| Eskom | Specification | Medupi Power Station |
|---|---|---|

Title: **Medupi Power Station EC 26027224 Install pumps in all PCDs Scope of Work**

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# 1. Introduction

Medupi Power Station is currently in urgent need to reduce water levels in the pollution control dams. The station dams are currently operating at high levels (above 80%, the maximum allowable limit is 30%) which lead to the contravention of the site's water use license due to spillages.

# 2. Supporting Clauses

## 2.1 Scope

### 2.1.1 Purpose

The purpose of this document is to define the scope of work for the acquisition of engineering works, material and labour for the installation of new pipelines, truck filling points as well as modifying existing ones such that water will be distributed between the Medupi Power Station dams. This project will preferably be a turnkey/EPC project and will assist with water management challenges to Medupi.

### 2.1.2 Applicability

This specification shall apply to Medupi Power Station and the Contractor employees that are required to perform project work and/or activities on all pollution control dams at Medupi Power Station.

### 2.1.3 Effective date

The effective date of this document will be the date of authorisation.

## 2.2 Normative/Informative References

The following documents contain provisions that, through reference in the text, constitute requirements of this document. At the time of publication, the editions indicated were valid. These documents are subject to revision and users are responsible to ensure that the most recent editions of the documents listed below are used.

### 2.2.1 Normative

[1] 240-49910693: Stakeholder Requirement Definition Installation of pumps in all PCDs Project

[2] 241-202287: Medupi Power Station Required Operational Capability for the installation of pumps in all PCDs Project Report

[3] ISO 9001: 2015 Quality Management System

[4] 240-105658000: Contractor Quality Management Specification

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[5] 240-86973501: Standard Drawing Practice

[6] Act No 107 of 1998: National Environmental Management Act, 1998

[7] Act No 14 of 2009: The National Environmental Laws Amendment Act, 2009

[8] Act No 73 of 1989: The Environment Conservation Act, 1989

[9] Act No 102 of 1980: National Key Points Act, 1980

[10] Act No 36 of 1998: National Water Act, 1998

[11] Act No 85 of 1993: Occupational Health and Safety Act & Regulations, 1993

[12] 36-681: Generation Plant Safety Regulations

[13] 32-826 Operating Regulations for High Voltage System

[14] 40-55714363: Coal Fired Power Stations Lighting and Small Power Installation Standard

[15] 240-56227443: Generation Requirements for Control and Power Cables for Power Stations Standard

[16] 240-56227927 Electrical Load List Template

[17] 240-56227516: LV Switchgear Control Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard.

[18] 240-55714363 Eskom Generation Power Station Lighting and Small Power Installation Standard

[19] 240-56356396: Earthing and Lightning Protection Standard

[20] 240-56360387: Storage of Power Station Electric Motors Standard

[21] 240-56361435: Transport of Power Station Electric Motors Standard

[22] 200-11768 Cabling and racking standard

[23] 240-56536505: Hazardous Locations Standard

[24] 240-57617975: New Low Voltage Motors Procurement Standard

[25] 240-56176097 Electrical Cable Schedule Template

[26] 240-56030406: Specification for Ring Main Units for Systems with Nominal Voltages from 3.3 KV to 33 KV.

[27] 240-64430501: Low Voltage Variable Speed Drive Control Equipment Standard

[28] 240-56355815: Junction Boxes and Cable Termination Standard

[29] 240-75883906: MV Reticulation General Requirements for Overhead Lines (up to 33kv) Standard

[30] SANS 10142-1: The wiring for premises Part 1 – low voltage installations

[31] SANS 10114-1: Interior lighting Part 1 – Artificial lighting of interiors

[32] SANS 10114-2: Interior lighting Part 2 – Emergency lighting

[33] IEEE 80: Guide for Safety in AC Substation Grounding

[34] SANS 204: Energy Efficiency in Buildings

[35] VGB – B 106 E Part A– KKS Application Commentaries Part A – General



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[36] VGB – B 106 E Part A– KKS Application Commentaries Part B1– Mechanical Engineering

[37] VGB – B 106 E Part A– KKS Application Commentaries Part B2– Civil Engineering

[38] VGB – B 106 E Part A– KKS Application Commentaries Part B3– Electrical Engineering

[39] VGB – B 106 E Part A– KKS Application Commentaries Part B4– C&I Engineering

[40] 240-109607332 Eskom Plant Labelling Abbreviation Standard

[41] 240-93576498 KKS Standard

[42] 240-71432150 Coding Standard

[43] 240-61227631 Piping and Instrumentation Diagram (P&ID) Standard

[44] 240-109607736 Eskom KKS Key Part Standard

[45] 84CIVL053 - Medupi Power Station Specification for Structural Concrete

[46] 240-56364545 Structural Design and Engineering Standard

[47] SANS 170016-2 Part 16 Fasteners Part 16: Washers Section 2: Plain washers - Normal series - Product grade A

[48] SANS 1700-16-3 Part 16 Fasteners Part 16: Washers Section 3: Plain washers, chamfered - Normal series - Product grade A

[49] SANS 121 Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods

[50] SANS 60529 Degrees of protection provided by enclosures (IP Code)

[51] 240-108079430 Power Plant Water Systems Design guidelines

[52] 240-105020315 Standard for Low Pressure Valves

[53] 240-123801640 Standard for Low Pressure Pipelines

[54] 240-106628253 Standard for Welding Requirements on Eskom Plant

[55] 240-563355754 Field instrument installation Standards

[56] 240-57859210 – Alarms Systems performance of Control systems applied in Fossil Plant Standard

[57] 240-5635546 – Alarm Management System Guideline

[58] 240-53113685 Design Review Procedure

[59] 240-56356376 On-Site Commissioning for Low Pressure Systems

### 2.2.2 Informative

[60] 240-56030558: Centrifugal Pumps Specification

## 2.3 Definitions

| | |
|---|---|
| Clean & Dirty Drains recovery system | Refers to the Clean and Dirty drains recovery system on the power station that is designed and constructed to perform the necessary |



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| | |
|---|---|
| | recovery of Dirty water from the CDD dams to the dirty water tanks which in turn provide suction to various dirty water systems. |
| Contractor | Service provider contracted for supplying specific service to Eskom, Medupi Power Station. |
| Employer | Eskom, or Eskom Medupi Power Station |
| Field Devices | Control and instrumentation equipment installed on the plant, for example transmitters, pressure switches, limit and proximity switches. |
| Medupi | Medupi Power Station |
| System | Assembly of components in which water is delivered and used |
| Water Use License | Medupi Power Station has a water use license which is necessary to use a certain amount of water. This amount may not be exceeded, and if exceeded, large penalties will be possibly liable to the Power Station. |
| Zero Liquid Effluent Discharge Policy | The aim to not allow any water which may have been contaminated by operations at Medupi Power Station to leave the land belonging to the power station |

## 2.4 Abbreviations

| Abbreviation | Explanation |
|---|---|
| CDD | Clean & Dirty Drains |
| CSY | Coal Stockyard |
| ECSA | Engineering Council of South Africa |
| EMS | Environmental Management System |
| FMECA | Failure Mode, Effects, and Criticality Analysis |
| GA | General Arrangement |
| HAZLOC | Hazardous Location |
| HAZOP | Hazard and Operability Study |
| HDPE | High Density Polyethylene |
| HMI | Human-Machine Interface |
| ITP | Inspection and Testing Plan |
| KPA | Key Performance Areas |
| MDL | Master Document List |
| OEM | Original Equipment Manufacturer |
| P&ID | Piping & Instrumentation Diagram |
| PCD | Pollution Control Dam |
| PSR | Plant Safety Regulations |

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| Abbreviation | Explanation |
|---|---|
| QCP | Quality Control Plan |
| RAM | Reliability, Availability, and Maintainability |
| SOW | Scope of Work |
| VDSS | Vendor Document Submission Schedule |

### 2.5 Roles and Responsibilities

**System Engineer** – Responsible for the compilation of this scope and the provision of technical input and support

**Projects Department** – Responsible for the execution and management of the installation project

### 2.6 Process for Monitoring

In case of any additions, subtractions and/or amendments to the contents of the scope of work or any part of this document, prior the revision date, the Auxiliary Engineering Manager shall appoint an Engineer to effect the necessary changes and to use the most current approved template for new revision. A Quality Control Plan (QCP) will be used to monitor the procurement and the installation of the components listed to execute the works. Other monitoring and control measures shall include the following:

- Submission of SHE File before any work begins on site
- Submission of method statements for all disciplines involved in the project
- Complete safety induction and clearance permits
- Submission of Data Books and Manuals for the equipment installed on site

### 2.7 Related/Supporting Documents

None

## 3. Scope of Work

### 3.1 Scope

The works shall be as follows (to be read in conjunction with [2]). Also see Figure 1:

1. Assess the currently installed temporary pumping installations at the eight dams for compliance with 240-53113333 - Eskom Plant Codification Standard and 240-71432150 Plant Labelling and Equipment Description Standards.
2. Draft and label the currently installed temporary pumping installations at the eight dams for compliance with 240-53113333 - Eskom Plant Codification Standard and 240-71432150 Plant Labelling and Equipment Description Standards.
3. Design and install a new line with one pump connecting the Clean Water Recovery Dam to the Crocodile compartment. Approximate Distance = 5.5km



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4. Design and install a new line with two pumps that will enable bidirectional flow between the Ash Dump Pollution Control Dam PCD1 and Pollution Control Dam PCD2b – Approximate Distance = 1 km. The pump that will be installed in D1, shall also be so designed to have sufficient head (pressure) to reach the top of the ash dump, i.e. allow for water to reach the Northern stacker at a pressure of at least 2,5 Bar.

   PCD1 has permanent power supply, however, the supplier must ascertain whether the infrastructure installed will be able to cater for an additional load he/she will propose. Power supply must be provided at PCD2b as there is no existing power supply system in that area. This power supply must also be provided with all equipment to allow for reliable and safe power supply.

5. Design and install a new line with two pumps that will enable bidirectional flow between the Ash Dump Pollution Control Dam PCD2 and Pollution Control Dam PCD2b – Approximate Distance = 1,2 km. The pump that will be installed in D2b, shall also be so designed to have sufficient head (pressure) to reach the top of the ash dump, i.e. allow for water to reach the Northern stacker at a pressure of at least 2,5 Bar.

   Power supply must be provided as there is no existing power supply system in that area. This power supply must also be provided with all equipment to allow for reliable and safe power supply.

6. Design and install a new line with at least five pumps that will enable bidirectional flow between the Ash Dump Pollution Control Dam D2, D3, D4, D5, D6 and D7– Approximate Distance = 4 km. The system should allow for water to be moved from one dam to the other.

   Power supply must be provided as there is no existing power supply system in that area. This power supply must also be provided with all equipment to allow for reliable and safe power supply.

7. Design and install a new line with one pump that will enable flow from the Coal Stockyard Pollution Control Dam (PCD CSY) to the Ash Dump Pollution Control Dam D1 – Approximate Distance = 2 km.

   PCD CSY has permanent power supply, however, the supplier must ascertain whether the infrastructure installed will be able to cater for an additional load he/she will propose. This power supply must also be provided with all equipment to allow for reliable and safe power supply.

8. The currently installed line connecting D2 with D4, D5, D6 and D7 must be modified to allow bidirectional flow between these dams. This can be achieved through the manual manipulation of the valve setup.

9. The current installed system supplying irrigation to the admin building situated in the CDD must be modified to allow for safe access, have permanent KKS coding as well as upsized to allow for sufficient pressure. The power supply must be corrected to comply with Eskom standards.

10. Provide new truck filling points in all the following dams:

    - Clean Recovery Dam
    - PCD1
    - PCD2

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- PCD2b
- PCD3 (dam still to be constructed)
- PCD5
- PCD6
- PCD7

These truck filling points must be equipped with isolation valves, drainage, access platform for the trucks to stand in and fill up. This infrastructure must be linked with the pumps that are being installed in the respective dams with exception to the clean dam recovery dam where a dedicated pump will be installed to allow or truck filling.

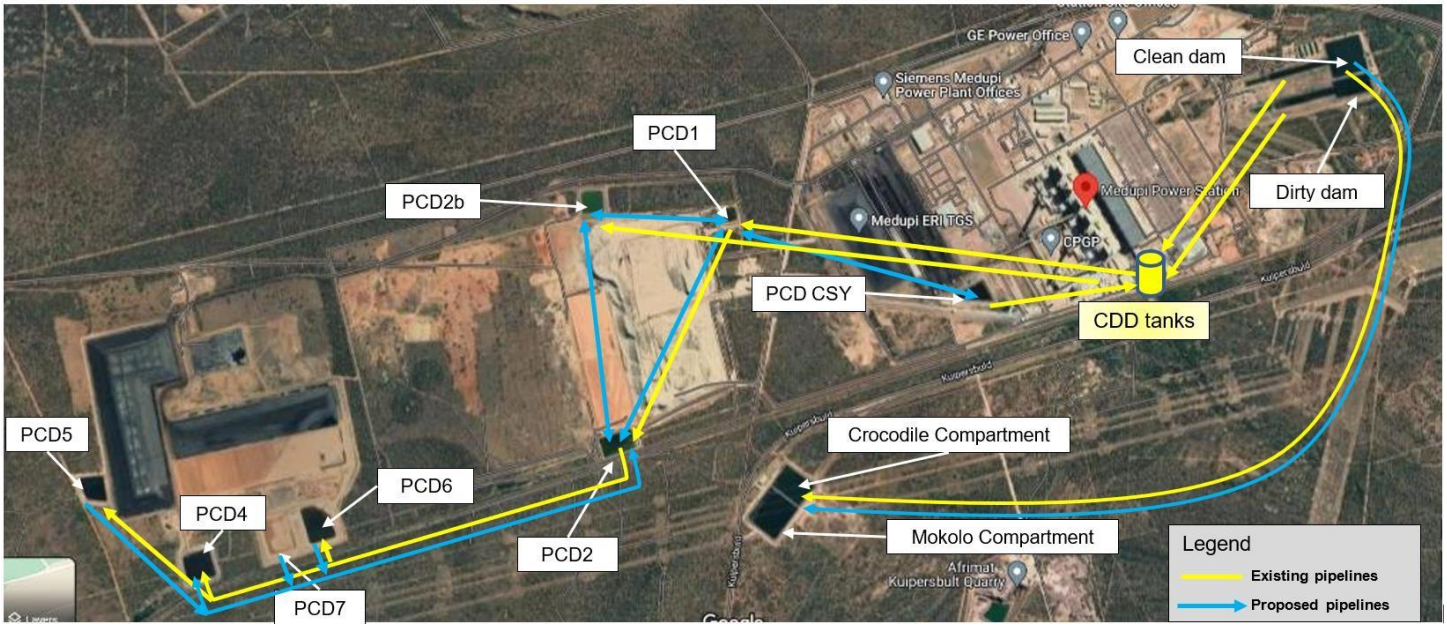


**Figure 1: Medupi Power Station dam layout**

## 3.2 Design

1. At all times, the Contractor must and shall design their systems according to document 240-108079430 Power Plant Water Systems Design Guideline as well as 240-123801640 Specification for Low Pressure Pipelines Standard.
2. The Contractor is required to design and propose their solution considering the location of the dams from each other, the site weather conditions, the availability/unavailability of live electrical power and access. Document “240-49910693 Stakeholder Requirement Definition Installation of pumps in all PCDs Project” must also be consulted to ensure stakeholder requirements are accounted for.
3. The Contractor will be required to use the services of a Professionally Registered Engineer with ECSA to design the system. The engineer will be expected to perform and produce design calculations in the fields of mechanical, electrical, control and instrumentation and civil engineering.

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4. The design work will and must include all system, hydraulic and dynamic calculations, input/measured data on site, studies, detailed drawings as well as “as built” construction drawings and pipe route drawings. The designs must include support structures including supports, blocks, etc. All basic engineering elements that make for sound engineering design principles need to be accommodated in the design and pricing structure.
5. The Contractor must be conversant with Eskom internal processes including the production of Quality Control Plans/ITPs and Method Statements prior to executing any work.
6. All design work must be accepted and signed for by Eskom Engineering prior to proceeding to next stages of the process. The pumping systems must be designed and built in accordance with all relevant national standards.
7. The Contractor will be responsible to design for safety, electrical, civil and mechanical functions which will enable the installed plant to work reliably and defect-free for a period of over 5 years minimum. All installations shall consider maintainability and operability of the systems, inclusive of safe access for maintenance of the systems around the dams
8. Control and instrumentation

8.1. Modes of operation

The Medupi Water Balance is used purely for monitoring purposes and, as a result, there are no control and operating requirements for these flowmeters and level transmitters.

Water Accounting Framework Standard states that “accurate water use monitoring, accounting and reporting is considered to be an integral and fundamental water management tool available to power stations”. As result Medupi is required to ensure that all the major streams are measured for water accounting purpose. The installed flow and level meters on the streams shall be monitored monthly.

All local display shall depict flow rate in cubic meters per hour ($m^3/h$) and total volume in cubic meter ($m^3$). The PLC shall display the flow meter flow rate and total volume per meter per month. On the first day of every month the total volume per meter per month shall reset to zero but the main counter for the flow meter should never reset and should reside on the VA View.

The PLC proposed by the Contractor will be used to convert 4-20mA signals received from the plant’s flowmeters into values that can be used to perform the Water Balance calculations.

The Contractor is responsible for the provision of a detailed Operating and Control philosophy if needs be as per the Contractors detailed design and submits this to the Project Manager for acceptance prior to commencing with the construction activities. The Operating and Control philosophy conforms to the Employer’s format for such a document.

8.2. Control and Instrumentation Design

The Control and instrumentation system design includes the following key components:

- Field instrumentation and interface
- Local indication



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- New Telemetry system
- New Programmable Logic Controller and Interface
- PLC Logic

The C&I Scope of work design provides control and monitoring of the process plant at the existing C&I control system and new PLC.

For every dam/pump station:

- Radar level Transmitter (with mounting stand and weather hood)
- Totalizing Clamp-On Flow meter. (with mounting stand and weather hood)
- Slave Telemetry with 4-AI's / 8-DI's/ 4-DO's. (housed in IP66 S/Steel Panel)
- Telemetry interfacing Measurements & doing Pumps Start/Stops
- 24VDC Battery & Charger powered by Pump Electrical Power Source
- 1 x Master Telemetry Station interfacing into BOP DCS for all remote PCD's.
- S/Steel Telemetry Antena Mast's (provision/plinths/erection/earthing)

### 3.2.1 Civil Requirements

The Civil & Structural scope of works includes but not limited to concrete works, steel works, earthworks Plinth works (i.e. pump bases; Pipe support structures; Concrete slabs/ Platforms; Steel structures and access platforms (gratings; cat ladders etc); Buried services (PCD water pipelines)) as well as any supporting infrastructure for the Mechanical, C&I and electrical scope.

The *Contractor* shall be responsible for the design and construction of the Civil and Structural Works required for all the works detailed under Section 3.1.

#### 3.2.1.1 Requirements

1. The *Contractor* shall take full professional accountability and liability for all the Works in the scope and shall provide the following for review and acceptance:

a) The concrete and structural detailed design.
b) Survey results, outcomes of Geotechnical investigation, design criteria/parameters, specifications and standards used, loadings, assumptions, calculations results including detailed design calculations, design models, sources of information and any record of other information associated with the completed Works.
c) Detailed drawings for construction. Drawings shall be submitted in PDF (and CAD) formats.
d) Construction and construction monitoring.

2. The *Contractor shall* submit as-built data and drawings of the completed works upon handover. As-built drawings shall be submitted in PDF and native CAD formats.
3. Any discrepancy or ambiguity between the Employer's Specifications or requirements shall immediately be brought to the attention of the Project Manager for clarification.

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#### 3.2.1.2 Structural Works

The structural works includes reinforced concrete and structural steelwork.

##### 3.2.1.2.1 Initial Assessment

The initial assessment for the structural designs shall include the following:

1. Geotechnical investigation to confirm if the location is suitable for foundations and location for the works.
2. The topographical survey of the proposed area(s)
3. Underground surveys in the proposed areas to locate any underground services.
4. Site Inspection

#### 3.2.1.3 Structural Design Criteria

The *Contractor* shall consider all the below mentioned design criteria for the Works and the Works shall comply with 240-56364545 Structural Design and Engineering Standard and the normative references.

##### 3.2.1.3.1 Concrete

The contractor shall comply with 84CIVL053 - Medupi Power Station Specification for Structural Concrete

#### 3.2.1.3.2 Structural Steel

The contractor to comply in accordance with the 240-56364545 - Structural Design and Engineering Standard and all relevant and applicable SANS.

1. Allowable deflections for differential structures are governed by the structural use of steel Part standard and the Southern African Steel Construction Handbook - Red Book.
2. Fixing of purlins to roof beams and trusses by means of angle cleats.
3. Washers shall be used for all bolted connections, and the washers shall comply with SANS 170016-2 Part 16 and SANS 1700-16-3 Part 16.
4. Bolts, nuts, and threads shall comply with requirements of SANS 1700.
5. All metal grating, stair treads and fasteners shall be hot dipped galvanized to SANS 121.
6. Hand railing, floors, platforms, and walkways shall be provided with kick plates.
7. Anchor bolts shall not be less than 16mm in diameter and shall be Grade 4.8 or Grade 8.8.

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#### 3.2.1.4 Construction Criteria

The *Contractor shall* construct the Works in accordance with the contractors' design based on the scope of work. The Construction works will be accordance to the above and other relevant and applicable SANS regulatory and legislative requirements, including but not limited to SANS 2001; SANS 10100 and SANS 10400.

#### 3.2.1.5 Construction Monitoring

The Contractor is responsible for developing the Construction Method Statement and the execution of construction work on site. Quality assurance and control shall apply during the execution phase of the project to ensure that construction is in accordance with the design. The contractor's designer shall comply with construction regulations i.t.o construction monitoring and supervision.

### 3.2.2 Mechanical Requirements

#### 3.2.2.1 Material

1. The following minimum material will be required:
    - Pumps preference will be for non-submissible, dewatering pumps that can be maintained outside of the water. Thus, sufficient suction head must be considered in the design work. Where the current installation pump is submersed, the new design should honour the non-submissible preference.
    - All pumps are to be installed with a local operating system allowing the pumps to be started locally and stopped as deemed necessary.
    - Valves including automatic vent and vacuum relief valves. The system must be vented at key points and include isolating valves as well as non-return valves as per good design principles.
    - Pipework that will be suitable and compatible with environment conditions (UV exposure)
    - Flowmeters connected on inlet of each dam
2. The Contractor must provide all the relevant maintenance manuals for all equipment included in the proposal which shall include all the necessary maintenance activities and frequencies thereof.
3. The Contractor must provide a list of spares (Electrical, Control and Instrumentation, Mechanical and Civil) which must be kept on site for the reliable and safe operation of the equipment.
4. The Contractor must provide all the relevant installation instructions and operating manuals for all equipment included in the proposal.

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5. All the mechanical installations shall be done in accordance to 240-108079430 Power Plant Water Systems Design guidelines, 240-123801640 Standard for Low Pressure Pipelines, 240-105020315, Standard for Low Pressure Valves and 240-106628253, Standard for Welding Requirements on Eskom Plant
6. As far as reasonably practicable, the equipment (valves, piping materials etc) will be of similar make to those already installed.
7. As far as reasonably practicable, the Contractor shall use similar make of pumps, valves and piping materials in the installations to be done.

#### 3.2.2.2 Installation

1. The Contractor will be responsible for the installation and commissioning of the system.
2. The Contractor must provide Certificates of Compliance and test prior to energising, commissioning, and handing over the various systems.
3. The Contractor will be responsible for proposing and providing a means of crossing roads and other areas where it is not suitable for pipes to be laid above ground.
4. The Contractor will be responsible for appropriately covering openings he/she created and must follow standard industry practices following accepted method statements from Eskom.
5. The Contractor will be responsible for re-tarring where tarred road was disturbed. This must be catered for by the Contractor.
6. Methods such as directional drilling may also be affected.
7. The Contractor must also take care to verify with Medupi engineering the presence of any underground pipework as well as electrical cabling prior to any excavations.
8. The Contractor must verify the pipeline path with Engineering at the planning stages.
9. The Contractor must provide and establish a trained execution and technical crew to execute the installation of the pumping systems and pipelines.
10. The contractor shall ensure that the team established on site has all the necessary hand and power tools.

### 3.2.3 Control and Instrumentation Requirements

#### 3.2.3.1. General C&I Requirements

The following general design requirements are applicable to all aspects of the C&I design:

1) All field equipment is installed in a suitable location.
2) The Contractor shall ensure field equipment operates in an environment within the parameters.
3) Where harsh environmental conditions are unavoidable, the field equipment shall be design for operation in that environment.
4) All IP ratings are as per SANS 60529.

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5) All supplied field equipment, excluding Junction Boxes (JBs) and their electrical connections are rated IP 65 or better.
6) Field equipment situated outdoors, or in adverse environments, must be provided with additional protection hoods and enclosures.
7) All supplied field equipment operates over an ambient temperature range of: -10°C to 70°C.
8) The equipment layout shall be such that when mechanical work is performed, no C&I equipment shall be damaged.
9) The supplied field equipment provided shall be standardised to the maximum extent possible.
10) The Contractor as part of the scope of work provides a detailed design report prior to execution of the works during the detail scope freeze as stipulated on the VDSS.
11) All the documents required to be submitted by the contractor during the design freeze shall be supplied as part of design data pack.
12) All the missing information on Appendix B must be populated by the contractor.
13) The detail design report shall be in line with Eskom detail design report template (240-499107707).
14) All field equipment installations is required to comply with field instrument installation Standards, 240-563355754.

#### 3.2.3.2. Flow meters and level transmitters

- The Contractor shall identify the location of the new instruments.
- The chosen location shall ensure optimal performance of the new instruments.
- The installation shall allow for:
- Safe and easy access during maintenance and calibration
- Environmental conditions
- An instrument shall be labelled such that when it is removed the label shall still be visible on the plant.
- All supplied instruments shall have a built-in diagnostics that constantly monitor any alarm faults.
- All provided instruments shall be suited to fulfil the following functional requirements:
- Built-in local digital indication that can be programmed to indicate the range and the engineering units of the process.
- Indication for both instantaneous and totalised flow rates.
- A high turn down ratio so that the minimum possible different types of transmitters can be used for all the applications.

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- A minimum accuracy of span of 2.0%.
- A 4-20 mA output.
- A minimum drift-free period guarantee of 10 years.
- All supplied analogue field equipment must be HART devices.
- All installed instruments shall be wired to the appropriate junction box.

#### 3.2.3.3. Transmitter Racks

- The instrumentation transmitters, where applicable, shall be mounted on suitable racks.
- Racks will provide adequate covering for protection against environment.
- The Contractor shall use existing rack where possible and supply racks where needed.
- All racks provided shall be durable, sturdy, suitable for the environment which they are installed and easily accessible.
- All racks provided shall be suitable be durable, sturdy, suitable for the environment in which they are installed and easily accessible.
- If angle iron is used for local indication racks, a minimum wall thickness of 3mm is required.
- Where local indication cannot be mounted on rack, the Contractor shall obtain clearance from the Employer regarding alternative installation.

#### 3.2.3.4. Power Supply

- The Contractor shall supply 24 VDC power supplies.
- The Contractor shall supply a single power supply for all field equipment terminated at a specific junction box.
- The 24 VDC power supply shall make use of a redundant 220 VAC supply.
- Where required, the Contractor shall make use of the available 220 VAC supply, available at the specified junction box.
- The Contractor shall earth the newly installed 24 VDC power supplies and provide surge and lighting protection.
- The 24 VDC power supply will make use of the 220 VAC power supply available at each junction box.

#### 3.2.3.5. Programmable Logic Controller (PLC)

- The Contractor is responsible for the design, supply, installation, commissioning and verification of the PLC.
- The contractor is required to meet the following minimum requirements:

  a) All works performed on the PLC is done by an OEM authorised service provider.



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b) The PLC must be modular, and rack mounted. The cubicle for the storage of the PLC will be provided for in the existing pump station room at the PCD dams.

c) The PLC must be compatible with the Alstom Alspa series 6 distributed control system (DCS).

d) The PLC must have 24 VDC power supply requirements.

e) The PLC must allow for the incorporation of approximately 54 signals. All Analog and binary cards necessary for this must be supplied and installed by the Contractor.

f) The PLC must have the ability to have a 0-300ms module scan rate. The faster scan rate allows the calculations that need to be performed to be current.

g) The PLC must have fast processing capability and cycle time. The PLC is required to perform simple addition calculations of totalised stream flow values to determine the water balance.

h) The Contractor designs, implement and commissions all instrumentation interfaced to the PLC at Medupi Power Station PCD pump house.

i) The Contractor identifies and terminates all signal cables in the nearest junction box.

j) The Contractor ensures that all signals interfaced on the PLC are also available on the HMI, Plant Historian and are archived on both the PLC and the Historian for trending and future analysis purposes.

k) The Contractor shall design, implement, and commission all instruments signals into the PLC, HMI and Plant Historian with regards to instantaneous values, Month to date totalised, year to date totalised values and alarms statuses.

l) The Contractor should provide training with regards to the PLC covering the following topics:

   a) Fault diagnostic

   b) Troubleshooting

m) Factory Acceptance Test (FAT) and Site Acceptance Tests (SAT) shall be carried out in accordance with IEC 62381, Automation Systems – FAT, SAT and SIT

n) Commissioning and Loop checks shall be carried out in accordance with IEC 62382, Electrical and Instrumentation Loop check.

o) The Contractor as part of the scope of work provided a detailed design report prior to execution of the works during the detail design scope freeze.

### 3.2.3.6. Human Machine Interface Graphic Requirements

- The Contractor is responsible for the configuration/ updating of the current existing common plant HMI graphics. The HMI graphics are to display indications for both instantaneous and totalised flow rates with the following units' measurements:



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a. Instantaneous flow – cubic meters per hour (m3/h)

b. Totaliser – cubic meter (m3)

The Contractor standardises the HMI to display the same units of measurements as above on all the streams measured.

- The Contractor ensures that the following alarms are configured on the PLC:

a. Communication Signal loss alarm

b. Zero flow alarm

All alarms shall be configured on the HMI in accordance with Eskom Standards following standards:

c. 240-57859210 – Alarms Systems performance of Control systems applied in Fossil Plant Standard.

d. 240-5635546 – Alarm Management System Guideline.

### 3.2.4 Electrical Requirements

3.2.4.1 Description of Electrical Scope of Work

- The Contractor shall design, install and commission the distribution box to supply the system and provide COC.
- The Contractor shall design, procure, install and commission all earthing and lightning protection required for the system. The earthing installation needs to be connected to the main earth mat of the station.
- The Contractor shall determine the design (selection, sizing, routing, and racking), install and commission all cabling and racking installation required for the system. The Contractor shall provide termination and racking schedule. The Employer shall provide a template.
- The Contractor shall design, install and commission the lighting circuit and supply of all lighting and small power required.
- The Contractor shall select, procure, install and commission any motors required to drive pumps for the system.
- The Contractor shall select, procure, install and commission any variable speed drives required to control motor speed for the system.

3.2.4.2 Compliance of electrical standards

The Contractor shall comply to the following electrical standards for execution of the electrical works, or any international standard stipulated:

- The electrical designs, manufacturing, construction and installations are done in accordance with SANS 10142-1 (The wiring of premises part 1: Low voltage installation).



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- Earthing and lightning protection is done in accordance with the Earthing and Lightning Protection Standard (240-56356396).
- Standards applicable electrical Motors installed in a Power Station are to be applied (Storage, transportation and procurement of motors 240-56360387, 240-56361435 and 240-57617975).
- The cable selection and routing are done in accordance with the cabling and racking standard (200-11768).
- The LV bucket will be procured and installed according to the LV Control Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard (240-56227516).
- The lighting and small power to be installed as per 240-55714363 Eskom Generation Power Station Lighting and Small Power Installation Standard.
- The medium voltage reticulation general information and requirements for overhead lines up to 33kv standard

3.2.4.3 General requirements for Electrical Works

- All electrical works shall comply with the requirements as per applicable Eskom standards, Templates and Work Instructions provided in this document.
- Where discrepancy exists between the requirements in this section and the Eskom standards, the Contractor shall raise a technical query for clarification. Develop quality control documentation and submit to the Project manager for review and acceptance before construction or procurement of all equipment.
- Unless otherwise specified, all electrical equipment necessary for the safe and efficient working of this plant shall be provided by the Contractor in terms of this Specification and the requirements as specified in relevant standards. This includes all electrical and auxiliary equipment as is necessary for the proper operation of the plant.
- All Electrical equipment and Steel structure (where applicable) shall be earthed. For earth cables, Kwena anti-theft earthing cable are preferred.
- All electrical equipment selected for the classified areas must comply with the area classification requirements and Eskom Hazardous Locations Standard (240-56536505). The design must cater for minimising the electrical equipment in hazardous zones by locating this equipment in less hazardous zones.
- Templates to be utilized.
  - 240-77302094 Electrical Termination Schedule Template
  - 240-56176097 Electrical Cable Schedule Template
  - 240-77100923 New LV Motor Technical Schedule AB Template
  - 240-56227927 Electrical Load List Template

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## 3.3 Configuration Management Requirements

### 3.3.1 Configuration Management Plan

The *Contractor* shall prepare a configuration management (CM) plan utilizing ISO 10007 as a reference guide for the scope of work. The CM plan shall include the following:

- A complete and comprehensive description of the *Contractor's* document numbering conventions and revision schema;
- A description of the electronic data management system(s) that the *Contractor* will use for the management of documents and/or configuration items;
- A description of the configuration management activities which will be undertaken by the *Contractor* as well as a rough time-scale thereof;
- A description of the baselines that will be established and the content of these baselines;
- The release procedure for product configuration information;
- The procedure for the control of changes prior to the establishment of baselines as well as after.
- The method for processing changes, emanating both internally and from sub-suppliers;
- The method for collecting, recording, processing and maintaining the data necessary for producing configuration status accounting records;
- The definition of the content and format for all configuration status accounting reports;
- A list of audits which will be conducted to ensure adherence to the CM plan.

### 3.3.2 Plant Designation

#### 3.3.2.1 Plant Designation System

The *Contractor* shall apply the Kraftwerk-Kennzeichensystem (KKS) codification system to uniquely identify the systems, sub-systems and components constituting the Plant.

The *Contractor* shall identify all plant indicated or referenced by documentation by the plant's unique KKS codes within the documentation itself.

The *Contractor* shall ensure that the codification assigned to plant is consistently maintained throughout the design cycle, e.g. the KKS codes indicated in the O&M manuals are consistent with the KKS codes indicated in the original process and instrumentation diagram.

The Employer shall supply the *Contractor* with a system-level plant breakdown structure (PBS) of the existing plant at the Site, as well as a preliminary system-level plant breakdown structure of the plant within the *Contractor's* scope at contract initiation. The *Contractor* shall review the PBS to ensure alignment with the *Contractor's* design philosophy, and shall expand the PBS to the complete system level (Fn level of the KKS hierarchy). The *Contractor* shall provide a complete system-level PBS with the submission of the process flow diagrams of the plant within the Contractor's scope.

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The *Contractor* shall codify all equipment, and any components which are required to be codified as per the guidelines and standards referenced in this document. The *Contractor* shall indicate equipment and component codification in drawings and documents indicating or referencing such plant.

The *Contractor* shall submit all KKS codes designated by the *Contractor*, with the documents in which they were originally designated, to the Employer for review. The *Contractor* will remain responsible for ensuring that the codes designated are unique and meet the requirements established by the various standards applicable to the Project. Where any ambiguities or doubts with regards to KKS codification exist, the *Contractor* will engage the Employer for resolution.

#### 3.3.2.2 Plant Labelling

The *Contractor* shall manufacture and install labels according to the new installed system. Labels shall be manufactured and installed according to the Employer's Plant Labelling Standard 240-71432150. The labelling standard shall be supplied as part of the enquiry documents. Contractor shall provide a label sample to be inspected and provided prior to bulk manufacturing of labels.

Any abbreviations to plant descriptions shall be prepared in accordance to the Employer's abbreviation standard.

Detailed nameplate or label lists with the service legends and including the KKS Code shall be prepared by the Contractor and submitted to the Employer for review and comment before commencing the manufacture of the labels. On plant areas where labels do not make ergonomically sense please consult site configuration management for guidance.

#### 3.3.2.3 Plant Designation within Documentation

The Contractor shall prepare a list of KKS designations allocated to components for each scope of delivery or system (this list shall be referred to as equipment list in the rest of this document for simplicity's sake, but includes documents such as cable schedules, valve schedules, etc.). The equipment list shall be submitted with the original implementation documentation describing the design of the system (e.g. process and instrumentation diagram, single line diagram, etc.). The *Contractor* shall ensure that the equipment list accurately represents the implementation documentation which it accompanies. The content of the lists will be agreed to per discipline with the Employer. As a minimum, the equipment list shall include:

- The KKS designation of all components within the relevant scope or system.
- The full verbal description of each component, compiled according to the standards referenced in this document.
- The abbreviated description of each component, utilising abbreviations as listed in the referenced project abbreviation list and abbreviated to several characters as required by the project digital control system (DCS) and as per the label requirements in Eskom Label specification.

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- The review and acceptance status of each component, in alignment with the list of approval statuses specified for document.

### 3.3.3 Document Submission

All documents shall be submitted to the Eskom Documentation Centre. The language of all documentation is required to be in English. The Contractor shall submit the Vendor Document Submission Schedule (VDSS) as per agreed dates to the Eskom Documentation Centre and to the Project Manager. Eskom shall pre-allocate document numbers on the VDSS and send back to the Contractor. The VDSS is revisable, and changes shall be discussed and agreed upon by all parties and properly documented. Changes in the VDSS include additional documentation to be submitted; changes in submission dates; corrections in documentation descriptions and document numbers; etc. The Vendor Document Submission Schedule (VDSS) shall indicate the format of documents to be submitted. Eskom shall be responsible for the management of the schedule i.e., to create a document register that shall be used to track submission progress of documentation by the Contractor as per the committed dates on the VDSS

### 3.3.4 Transmittal

The *Contractor* shall list all project documents (soft copies and hard copies) for submittal on the transmittal with the following metadata fields:

- Title of the document
- Document Unique Identification number
- Revision number
- Name of Discipline
- Reason for issuing/submission
- Sender's detail
- Sent date
- Recipient's Details
- Date received
- Quantity of documentation referenced on the transmittal
- Number of copies
- Format/medium submitted (e.g.: paper, DVD, etc.)
- Sender signature
- Recipient signature, once submitted, to acknowledge receipt

### 3.3.5 Email Subject

The email subject shall as a minimum have the following:

**(Project Name_Discipline_Subject)**

The *Contractor* shall submit documentation to the Eskom Representative as well as the Project's Documentation Centre in the following media:

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- Electronic copies shall be submitted to Eskom Documentation Centre through a pre-defined email address. Electronic copies too large for email shall be delivered on USB/Hard drives, large file transfer protocol and/or hard drives to the Project Documentation Centre. A notification email, with the transmittal note attached, shall be sent to the project generic email address. The Representative shall be copied on the email as well.
- Hard copies shall be submitted to the Eskom Representative accompanied by the Transmittal Note.
- The format of the final documentation handover shall be specified in the Vendor Document Submittal Schedule.

### 3.3.6 Documentation Requirements

- All documents supplied by the *Contractor* shall be subject to Eskom's approval. Documents such as QCP's, Method Statements and other documents impacting the work shall be approved by the *Employer* at least 3 working days prior to commencement of the Works.

- Each revision of a document or drawing shall be 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 shall be recorded in a revision table contained on/in each drawing/document.

- Documents and drawings shall indicate the Employer's drawing number as allocated by the Employer. The Contractor may have his own internal document or drawing number on the document or drawing, but where reference is made among documents or drawings, the Employer's number shall be used.

- The Contractor shall compile a complete data book for all work done during manufacturing, construction and commissioning containing the following as a minimum if applicable:

1. Scope of work
2. Commissioning procedure
3. Performance testing procedure
4. Functional test procedure
5. Approved "As built" drawings (P&ID's, isometric drawings, GA's, Detail design drawings)
6. Design calculations
7. Approved QCP / ITP's (each separate section shall have its own ITP's with a section for system engineer, Quality and construction sign)
8. Inspection reports
9. Pipe ovality reports if applicable
10. Design Changes, RFI, RFD, FCN, ECN
11. Material summary that gives full traceability between components used, drawings and material certificates

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12. All material certificates for pipes, fittings and all components used.
13. Pressure test certificate and the calibration certificates of the gauges used.
14. Pressure test procedures
15. The manufacturer's/repairer's certificate as defined in PER.
16. Flushing procedure
17. All CAR's and corrective actions
18. Operating Philosophy including
19. Training Manual
20. Parts catalogue
21. Maintenance manual
22. Storage, packing and transportation instructions
23. Equipment list
24. HAZOP Reports if applicable
25. HAZLOC if applicable
26. FMECA and RAM studies if applicable
27. Hydraulic Analysis Calculations
28. Process and Flow Diagrams (P&ID's)
29. General Arrangement Drawings,
30. Isometric Drawings
31. As Build Surveyed Drawings, showing the installed lines
32. MDL

### 3.3.7 Documentation

For consistency it is important that all documents used within the project follow the same layout, style and formatting standard therefore the *Contractor* shall ensure that the Document and Record Management Procedure is used for any documentation requirements.

### 3.3.8 General Requirement

The *Contractor* shall include the *Employer*'s drawing number in the drawing title block. This requirement only applies to design drawings developed by the *Contractor* and his Subcontractors. It shall not apply to drawings developed by manufacturers for equipment and material such as valves, instruments, etc. Drawing numbers shall be assigned by the Employer as drawings are developed.

The project name shall be listed on all drawings, including manufacturers' drawings. A separate sheet may be attached to the submittal if needed to adequately list all tag numbers associated with the drawings such as valves or instruments which may have numerous tag numbers associated with

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it. The language of all documentation shall be in the English language. The units of measure shall be metric.

The *Contractor* retains project designs and information and provides these to the *Employer* at any time notwithstanding the expiry or termination of the contract.

### 3.3.9 Engineering Change Management

All Design change management shall be performed in accordance to the latest revision of the Eskom Project Change Management Procedure and the Employer shall ensure that the Contractor is provided with latest revisions of this procedure. Any uncertainty regarding this procedure shall be clarified with the Employer, and clarification updates should be reflected in updated versions of this procedure. All design reviews will be conducted according to the Design Review Procedure (240-53113685).

## 3.4 As-built drawings, operating and maintenance manual schedules

The contractor shall

- Grant the Employer an irrevocable, nonexclusive, royalty-free licence to utilize any intellectual property to the extent necessary for the operation, maintenance, repair or alteration to any works certified or that of the third party.
- Supply Operating and Maintenance Manuals for all new equipment supplied as part of the works.

## 3.5 Environmental Management

1. All activities listed in the National Environmental Act 107 of 1998, EIA Regulations as amended, must have environmental authorisation before commencement of work.
2. The Contractor shall comply with all applicable legal and other requirements.
3. The polluter pays principle will be applied.
4. The contractor manager shall ensure compliance with Eskom Medupi Environmental procedures to ensure the prevention of pollution. The minimum of which is 32-726 SHE Requirements for Eskom Commercial Process

## 3.6 Quality Management and Documentation Control

1. The Contractor shall utilise the Employer's quality documentation management system and processes.
2. All Quality References and Standards as stipulated in this document will be adhered to.

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3. The Contractor to ensure that all measuring and test equipment are calibrated at all times with valid calibration certificates must be readily available
4. The Contractor shall develop Quality Control Plans (QCPs) and ensure that such are approved by Engineering prior to any work execution. The principle of "no QCP, no work shall apply". All intervention points such as witness, hold and inspection points shall be strictly adhered to. Any Eskom intervention point waived by Eskom shall be in writing.
5. The Contractor shall include as a minimum the following activities and interventions on Inspection and Test Plans (ITP):

- Approval of ITP – hold point for Contractor, Quality and Engineer and Construction
- Approval of construction drawings – hold point for Contractor and Engineer
- Approval of method statements – hold point for Contractor and Engineer
- Approval of excavation permits – hold point for Contractor and Engineer
- Confirmation of the Permit to Work (refer to 36-681 Generation Plant Safety Regulations) – hold point for Contractor and Supervisor
- Approval of pipes – hold point for Contractor and Engineer
- Approval of concrete mix design – hold point for Contractor and Engineer
- Setting out – hold point for Contractor and Engineer
- Excavation of pipe trenches to specified alignment, grade and depth – hold point for Contractor and witness point for Engineer
- Inspection of trench bottom – hold point for Contractor and Engineer
- Cure concrete in accordance with Medupi Structural Concrete Specification 084CIVL053, prior to backfilling alongside and over thrust blocks – hold point for Contractor and Engineer
- Submit 28-day concrete cube strength results – hold point for Contractor and Engineer
- Conduct specified pressure test – hold point for Contractor and Engineer
- NCR closed – hold point for Contractor and Engineer
- Data Book review – hold point for Contractor and Engineer
- Punch list – hold point for Contractor and Engineer
- Final inspection – hold point for Contractor and Engineer
- Hand-over – hold point for Contractor and Engineer

  The above requirements are generic. Actual QCP's will be dictated by site conditions e.g. if groundwater seepage is encountered, the installation of sub-soil drainage may be in order and where shallow pipes need to traverse roads concrete sleeves and/or concrete encasement may be required.

6. The QCP shall be signed progressively by the Engineer/Supervisor, Eskom QC Inspector, Contractor QC Inspector and/or AIA.

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7. The Contractor will be required to provide method statements for executing various tasks in conjunction with the QCPs.
8. Data books, reviews, reports and diagrams/drawings shall be submitted to Engineering after the completion of respective work.
9. QCP's to be submitted to Engineering and Quality for approval prior to project work commencement.
10. Work will only be conducted with an Employer approved Quality Management Programme.
11. The Contractor will ensure that the required OEM specifications and standards are met.
12. The Contractor is subjected to quality auditing at any point in time during the life of the contract.
13. Drawings shall be for the full ownership of Eskom and must be supplied in hardcopy format and softcopy (including CAD).

### 3.7 Spares provisions

1. The Contractor shall bring any specialised tools required for the execution of all associated maintenance activities on this system.

### 3.8 Management of goods

1. The Contractor will be responsible for the safe and legal removal, testing and transportation of goods and equipment on and off site. Disposal of any equipment must be approved by Eskom Environment Management prior to such action.
2. Motors shall be transported as per document 240-56361435 Transport of Power Station Electric Motors Standard.

### 3.9 Management and Reporting

1. Liaison meetings shall be held with the Employer's Representative or his/her delegate on a weekly basis to discuss progress any technical details, or concerns.

### 3.10 Housekeeping

a) The Contractor shall be responsible for clearing up any mess, debris, spills from the execution actions and that which come about from maintenance activities resultant from the Contractor's own actions. This shall be in accordance with 3.5.

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### 3.11 Guarantee of Services

1. The Contractor shall guarantee his workmanship and materials for a minimum period of five (5) year following the completion of the project. All supplied and installed spares shall carry the same guarantee as the services mentioned above.
2. If requirement 1 above cannot be met, the Contractor shall provide, in writing, reasons as to why this cannot be achieved.

### 3.12 Commissioning

1. The Contractor shall prepare commission procedures.
2. The contractor shall compile commissioning reports following the commissioning.
3. Commissioning procedures shall comply with document 240-56356376: On-Site Commissioning for Low Pressure Systems Standard and provided before any cold or hot commissioning proceeds.
4. The contractor shall provide a technical performance report after commissioning.

### 3.13 Technical Tender Returnable

Tender returnable will be as outlined in 241-2022882 Tender Technical Evaluation Strategy for Installation of PCD pumps on all dams EC 26027224.

## 4. Acceptance

This document has been seen and accepted by:

| Name | Designation |
|---|---|
| Derrick Chauke | C&I Engineering Manager (Acting) |
| Ivy Mosese | Electrical Engineer LDE |
| Justice Mphahlele | Project Manager |
| Lerato Ntuli | Project Coordinator |
| Lerato Sehume | C&I Maintenance Manager |
| Letago Manyelo | C&I LDE |
| Mokgadi Dikgale | Environmental Management Manager |
| Moses Nonyane | Manager Contracts Management |
| Ntsikie Nani | Water Treatment Plant Manager |
| Phethego Thankge | Civil Engineer LDE |
| Prince Twala | Electrical Maintenance Manager (Acting) |
| Royce Cole | Project Coordinator |
| Thambo Shiba | Configuration Management |

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| Name | Designation |
|---|---|
| Tshepo Sethosa | Auxiliary Plant Maintenance Manager |

## 5. Revisions

| Date | Rev. | Compiler | Remarks |
|---|---|---|---|
| June 2025 | 3 | Mufarisi Manyuha | Additional details on technical specification for Civil Engineering, Electrical Engineering, Mechanical Engineering, Configuration Management and Control and Instrumentation Engineering |
| June 2024 | 2 | Katlego Mathibedi | Final revision after second round of comments including Project Execution, Civil Engineering, Electrical Engineering and Maintenance |
| | 1 | Katlego Mathibedi | Final revision after comments |

## 6. Development Team

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

- Phethego Thankge
- Ivy Mosese
- Thambo Shiba
- Letago Manyelo

## 7. Acknowledgements

Katlego Mathibedi

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