-Contractor*s and suppliers of material in the Quality Control Plans (QCPs). This level is based on the criticality of equipment and must be submitted to the *Project Manager* for acceptance.
4. Product data sheets, product samples, and any other documents are submitted for review and acceptance by the *Project Manager* after contract award and prior to the commencement of work.
5. All quality control documentation is submitted to the *Project Manager* within seven (7) days of Contract date

3.15.11 Handover

1. Apart from any statutory data packages required, the *Contractor* also submits a data package of the relevant drawings, test certificates etc. to the *Project Manager* for acceptance. These include, but are not limited to:
    - Approved ITP's, QCP's
    - Concrete 7 day and 28 day cube test results
    - Slump test results
    - Concrete mix designs including all required test results e.g. aggregate test results
    - Pre-concrete and post concrete surveys
    - Method statements and specifications adhered to
    - Risk assessments
    - Approved drawings
    - Inspection reports
    - Notifications
    - Modifications
    - Technical Queries, Engineering Responses and communications with *Project Manager*/*Employer*

- Non-conformance reports
- Transport notifications
- Calculations for any temporary works that may be required for the safe execution of the works
- Material certificates
- Test results and reports
- As-built data and drawings of the completed works upon handover. As-built drawings are submitted in PDF and native CAD formats.

3.15.12 Specifications for Civil the *Works*

3.15.12.1 Applicable Standards

The *Contractor* is required to adhere to the latest editions of and the normative references within the following SANS standards and other codes of practice, regulations & standards:

Number	Title
240-56364545	Structural Design and Engineering Standard
240-86973501	Engineering drawing Standard
SANS 10400	The Application of the National Building Regulations
240-107981296	Constructability Assessment Guideline
240-99527377	Inspection Manual for Civil Works at Eskom's Power Station
SABS 471/ SANS 50413 & SANS 50196	Portland cement (ordinary, rapid hardening and sulphate resisting)
SANS 2001-BE1	Construction works Part BE1: Earthworks (general)
SANS 2001-BS1	Construction works Part BS1: Site clearance
SANS 2001-CC1	Construction works Part CC1: Concrete works (structural)
SANS 5861-2	Concrete tests - Sampling of freshly mixed concrete
SANS 5862-1	Concrete tests - Consistence of freshly mixed concrete - Slump test
SANS 5863	Concrete tests - Compressive strength of hardened concrete
SANS 5864	Concrete tests - Compressive strength of hardened concrete
SANS 10400	The Application of the National Building Regulations
SANS 1200 G	Standardized specification for civil engineering construction Section G: Concrete (structural)

3.15.13 Additional Requirements and Pre-requisites

1. The *Employer* will arrange a mandatory site clarification meeting with all tenderers so that tenderers are afforded the opportunity to visually inspect the works to be done.

3.15.13.1 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 *Employer* in writing before casting of concrete may commence.
3. The *Contractor* is required to obtain written acceptance from the *Employer* 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.
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 *Employer* 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 5: SANS Specifications

Clause	Particular Specification
4.2	**Materials**
4.2.3.5	The following tests are required: • drying shrinkage on fine and course aggregates; • drying shrinkage of concrete; • flakiness index of the stone; • alkali-silica reaction; • alkali-aggregate reaction.
4.2.7	In general, one of the following types of non-shrink grout are required to be used: • 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: • Class 15 MPa/ 19 mm for Blinding Concrete (28 days),

Clause	Particular Specification
	• Class 35 MPa/ 19 mm for Structural Concrete (28 days).
4.3	**Formwork**
4.3.1.8	• 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: • 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	• *Contractor* submits to the *Supervisor* 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: • 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
4.7.12.2.3	• All angled corners are chamfered 20 mm x 20 mm, unless such other larger size is detailed on the Drawings.
4.7.19.3	• *Contractor* submits a detailed procedure for acceptance by the *Supervisor* on how he intends to carry out the repairs of structural concrete defects
4.7.22	• For concrete pour records, the *Contractor* submits a detailed Quality Control Plan to the *Supervisor* for acceptance. • In addition the *Contractor* supplies the *Supervisor* with two copies of these records each day covering works carried out the preceding day.
5.1	**Testing**
5.1.1.4	• Six 150 mm cube samples taken from each batch or place of concrete deposition, three cubes are tested at 7 days and three at 28 days.

Clause	Particular Specification
	• Strength at 7 days is required to be at least two thirds of 28 day strength.
5.1.2.1	• Any of the cube samples tested indicating a result more than 3 MPa below the specified strength is disregarded.
5.1.3.3	Add the following: • …, unless no more than three batches of concrete is being mixed.
5.2	**Tolerances**
5.2.1.1	• 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	Add the following under “Location of holding-down bolts”: • 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.

3.15.14 DELIVERABLES

The *Contractor* provides the following document deliverables as part of the *works*.

3.15.15 Tender Phase

The tenderer submits the following as a minimum in the tender submission:

1. A Level 3 schedule for the assigned scope clearly highlighting all activities involved, major milestones and provision for the *Employer* review.
2. Method Statement for the entire works clearly demonstrating understanding of and compliance with the full scope as detailed in the scope of *works*.
3. Relevant experience in the design and construct of similar projects. List of verifiable relevant references (minimum of 3 projects) must be provided for the works completed within the last 5 years. References to include contact numbers and name of client, description of scope in the project and the cost of the project as a minimum.
4. CV’s of the proposed key resources each having a minimum of 5 years’ relevant experience (construction manager, design engineer). Civil engineer/technician to be professional registered with the Engineer Council of South Africa. Copy of valid certificate to be provided. Organogram of site team to also be provided clearly indicating the roles that the resources will fulfil in the project

3.15.16 Planning Phase

1. A Level 3 schedule (schedule with defined activities) for the scope clearly highlighting all activities involved, major milestones and provision for the *Employer* to review.
2. Method Statement
3. Risk Assessments
4. Project specific safety file
5. Project Quality Control Plan
6. VDSS
    - The *Contractor* is required to update the provided VDSS throughout the project phases.

3.15.17 Design Phase

1. Consolidated detail design report signed by a professionally registered Civil Engineer/Technologist which includes:
    - Survey drawings, design criteria/parameters, specifications and standards used, loadings, assumption, calculations results including detailed design calculation, design models, source of information and any record of other information associated with the completed works.
2. Detailed drawings for construction, signed by a professionally registered Civil Engineer/Technologist. Drawings are to be submitted in DGN. formats.
3. Construction specifications for the *works* including measurement and payment items.
4. Priced Bill of Quantities for the *works*.
5. Detailed Risk Assessments

3.15.18 Pre-construction Phase

1. Detailed method statements for the construction of the works (including Rigging Studies)
2. Inspection and Test Plans (ITP's) indicating all intervention points
3. Quality Control Plans (QCP's)
4. Construction Programme
5. Project Specific Safety File (updated)
6. Any temporary works required as part of construction signed by a professionally registered Civil Engineer/Technician
7. Detailed Risk Assessments (updated)

3.15.19 Post-construction Phase

1. QA returnables (monthly)
2. As-Built drawings
3. Data books as detailed in Section 3.15.11
4. Certificate of completion, signed by the ECSA registered civil engineer/technologist, confirming that the *works* has been constructed in accordance with the design.

3.16 *WORKS* TO BE EXECUTED BY THE *EMPLOYER*

(1) The *Employer's* engineering representatives will review the detail design package, will assist with quality assurance during project execution, review QCPs, assess validity of equipment specifications against design before installation and assist with commissioning of plant.

(2) The *Employer's* operating representative will assist with testing and commissioning of the new analysers.

(3) The *Employer* assigns personnel from operating, maintenance and engineering for operating, troubleshooting and maintenance training on the new equipment.

4. AUTHORISATION

This document has been seen and accepted by:

Name and Surname	Designation
Nombuyiselo Molosiwa	D&S Engineering Manager
Perusha Moodley	Senior Engineer LDE- Chemical-D&S
Retief Ras	Lethabo Power Station –System Engineer -OPE
Remofiloe Ranaka	Senior Technologist – System Design-D&S
Zesizwe Ncane	Lethabo Power Station -LDE – Senior Electrical Engineer D&S
Anasen Pillay	Lethabo Power Station – LDE -Senior Engineer Mechanical D&S
Rajiv Beharie	Lethabo Power Station -LDE – Senior Engineer C&I D&S
Carl Woodhouse	Lethabo Power Station – Senior Technologist
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Gareth Macintosh	Kusile Power Station Senior Civil Engineer
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5. REVISIONS

Date	Rev.	Compiler	Remarks
Feb 2021	0	Perusha Moodley	First Draft of Technical Specification Report
October 2021	1	Perusha Moodley	Final Technical Specification Report

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

Perusha Moodley

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7. ACKNOWLEDGEMENTS

The following people should be acknowledged in the development of this document:

- All team members

APPENDIX A: C&I APPENDICES

a. A1 INSTRUMENT SCHEDULE

http://eng.eskom.co.za/sites/fs/ge/Lethabo/d/DS%20Reporting/Perusha%20Moodley/Loading%20of%20the%20SRO%20CIP%20Chemicals/Tech%20Spec/Appendix%20A1%20-%20Instrumentation%20Schedule%20R0.1.xls

b. A2 LIMITS OF SCOPE AND SUPPLY & SERVICE DIAGRAMS

http://eng.eskom.co.za/sites/fs/ge/Lethabo/d/DS%20Reporting/Perusha%20Moodley/Loading%20of%20the%20SRO%20CIP%20Chemicals/Tech%20Spec/Appendix%20A2%20-%20Limits%20of%20Supply%20and%20Services%20Diagrams%20R0.1.xlsm

APPENDIX B: VDSS

http://eng.eskom.co.za/sites/fs/ge/Lethabo/d/DS%20Reporting/Perusha%20Moodley/Loading%20of%20the%20SRO%20CIP%20Chemicals/Tech%20Spec/Appendix%20B%20VDSS.xlsx

APPENDIX C: DRAWINGS

Redlined P&ID 1

http://eng.eskom.co.za/sites/fs/ge/Lethabo/d/DS%20Reporting/Perusha%20Moodley/Loading%20of%20the%20SRO%20CIP%20Chemicals/Drawings/Red%20lined%20PID%201.pdf

Redlined P&ID 2

http://eng.eskom.co.za/sites/fs/ge/Lethabo/d/DS%20Reporting/Perusha%20Moodley/Loading%20of%20the%20SRO%20CIP%20Chemicals/Drawings/Red%20lined%20PID%202.pdf

APPENDIX D: DOCUMENT LIST

Document Number	Rev.	Document Title	Remarks
375-LET-BEEC-D00D35-32	1	Lethabo Power Station Loading of SRO CIP Chemicals Required Operational Capability (ROC)	Approved
375-LET-BBBB-D00138-5	1	Lethabo Power Station Loading of SRO CIP Chemicals Root Cause Analysis (RCA) Report	Approved
375-LET-FBBBD00139- 1	1	Lethabo Power Station Loading of SRO CIP Chemicals Engineering Management Plan Rev 1	Approved
375-LET-ADDB-D00180-2	1	Lethabo PS Loading of the SRO CIP Chemicals SRD	Approved
375-LET-AABB-D00139-93	1	Lethabo PS Loading of the SRO CIP Chemicals SRD End of Phase Report	Approved
375-LET-MDDD-D00185-9	1	Lethabo PS Loading of the SRO CIP Chemicals Concept Design Report	Approved
375-LET-AABB-D00138-105	1	Lethabo PS Loading of the SRO CIP Chemicals Concept End of Phase Report	Approved