	<b>Technical Specification</b>	<b>Technology</b>
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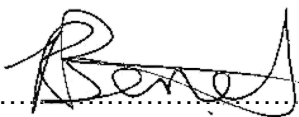
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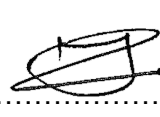
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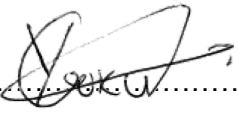
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## **1 INTRODUCTION**

The existing leakage detection sumps at the Ash Dump Dirty Dam (ADDD) were overflowing due to inadequate design capacity and no pumping system being installed to pump water back into the ADDD. This would result in dirty water contaminating the environment. The Raw Water Reservoir (RWR) had no leakage detection sumps installed.

The solutions to be implemented at both the ADDD and RWR aim to make maximum use of the existing infrastructure whilst providing a system that will minimise the risk of further spillages from the existing leakage detection systems into the environment.

## **2 SUPPORTING CLAUSES**

### **2.1 SCOPE**

#### **2.1.1 Purpose**

The purpose of this document is to define the Works required on all stated structures and systems.

#### **2.1.2 Applicability**

This document is applicable to Kusile Power Station.

### **2.2 NORMATIVE/INFORMATIVE REFERENCES**

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

#### **2.2.1 Normative**

- [1]. ISO 9001 Quality Management Systems.
- [2]. All work shall be conducted in accordance with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) as amended.
- [3]. AB-Z-Z- All work shall be conducted in accordance with the requirements of the Occupational Health and Safety Act (Act AN-0001: Kusile User Requirement Specification, Rev 0.
- [4]. 203-770: Kusile Power Station Specification for Structural Concrete, Rev 4
- [5]. SANS 1200 Series: Standardised Specification For Civil Engineering Construction
- [6]. SANS 10142-1: The wiring of premises. Part 1: Low-voltage installations.
- [7]. ESKASAAA3 Approval of Personnel Performing Quality Related Special Processes on all Eskom Plant.
- [8]. ESKPVAAD0 The Approval of NDT Personnel Employed on Eskom Plant.
- [9]. GGS 0462 Eskom Quality Requirement.
- [10]. NWS 1058 Safety at Construction Sites.
- [11]. OHSACT Occupational Health and Safety Act, 85 of 1993.
- [12]. Construction Regulations, 2014

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- [13]. PA/270/003 Safety Guide for Contractors.
- [14]. PS/031/001 Scaffolding Erection, Use and Inspection Standard Process.
- [15]. SABS ISO 9000 I-III SERIES Code of Practice for Quality Systems (as Amended).
- [16]. OPR 3305 (rev 3) Eskom Plant Safety Regulations.
- [17]. Inspection Manual for Civil Works At Eskom's Power Stations
- [18]. Specification for submersible Sump Pumps (Appendix – A)

### 2.2.2 Informative

- [19]. 32-727 Safety, Health, Environment and Quality (SHEQ) Policy/Procedure
- [20]. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations
- [21]. AASTHO Series: American Associates of State Highways and Transport Officials

## 2.3 DEFINITIONS

**Table 1: Table of Definitions**

Definition	Description
Contractor	Service provider contracted to provide a specific service to Eskom, Kusile Power Station.
Employer	Eskom, or Eskom Kusile Power Station or representative
Engineer	A registered Professional Engineer or a registered Professional Engineering Technologist specialising in and having experience in the design of civil works or structures
Lifting Station	A lift station is used to pump raw/process water from a lower elevation location to one on a higher location when the gradient of the area does not allow for gravity flow

## 2.4 ABBREVIATIONS

**Table 2: Abbreviations**

Abbreviation	Explanation
ADDD	Ash Dump Dirty Dam
BMS	Building management System
C&I	Control and instrumentation
CoE	Centre of Excellence
CoC	Certificate of Completion
DCS	Distributed Control System
KET	Kusile Execution Team
LCP	Local Control Panel
LV	Low Voltage

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<b>Abbreviation</b>	<b>Explanation</b>
OHSA	Occupational health and Safety Act
PFC	Potential Free Contact
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
QMS	Quality Management System
RWR	Raw Water Reservoir
SABS	South African Bureau of Standards
SANS	South African National Standards
SHE	Safety Health and Environmental
SOW	Scope of Work

## **2.5 ROLES AND RESPONSIBILITIES**

### **2.5.1 Employer requirements are:**

- The Employer requires the Contractor to provide personnel with appropriate and suitable skills to perform the work.
- The Employer requires that the works are performed within budget and agreed time schedule.
- The Employer requires the Contractor to adopt and comply with the Kusile environmental plan.
- The Employer requires the Contractor to adopt and comply with the Kusile safety and safety plan.
- The Employer requires the Contractor to adopt and comply with the Kusile quality plan.
- The Employer requires the Contractor to adopt and comply with the Kusile emergency preparedness procedure
- The Employer requires the Contractor to adopt and comply with the Kusile traffic management plan
- The Employer requires the Contractor adopt and comply with the Kusile access control procedure
- The Employer requires the Contractor to adopt and comply with the Kusile vehicle access control procedure
- The Employer requires the Contractor to adopt and comply with the Kusile security operating plan
- The Employer requires the Contractor to adopt and comply with the Kusile security action plan

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## **2.5.2 Contractor**

### **2.5.2.1 Safety, Health and Environmental Matters**

The *Contractor* ensures:

- Compliance with all requirements of the Occupational Health and Safety Act no 85 of 1993 and its regulations so as to ensure the health and safety of persons carrying out the *Works*.
- All employees are medically, physical and psychologically fit to enter the drainage structures.
- All employees undergo the relevant training as per their function requirement
- Compliance with Eskom's SHE policy, procedures, standards, guidelines, specifications and site regulations. Employees shall have a valid medical certificate of fitness specific to the work to be performed
- Employees are informed of hazards identified in the risk assessment before commencement of *Works*
- The emergency rescue plan is communicated to personnel undertaking the *Works*
- All safety and health related incidents around site or working areas and threats that pose a danger to one's life or health are immediately reported
- Sufficient health and safety information as well as resources are made available
- All employees undergo safety induction training on-site
- Full PPE is worn at all times before undertaking works. The provision of PPE shall be the responsibility of the *Contractor*.

### **2.5.2.2 Works**

The *Contractor* ensures the following:

- Personnel to conduct the works are competent and shall have received the necessary training to carry out the Works. The Personnel shall undergo the following training:
  - a. Confined space training
  - b. Working at heights training
- Resources and tools required by personnel for executing Works are provided. Equipment shall be certified in accordance with all relevant regulatory standards. These shall be inspected on a daily basis before use or as and when required.
- Employees are supervised. Full responsibility and accountability shall be taken to ensure that all employees are competent and aware of all requirements needed to execute Works safely
- Inspections are performed upon completion of Works
- Works activities are planned, organized and managed
- Adequate precaution is taken to prevent damage to drainage structures
- Quality control is performed on all Works or activities
- Before commencement of any Works, a risk assessment is performed to identify all risks and hazards to which persons may be exposed to.
- Works shall be halted during heavy rain, where manholes and piping are flooded and when the necessary tests inside the manhole are not conducted

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## **2.6 PROCESS FOR MONITORING**

Not applicable.

## **2.7 RELATED/SUPPORTING DOCUMENTS**

Not applicable.

# **3 ENGINEERING AND CONTRACTOR'S DESIGN**

## **3.1 DESCRIPTION OF WORKS/ WORKS INFORMATION**

The sections to follow contain the details of the *Works* required to be completed by the *Contractor*. The *Contractor* provides all equipment, materials, consumables, and services required to complete the work as specified herein. The scope of this project includes, but is not limited to, the following:

### **3.1.1 LPS Design and Installation**

#### **3.1.1.1 Boundary of Scope of Work at ADDD and RWR**

Defined below are the boundaries of this instruction or the applicable systems that are to be considered

- Lifting Station and pumping system Installation
- Lifting Station and pumping system pumps supply and install with duct foot and guide rails
- Installation of ADDD recirculation piping from pump house to ADDD
- Controls and Instrumentation Design and Installation
- Electrical supply, local control panels and cabling

The Works under these specifications shall include:

Furnish all construction materials and services for the execution of the Works under this contract unless otherwise specified.

Onsite transportation and temporary laydown of equipment and materials

Design, furnish, and erect all temporary and permanent structural steel and lifting lugs required for piping and equipment erection.

All temporary works shall be removed from site upon work completion

Furnish, fabricate, clean, coat, erect, and test all Contractor-furnished piping

Design drawings including piping drawings and design lists will be provided by the Employer for piping sizes 50 mm and larger.

Fabrication drawings for piping, pipe supports, pipe racks, etc. shall be provided by the Contractor.

Contractor required to field route and design supports for piping sizes 50 mm and smaller unless otherwise indicated

Wherever the word " LATER " or "LTR" is referenced in the engineers drawings, the scope associated with the references shall be construed as falling within the boundary of this scope of work.

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Contractor's scope includes the following components:

- All pumps, duct feet and guide rails
- Electrical panels and cabling
- Control and Instrumentation
- All piping
- Pipe supports and hangers
- Flanges and fittings
- Piping accessories
- Valves
- Supplemental support steel
- Supplemental sleeper support steel
- Nuts, bolts, and gaskets
- Coating, pipe wrapping, and galvanizing
- Supply all fit-up bolts, gaskets, welding electrodes, welding rod, backing rings and other fasteners for attachment of or joining of equipment and materials.
- Supply, install and remove all temporary guying, bracing, rigging, attachments, and supports.
- Survey and lay out the work from the Employer's or Project Field Manager's designated control points.
- Furnish and install equipment base expansion and epoxy anchors.
- All welding materials and consumables required for attachment of equipment, piping, or structural steel furnished under these specifications
- Construction consumables
- Supply, surface preparation and application of painting and galvanizing in accordance to DCS 100 of all Contractor-furnished piping and structural shall be in accordance with Eskom Standard SSZ\_45-17 Corrosion Protection of Medupi Power Station Corrosion Protection Specification
- Attendance at coordination meetings at the site at a time selected by the Engineer to discuss matters relative to the execution of this contract.
- Restoration of Contractor damage to the site.
- Wall and floor penetrations for Contractor furnished piping
- Pressure test all piping installed under this Contract as specified in the attached drawing lists.

Table 3: Scope of Work Items

<b>ADDD</b>	<b>RWR</b>
<ul style="list-style-type: none"><li>• Procure and install a Lifting Station and discharge piping from pump back to dam compartments design and Installation in compliance with appendix A - Submersible Sump Pumps</li><li>• Installation of ADDD recirculation piping from pump house to ADDD</li></ul>	<ul style="list-style-type: none"><li>• Procure and install a pumping system, tank and suction/discharge piping from tank to pump back to dam compartments</li><li>• Design and Installation in compliance with appendix A -Submersible Sump Pumps</li></ul>
Electrical Design and Installation	Electrical Design and Installation
C&I design and installation	C&I design and installation
Additional Works	Additional Works

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### 3.1.1.2 Lifting/Pumping Station Installation

Lifting/ pumping stations are required to be procured and installed at the following locations:

- i) At RWR a Pumping station in - Tank 1 and Tank 2
- ii) At ADDD a lifting station – Sump 1A and Sump 2A

See Process and instrumentation diagram P146838-0GME-M2646W

Table 4. Lifting stations

<b>ADDD</b>
A lifting station is to be installed in the additional leakage detection sumps and fitted with two pumps, duct feet and guide rails, piping and lift-out station as per the engineer and client specifications in accordance with Appendix A and drawing 146838-0GME-M1642L and 46838-0GME-M1642M.  The discharge pipe shall be individually routed to both reservoirs as per engineers drawings 146838-0UXC- S3300, 146838-0UXC- S3387, 146838-0GME-M4646EJ and 146838-0GME-M4646EI. See figure 1.
Piping connection of the pump lift-out system to the discharge piping that shall be routed back to the reservoirs including adequate pipe supports or supporting structures. Piping configurations shall be in accordance to drawing 146838-0GME-M1642L and 46838-0GME-M1642M

Table 5 Pumping stations

<b>RWR</b>
A pumping station is to be installed at the location indicated on drawing 146838-0GME-M1642J and 46838-0GME-M164K and fitted with two pumps, piping and valves per the engineers specifications in accordance with Appendix A and drawing 146838-0GME-M1642J and 46838-0GME-M164K
Connection of pump system to discharge piping that shall be routed back to the reservoirs including adequate pipe supports or supporting structures. The discharge pipes shall be individually routed the corresponding reservoirs as per engineers drawing 146838-0UXC- S3300, 146838-0UXC-S3393, 146838-0UXC-S3397, 146838-0GME-M4646EM and 146838-0GME-M4646EL

### 3.1.1.3 Lifting/Pumping Station Pumps

Table 6 Lifting station pump details

<b>ADDD</b>
Two pumps (one for operation and the other as redundancy) per lifting station, complete with fittings, mounting details as per manufacturers specifications and control panel for automatic operation based on level indication are to be complete with duct feet and guide rails are to be procured and installed, according to the engineer's specifications ( <i>Specification for submersible Sump Pumps</i> ), for

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use at the following lifting stations:

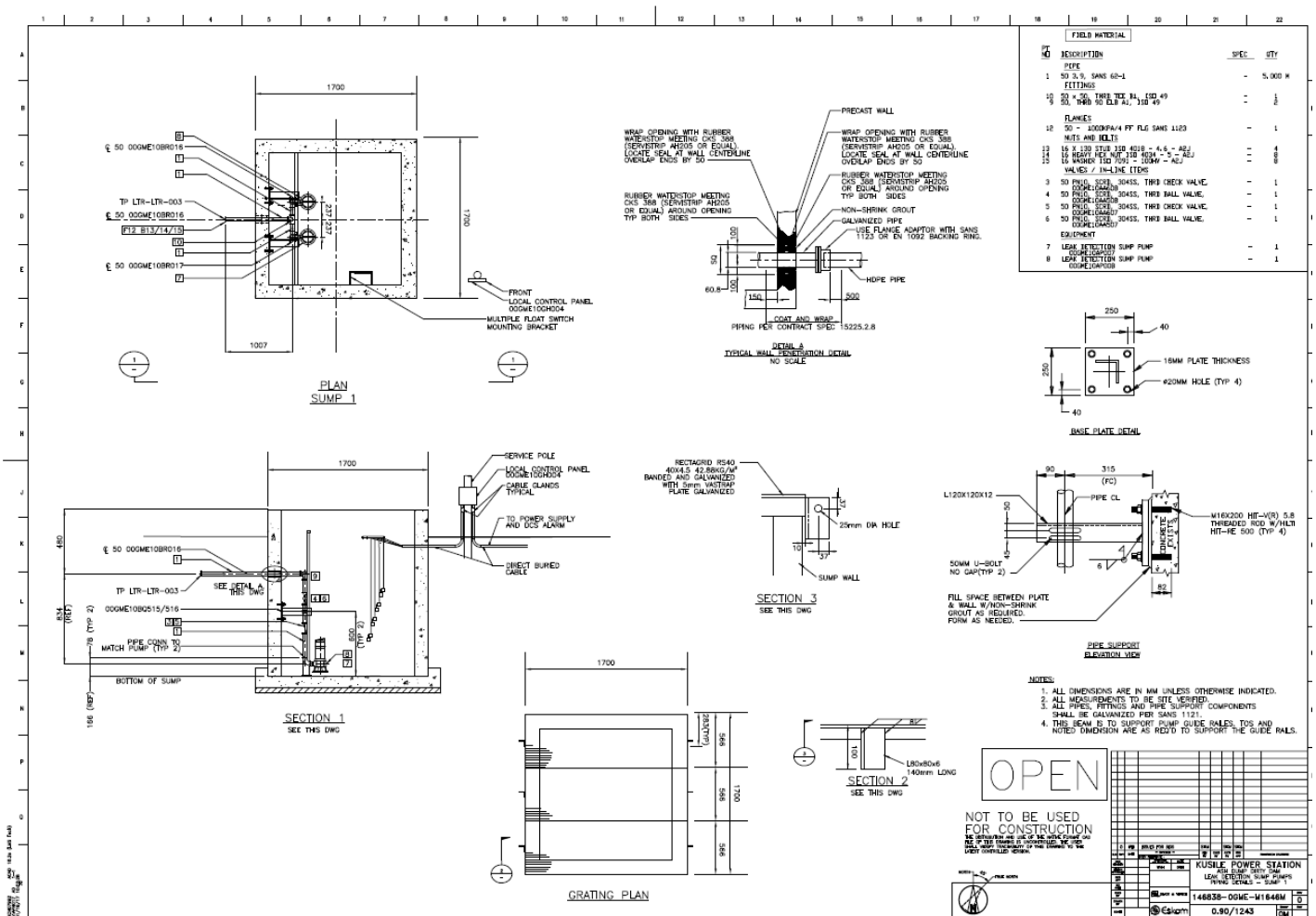
- i) At ADDD – Sump 1A and Sump 2A

Each pump is to be fitted with:

- i) Automatic float level switches for the pump start and stop. The Pump control panel will not be able to send signals to the control room but have local audible alarm function only in case of unforeseen circumstances – such as a possible overflow of water in the lifting stations caused by the pump malfunction.

See Drawing 146838-OGME-M1642L and 46838-OGME-M1642M for reference.

Figure 1 ADDD Lift Station details (Drawing M1642L and M1642M)



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**Table 7 Pumping Station Pump Details**

<b>RWR</b>
Two pumps (one for operation and the other as redundancy) , complete with fittings, mounting details as per manufacturers specifications and control panel for automatic operation based on level indication are to be procured and installed, according to the engineer's specifications ( <i>Specification for Centrifugal Pumps</i> ), for use at the following lifting stations: i) At RWR - Sump 1 and Sump 2
Each pump is to be fitted with: i) Automatic level switches for the pump start and stop. It is also recommended that the Pump control panel will not be able to send signals to the control room but have local audible alarm only in case of unforeseen circumstances – such as a possible overflow of water in the lifting stations caused by the pump malfunction. See Drawing 146838-0GME-M1642J and 46838-0GME-M164K for reference.

### **3.2 RECIRCULATION LINE INSTALLATION AT ADDD**

This scope includes the supply and installation of the recirculation piping for the ash dump dust suppression system to replace the current defective system that has been abandoned.

This consists of the above grade piping starting at the tie-in with the existing recirculation piping and then runs to the existing discharge pipe on plinths situated on the dam wall. Where indicated on the isometric, pipe shall be direct buried piping wrapped with Petrolatum impregnated cloth corrosion prevention tape.

The scope is defined as per drawings in addition to the articles listed in this document:

- P146838- 0UXC-S5480 –pipe pedestals at the Ash Dump Pump House
- P146838-0UXC-S9480D –rebar details for pedestals
- P146838-0UXC-S5459 - plan view of the pedestal location for the piping
- P146838-0UXC-S3387-R11 pipeline routing as per cross hatched section

The general piping layout schematics will be as per drawing P146838-0ETN-M4662-4Q Model and P146838-0ETN-M4662-4L Model.

The piping shall conform to the specifications shown on P146838-0UZX-M0104-Rev.04 - Pipeline - 72.0202 in addition to the articles listed in this document.

The detailed Piping isometrics, routing and scope are defined as per the following drawings listed in table 8.

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**Table 8 ADDD Recirculation drawings**

P146838-0ETN-M2662C	System P&ID
P146838-0ETN-M2662D	System P&ID
P146838-0ETN-M4662UA	Detailed Isometric
P146838-0ETN-M4662UB	Detailed Isometric
P146838-0ETN-M4662UC	Detailed Isometric
P146838-0ETN-M4662UD	Detailed Isometric
P146838-0ETN-M4662UE	Detailed Isometric
P146838-0ETN-M4662UF	Detailed Isometric
P146838-0ETN-M4662UG	Detailed Isometric
P146838-0ETN-M4662UH	Detailed Isometric
P146838-0ETN-M4662UI	Detailed Isometric
P146838-0ETN-M4662UJ	Detailed Isometric
P146838-0ETN-M4662UK	Detailed Isometric
P146838-0ETN-M4662UL	Detailed Isometric
0ETN-M6662-24 (0.90/55722-24)	Hanger List

### 3.2.1.1 Mechanical Design

#### 3.2.1.1.1 Design Options

The mechanical design was largely dependent on the sump and flows during normal operation as well as peak flows, designated as Action Leak Rate (ALR). Thus, the system needed to adequately address the expected peak flows and also be suitably sized for normal operations.

The medium to be pumped is water. The flow velocity cannot be too high, leading to high pipe frictional losses and resulting in a high pump head which leads to high absorbed power, nor too low which will result in large initial capital costs for procurement of equipment.

##### 3.2.1.1.1.1 Ash Dump Dirty Dam (ADDD)

The existing two sumps at the ash dump dirty dam are small and were designed for temporary use during construction. These sumps will be repurposed for permanent catchments and submersible pumps will be installed with a small lift out station and duct foot.

The ALR for ADD reservoir is 2713l/hr. Due to the fact that the ADDD contains process effluent; it cannot not be discharged to the environment as this will result in an environmental contravention.

Two 100-percent rated parallel pumps, each sized for double the ALR of ADDD reservoir are to be installed in each sump to ensure prevention of spilling to the environment.

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#### **3.2.1.1.1.2 Raw Water Dam (RWR)**

There are no existing sumps for the RWR, and two 10000l storage tank will be installed for capturing the leakage flows from each of the two RWR cells.

The ALR for RWR reservoir cells is 3460l/hr. Due to the fact that the RWR contains raw water; it can spill to the environment without risk of an environmental contravention.

Two 100-percent rated parallel submersible pumps, each sized for ALR of each reservoir cell are to be installed for each reservoir that is fed from one of the storage tanks. The pumps are located on a pumping plinth inside the KPC fence about 70m from the storage tank to mitigate risk to the pumps. The two pumps, one duty pump and one standby pump connect to one main discharge header. The two pumps will inherently be over-sized for the normal sump inflows and consequently the discharge piping will be unnecessarily larger to cater for the ALR.

#### **3.2.1.1.2 System Description**

##### **3.2.1.1.2.1 System Identification**

System Name	ADD and RWR Leakage Detection Sumps
KKS Code	GME

##### **3.2.1.1.2.2 Function**

The system pumps water from the leakage detection catchments back to the reservoirs

##### **3.2.1.1.2.3 Process Description**

Refer to the 0.90/1243 –Piping and Instrument Diagrams Leakage Detection Sumps.

There are two leak detection sumps located near the Ash Dump Dirty Dams, and two storage tanks located near the Raw Water Reservoirs. The function of these sumps/tanks is to capture any leakage from the dams and return the water back to the dams. The process of pumping the water from the sumps/tanks back to the dams is, under normal circumstances, an automatic operation but the pumps can be manually started from the local control starter panel if the automatic operation fails.

##### **3.2.1.1.2.4 Pump Systems**

The system includes the following major equipment and components:

- Four (4) 100 percent RWR centrifugal pumps
- 1 additional Storage tank (10m3 Storage Capacity)
- Four (4) 100 percent ADDD submersible pumps
- Dedicated Controls Pump Controller
- Associated piping, valves, instruments, controls, and accessories

The ADDD sump level is monitored using a float level sensor. The RWR tanks levels is monitored using a float switch sensor. The signal from the level sensor is sent to the controller to start and stop the sump pump.

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#### **3.2.1.1.2.5 Design Basis**

The design pumping velocity is adequate to keep the pump head as low as possible and retain the piping sizing as small as possible. Normal operation is with one pump running and one pump on standby. However, both pumps can be operated in parallel at the same time to provide an increase in pumping capacity. This will be permitted through automatic operation when level Hi-Hi is reached with one pump already in operation.

All discharge piping will be below grade as far as possible. A lifting station with a duct foot will be installed for the submersible pumps connecting the pump discharge to the discharge piping so that the pumps can be removed from the sumps via hoist/chains without disconnecting the discharge piping. A check isolation valve is installed on the discharge piping of each sump pump.

#### **3.2.1.1.2.6 System operation**

Two sump pumps are installed in each sump or for each storage tank and are provided with a level control system which automatically starts and stops the pumps as water levels in the sumps change. The control system uses ON-OFF selector switches for each pump. In the ON mode, the level controls start the first pump on increasing level. The second pump starts if the level continues to increase. The level controls stop the pumps as each respective level switch is reset. The level control switches operate the pumps as follows:

Low Level- turns respective pump off. High level- turns 1st pump on.

High-high level- turns 2nd pump on and activates an audible alarm.

High-High-High level- activates an audible alarm.

Indicating lights on the local control starter panel are provided for each pump's running status (red for pump running and green for pump stopped) and control power available (amber). Trouble is also annunciated locally by a beacon-style indicating lamp, audible alarm with silence pushbutton, and a white lamp on the front of the panel

The pumps are selected to be capable of conveying the water at the design velocity with one pump operating. The total head required for the sump pumps is determined by the piping and frictions losses and the elevation differences between the sump location and top of the reservoir. Should additional flow be required, two pumps can be simultaneously operated in parallel to achieve an increased flow operation as permitted by the pump Controller.

The Local comptroller panel (No DCS interface) will be used to control pump operation (Start/Stop) based on sump level monitored by a level sensor.

Each pump basin level is monitored using a level sensor device that is a float switch. The signal from the sensor is sent to start and stop the sump pump. The controls are designed to equalize operating time on the two pumps by alternating which pump runs for each operation cycle. Local control station located at the sumps allows operators to send pump start and stop requests and emergency stop commands.

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#### ADD Sump Operation:

The total pump sump depth is 1.15 meters. On sump high level (0.85m), the start signal is sent to the sump pump selected for primary duty. If the primary pump fails to start, trips, or if the sump level reaches a high-high level (1 m), the secondary pump starts.

When the sump level recedes to low level (0.15 m), a stop signal is sent to the operating sump pump(s).

#### RWR Storage Tank Operation:

The total storage tanks depth is 3 meters. On sump high level (2.5m), the start signal is sent to the sump pump selected for primary duty. If the primary pump fails to start, trips, or if the sump level reaches a high-high level (2.8 m), the secondary pump starts.

When the sump level recedes to low level (0.25 m), a stop signal is sent to the operating sump pump(s).

#### **3.2.1.1.2.7 Pipe Routing**

##### ADDD:

Below grade piping required for the pump discharge will be routed below grade from the existing sumps to the corresponding reservoir. The below grade piping will be High Density Polyethylene (HDPE) up to the sump wall after which it will connect to carbon piping which will be routed through the sump wall and connect to the lift out station piping which will be of galvanized carbon steel.

Ball valves and non-return valves will be installed on the pump discharge.

##### RWR:

Below grade piping required for the pump discharge will be routed below grade from the new pump plinth to the corresponding reservoir. The below grade piping will be High Density Polyethylene (HDPE) up to the pump plinth after which it will surface and continue to connect to the pumps. The pump suction lines from the Storage tanks will be routed to the pumps and will be High Density Polyethylene (HDPE) . Ball valves and non-return valves will be installed on the pump discharge. Pipe sections crossing road servitudes shall be sleeved inside SANS 719 heavy wall pipe coated hot dip galvanized per CPS 100 in Eskom Corrosion Standard.

#### **3.2.1.2 General Requirements**

All works shall comply with Section 8 unless otherwise noted

##### **1.1.1.1 Piping**

Above grade piping is hot dip galvanized per CPS 100 in Eskom Corrosion Standard, medium wall SANS 719 or SANS 62 carbon steel. All piping above grade is supported by pipe supports.

All below grade piping will be HDPE piping and will comply with SANS 4427

The pipe will be supported of the sump wall of the lifting station sump walls per engineers drawing. Supports shall be either shop or field fabricated at the discretion of the Contractor

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Buried piping will be installed with Class B bedding in accordance with drawing 146838-0GUA-S3152  
Flanges shall be in accordance with SANS 1123  
Screwed fittings shall comply with ISO49 as per engineering's drawings.

Carbon steel bolting shall be used for joining all other flanges, including slip-on flanges

U-bolts shall be comply to ANSI/MSS SP-58 (Type 24)

Piping once installed, shall be subjected to a hydrostatic test. Applied test pressure shall be 1.5 times the maximum permissible operating pressure of the process fluid for steel piping and 1.25 times the maximum permissible operating pressure of the process fluid for HDPE piping. The pressure shall be applied with water or process liquid at a temperature not less than 16deg Celsius and shall be held for 30 minutes.

The contractor shall supply all equipment and fitting necessary to complete the test

### **1.1.1.2 Valves**

The valves shall be guaranteed for safe and reliable operation at high velocities and at operating pressures and temperatures up to the maximum pressure-temperature ratings of the valves. All valves shall provide tight shutoff over a range of differential pressures up to the maximum pressure rating coincident with operating temperatures and up to the maximum temperature rating of the valve. Steel valves 50 mm and smaller shall have forged steel bodies  
Valves 50mm and smaller will be lever operated.

Valves shall have Locking devices that allow the valve to be locked in either the open or closed position by use of a chain and standard padlock.

Butterfly valves shall have rubber or metal seats in the valve body and 17-4 pH or 18-8 or Type 316 stainless steel shafts and shall be equipped with position indicators. Seating surfaces on the disks shall be hardened, ground, and polished. Rubber seats shall be a synthetic rubber that does not contain polyisoprene. The rubber seats shall be one of the following types of construction:

For flanged type valves, a reinforced rubber ring retained by the mating pipe flange.

The body material and seat material shall be as specified on the Control Valve Specification Sheets.

#### **1.1.1.2.1 Steel valves**

All steel valves shall be ball valve type.

All ball valves shall have full area ports, teflon seats and seals, and chrome plated carbon steel or stainless steel balls. Valves shall open in the counter-clock wise direction. The valves shall not require lubrication. Operating wrenches shall be provided on each valve

Valves shall comply with SANS 1056

Valves smaller than 50mm shall be of stainless Steel 304 or 304L and materials to conform to ASTM A182 Grade F304 or ASME SA182 Grade F304

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### **1.1.1.2.2 Bronze Gate, Globe, Angle, and Check Valves**

Unless otherwise indicated in the Valve List, bronze valves shall have braze joint or compression fitting type end connections when used in copper piping or copper tubing systems, and shall have threaded end connections when used in steel piping systems.

Check Valves will comply with SANS 1551

Ball Valves will comply with SANS 1056-3

### **3.2.2 Civil and Structural Scope**

The Contractor constructs all civil works as detailed in the drawings. This includes, but is not limited to, the following:

- Excavation of area required to construct concrete plinth as per DRG. 146838-OGME-M1646H Rev 1;
- Rip & Recompact soil under the footprints of the proposed concrete plinths as per the drawings;
- Mesh reinforced concrete plinths and double brick walls as detailed on DRG. 146838-OGME-M1646H Rev 1;
- Galvanised steel heavy duty security cage per pump as indicated on DRG. 146838-OGME-M1646H Rev 1. Each cage must be secured to the concrete plinth below and incorporates hinges and locks as indicated on the drawings for maintenance access;
- Galvanised steel heavy duty grid over existing two leakage detection sumps at ADDD. The grids should be secured to the concrete sumps and includes hinges and locks as indicated on the drawings for maintenance access;
- The Contractor reinstates any road crossings to their original condition where excavations for pipe or cable placement are required.

The Contractor designs and constructs concrete footings and galvanised steel supports for the electrical local control/starter panels at both the ADDD and RWR. All designs are reviewed and accepted by the Employer prior to the start of construction.

#### **3.2.2.1 Structural steelwork**

##### **3.2.2.1.1 List of applicable standards**

All references to standard/codes/publications are to be the latest issue of each, together with the latest additions and/or amendments thereto, as of the date of contract, unless otherwise indicated. Standards referenced within the following standards are also adhered to. This list is not all-inclusive and does not relieve the Contractor from complying with all applicable codes.

**Table 9: List of applicable standards for structural steelwork**

<b>Code</b>	<b>Description</b>
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 455	Covered electrodes for manual arc welding of carbon steels
SANS 517	Light Steel Frame Building
SANS 657	Steel tubes for non-pressure purposes

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<b>Code</b>	<b>Description</b>
SANS 679	Zinc chromate primers for steel
SANS 681	Undercoats for paints
SANS 684	Structural steel paint
SANS 1273	Fasteners for roof and wall coverings in the form of sheeting
SANS 1465	Steel castings for general engineering applications
SANS 1700	Fasteners
SANS 1921-3	Construction and management requirements for works contracts, Part 3: Structural steelwork
SANS 2001-CS1	Construction works Part CS1 : Structural steelwork
SANS 3834	Quality requirements or fusion welding of metallic materials
SANS 4042	Fasteners – Electroplated coatings
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10085	The design, erection, use and inspection of access scaffolding
SANS 10094	The use of high-strength friction grip bolts
SANS 10104	Hand railing and balustrading (safety aspects)
SANS 10120	Code of practice for use with standardised specifications for civil engineering construction and contract documents
SANS 10143	Building drawing practice
SANS 10155	Accuracy in buildings
SANS 10160	Basis of structural design and actions for buildings and industrial structures
SANS 10162	The structural use of steel
SANS 10177	Fire testing of materials, components and elements used in buildings
SANS 10237	Roof and side cladding
SANS 10400	The application of the National Building Regulations
SANS 10684	Fasteners – Hot dip galvanised coatings
SANS 14399	High strength structural bolting assemblies for preloading
SANS 14713	Protection against corrosion of iron and steel in structures – zinc and aluminium coatings – guidelines (ISO 14713)
SANS 15609	Specification and qualification of welding procedures for metallic materials – welding procedure specification
SANS 15614	Specification and qualification of welding procedures for metallic materials – welding procedure test
SANS 16961	Petroleum, petrochemical and natural gas industries – Internal coating and lining of steel storage tanks
SANS 23279	Non-destruction
SANS 50025	Hot rolled products of structural steels
SANS 50028	Flat products made of steels for pressure purposes
SANS 50219	Cold formed welded structural hollow sections of non-alloy and fine grain steels Part 1 – Technical delivery
EN 10210-1	Hot finished structural hollow sections of non-alloy and fine grain steels –

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Code	Description
	Part 1: Technical delivery requirements
EN 10210-2	Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 2: Tolerances, dimensions and sectional properties
ANSI/AWS A5.1/A5.1M	Specification for carbon steel electrodes for shielded metal arc welding
ANSI/AWS A5.17/A5.17M	Specification for carbon steel electrodes and fluxes for submerged arc welding
ANSI/AWS A5.18/A5.18M	Specification for carbon steel electrodes and rods for gas shielded arc welding
ANSI/AWS A5.20	Specification for carbon steel electrodes for flux cored arc welding
ASTM A 6/A 6Mb	Standard specification for general requirements for rolled structural steel bars, plates, shapes and sheet piling
ANSI/AWS D1.1/D1.1M	Structural welding code – steel
BS 4-1	Structural steel sections – Part 1: Specification for hot-rolled sections
DIN 1026-1	Hot rolled steel channels – Part 1: Taper flange steel channels - dimensions, masses and sectional properties
EN 10024	Hot rolled taper flange I sections – Tolerances on shape and dimensions
EN 10025-2	Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels
EN 10034	Structural steel I and H sections – Tolerances on shape and dimensions
EN 10056-2	Structural steel equal and unequal leg angles – Part 2: Tolerances on shape and dimensions
ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and reparation grades of uncoated steel substrates and of steel substrates after overall removal of precious coatings

### 3.2.2.1.2 Specification data associated with SANS 2001 CS1 – Structural steelwork

All steel materials supplied and erection of the steelwork complies with the requirements of the latest issue of SANS 2001 – CS1.

All steel elements are marked to be traceable to a specific cast or trace of steel.

**Table 10: Specification data associated with SANS 2001 CS1 – Structural steelwork**

Clause/No	Specification Data
<b>Essential data</b>	
<b>4.1</b>	<b>Materials</b>
4.1.1	"All structural steelwork is manufactured using grade S355JR steel."
4.1.5	Structural fasteners are of the following grades and types: "All structural bolts and holding down bolts are of class 8.8 and nuts are of class 8, unless otherwise specified on the <i>Employer's</i> drawings."
<b>4.2</b>	<b>Drawings</b>

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Clause/No	Specification Data
4.2.1.3	The format of drawings are as follows: “All drawings prepared by the <i>Contractor</i> are issued to the <i>Project Manager</i> in the form of two paper prints that are signed off in ink, one electronic printable document in “PDF” format that contains a digital signature in accordance with the <i>Employer’s</i> Documents and Records Management Procedure (32-6) and one editable softcopy in Native Format (.dgn or .dwg)”.
4.2.4.2	Attachments to facilitate erections do not remain as part of the permanent structure.
4.2.4.4	Hole sizes for holding-down bolts in excess of 36mm diameter are as per the <i>Employer’s</i> drawings. The <i>Contractor</i> requests clarification in writing from the <i>Project Manager</i> if this information is not available on the <i>Employer’s</i> drawings.
4.2.4.7	Connections to allow movement are as per the <i>Employer’s</i> drawings.
4.2.4.8	The requirement for machining is as per the <i>Employer’s</i> design.
<b>4.3</b>	<b>Workmanship (General)</b>
4.3.1.1	All steel elements are marked to be traceable to a specific cast or heat of steel.
<b>4.4</b>	<b>Workmanship (Welding)</b>
4.4.4.3	Tack welds are not to be incorporated into the final welds.
<b>4.5</b>	<b>Workmanship (Bolting)</b>
4.5.1.3	The maximum protrusion beyond the nut is not less than 3mm, but not greater than 5mm.
4.5.1.4	Washers under nuts and bolt heads on flat surfaces are required.
<b>5.3</b>	<b>Non-Destructive testing of welds (Welding)</b>
5.3.4	Ultrasonic or radiographic examination is required for all complete joint penetration welds.
5.3.5	The requirements for non-destructive tests are as follows: <ul style="list-style-type: none"> <li>“50% of all fillet welds are tested with either dye-penetration (DPI) or Magnetic Particle Inspection (MPI). The testing positions for DPI and MPI are indicated by the <i>Supervisor</i>. All welds that fail the test are repaired. The scope of the welds to be tested is increased to 100% of the welds for the case where any welds fail the test.”</li> <li>100% of all complete joint penetration welds are tested both with DPI or MPI and by Ultrasonic examination.”</li> </ul>
<b>Variations</b>	
CS1.V.1	Clause 4.2.4.2 and 4.4.4.5: All attachments to facilitate erection are removed and holes are closed up after erection.
CS1.V.2	Clause 4.4.4.3: All tack welds are removed before welding, tack welds are not to be incorporated into the final welds.
<b>Additional clauses</b>	

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Clause/No	Specification Data
CS1.A.1	Add the following to clause 4.1.1:  “In the event of specified steel not being available, the <i>Contractor</i> notifies the <i>Project Manager</i> in writing. The use of an alternative steel grade is subject to the acceptance of the <i>Project Manager</i> .”
CS1.A.2	Add the following to clause 4.1.2:  The chemical composition and mechanical properties of all steel incorporated into structures is stated in the mill test certificates and submitted to the <i>Project Manager</i> for acceptance.  Where required and prior to fabrication, test certificates or cast analysis certificates, or both, pertaining to the steel to be used, are supplied to the <i>Supervisor</i> by the <i>Contractor</i> .
CS1.A.3	The following clause is added to 4.2.4:  “Fabrication drawings are prepared by the <i>Contractor</i> . The drawings are issued to the <i>Project Manager</i> for acceptance in the form of two paper prints and in “PDF” electronic format and in Native Format (dgn or dwg). The <i>Contractor</i> does not commence with fabrication until written acceptance from the <i>Project Manager</i> is received.”
CS1.A.4	Add the following to clause 4.3:  “The <i>Project Manager</i> is informed of the necessity for repair or rectification work before any attempt is made to carry out such repair. Approval is obtained from the <i>Project Manager</i> prior to commencement of the work.”
CS1.A.5	Add the following to clause 4.3:  “All waterproofing is to be in accordance with SANS 10021.”
CS1.A.6	Add the following to clause 4.3:  “All gutters and down pipes are provided to ensure free water flow away from the <i>works</i> .”
CS1.A.7	Add the following to clause 4.3:  “Handling and lifting plant have sufficient capacity to ensure that steelwork is placed in its final position without distortion or undue stressing of members.”
CS1.A.8	Add the following to clause 4.3:  “Except where otherwise authorised in writing by the <i>Supervisor</i> , the <i>Contractor</i> ensures that the work is carried out strictly in accordance with the relevant drawings supplied to the <i>Contractor</i> by the <i>Project manager</i> or supplied by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .”
CS1.A.9	Add the following to clause 4.3:  “Steel sections are provided as specified on the relevant drawings except that substitution by larger sections is permitted with the <i>Project Manager</i> ’s prior acceptance. Where the <i>Contractor</i> wishes to make a substitution, he states his reasons and alternative proposals in writing.”
CS1.A.10	Add the following to clause 4.3:  “Splices:  <ul style="list-style-type: none"> <li>All splices in platework are complete joint penetration welds as required to</li> </ul>

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Clause/No	Specification Data
	<p>maintain the full strength of the plate.</p> <ul style="list-style-type: none"> <li>When a beam is required to be spliced, the <i>Contractor</i> obtains acceptance from the <i>Employer</i> with regard to the location of the splice and the welding procedure to be used.</li> </ul> <p>Visual inspections of the root pass and final welds are required for splice welds.”</p>
CS1.A.11	<p>Add the following to clause 4.3:</p> <p>“Tolerances:</p> <ul style="list-style-type: none"> <li>Tolerances for overall dimensions (length, width, height, etc.) are 3mm unless otherwise specified by the drawing.</li> <li>Tolerances for door locations are +/- 9mm.</li> <li>Tolerances for stiffener, channels, angles and bars are +/- 3mm non-accumulative, unless noted of the drawing.</li> <li>Tolerances for attachments such as supports, plates and pipes are located within 3mm of the required drawing location.</li> <li>The centre line of a bolt hole is aligned within 1.5mm of the drawing dimension.</li> <li>Bolt hole spacing is 3mm (non-accumulative) and 6mm (overall) of the drawing dimension.</li> <li>Bolt hole diameter is within 2mm of the drawing dimension.</li> <li>Special tolerances are shown on the <i>Employer’s</i> drawings and take precedence.</li> </ul> <p>Unless otherwise specified by the drawing, tolerances for all overall dimensions (length, width, height, etc.) are within 3mm.”</p>
CS1.A.12	<p>Add the following to clause 4.3.6:</p> <p>“Flame cutting of holes is not permitted.”</p>
CS1.A.13	<p>Add the following to clause 4.3.7:</p> <p>“Structures, composite units and bolted assemblies that comprise component parts are not subjected to excessive stresses during the assembly, fabrication, or erection process.”</p>
CS1.A.14	<p>Add the following to clause 4.3.8:</p> <p>“Any necessary straightening or forming is carried out by methods that neither weaken nor deface the material.”</p>
CS1.A.15	<p>Add the following to clause 4.4:</p> <p>“Arc strikes outside the area of permanent welds are to be avoided on any base material. Cracks or other damage caused by arc strikes are ground to a smooth contour.”</p>
CS1.A.16	<p>Add the following to clause 4.4:</p> <p>“All weld joints in areas to be covered by stiffeners are to be ground flush after welding and prior to installation of stiffeners.”</p>

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Clause/No	Specification Data
CS1.A.17	Add the following to clause 4.4.1: “All complete joint penetration welds have complete penetration and wherever practicable are welded from both sides. The backs of the first run are suitably gouged out.”
CS1.A.18	Add the following to clause 4.4.1: “The <i>Project Manager</i> may instruct the <i>Contractor</i> to replace any welding equipment which is unsuitable or unsatisfactory for the service in which it is being used.”
CS1.A.19	Add the following to clause 4.4.3: “The <i>Contractor</i> submits for acceptance full details of his proposed welding procedures and the provisions of AWS apply to the acceptance thereof. Acceptance of the welding procedures does not relieve the <i>Contractor</i> of his responsibility for correct welding and for the minimising of distortion in the finished structure.”
CS1.A.20	Add the following to clause 4.4.3: All welding procedures covering all forms of weld in the contract are in accordance with <i>Employer's</i> standard 240-106628253 and are submitted to the <i>Project Manager</i> and the Appointed Inspection Authority (AIA) for acceptance. Electrodes are selected, by the <i>Contractor</i> , to be suitable for the welding application to be used. The <i>Contractor</i> adheres to the following <i>Employer</i> standards where applicable; <ul style="list-style-type: none"> <li>• 240-106628253: Standard for Welding Requirements on Eskom Plant</li> </ul>
CS1.A.21	Add the following to clause 4.4.6: “Welds showing any planar defects such as cracks, lack of fusion or penetration and excessive slag inclusions or porosity are cut out and rewelded. Under-cutting is not permitted.”
CS1.A.22	Add the following to clause 4.4.6: “Weld repairs are made to the same procedure as for the original weld. All tests are repeated after the repair has been completed and reports on radiographic and ultrasonic tests are marked to indicate that the report refers to a repaired weld.”
CS1.A.23	Add the following to clause 5.2: “The <i>Contractor</i> submits properly documented evidence of the qualification of the welders to the <i>Project Manager</i> and the AIA for acceptance. The <i>Project Manager</i> reserves the right of testing the welder according to the welder's qualification. Welder qualifications are in accordance with <i>Employer's</i> standard 240-56241933.” “The welders are qualified on Site under conditions simulating the conditions in the plant prior to any change in welding procedures, materials and prior to employment.”

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Clause/No	Specification Data
CS1.A.24	Add the following to clause 5.2: “Welders hold the relevant current welders qualification certificates.”
CS1.A.25	Add the following to clause 5.2: “All welders' tests are witnessed and/or accepted by the <i>Project Manager</i> before the welder or operator is permitted to work. The decision of the <i>Project Manager</i> regarding the acceptability of any test or existing qualification is final. Evidence of previous qualification tests are accepted solely at the discretion of the <i>Project Manager</i> .”
CS1.A.26	Add the following to clause 5.2: “Records showing the date and results of the qualification tests performed by each welder and weld operator together with the identification number assigned to him is at all times available for scrutiny by the <i>Project Manager</i> .”
CS1.A.27	Add the following to clause 5.2: “Each qualified welder and weld operator are assigned a unique identifying number. This number is marked on the work in indelible crayon to establish the extent of welds performed by the welder to whom it is assigned. Any welder or weld operator whose work is subject to multiple rejections will be required to undergo a re-qualification test on the appropriate weld procedure. At the discretion of the <i>Project Manager</i> any welder or weld operator failing a re-qualification test may be disqualified from any further welding on the <i>works</i> .”
CS1.A.28	Add the following to clause 5.3.2: “Visual examination of all welds check at minimum that: <ul style="list-style-type: none"> <li>there are no uneven leg lengths and there is no cracking or unacceptable undercutting or porosity, and</li> <li>full fusion is being achieved while welding is in progress.”</li> </ul>

### 3.2.2.1.3 Specification data associated with SANS 1921-3: Structural steelwork

Clause/No	Specification Data
<b>Essential data</b>	
4.1.1(b)	<i>Contractor</i> is to provide all labour, material, plant, equipment, scaffolding and tools.
4.2.1	The responsibility strategy assigned to the steelwork <i>Contractor</i> for the <i>works</i> is:  For the portion of the works design by the Employer the responsibility strategy is B, “Contractor provides fabrication drawings”  For the portion of the works design by the Contractor the responsibility strategy is C, “Design and build”

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Clause/No	Specification Data
4.2.2	<p>For the portion of the works design by the Employer, the steelwork structural engineer is the Employer</p> <p>For the portion of the works design by the Contractor, the steelwork structural engineer is the Contractor</p>
4.3.2.1	The site will be ready for steelwork to commence as stipulated in the Contract Data or as agreed with the <i>Project Manager</i> .
4.3.3.2	The <i>Contractor</i> is required to provide the <i>Supervisor</i> with a detailed method statement for the erection of each structure prior to commencing with the erection of the structure.
4.5.1.1	<p>Information, drawings and calculations provided to the <i>Contractor</i> will be provided, where applicable, in the following format via email or transmittal:</p> <ul style="list-style-type: none"> <li>• Drawings – pdf</li> <li>• Calculations – pdf</li> </ul>
4.5.1.2	<p>The <i>Contractor</i> is provide information in the following format:</p> <ul style="list-style-type: none"> <li>• Information – All information are provided in its native form, together with a pdf version.</li> <li>• Drawings – Drawings are submitted in an editable (not locked) native format (dgn), pdf (digitally signed) and the original hard copy signed in ink (A0).</li> <li>• Calculations – Calculations are provided in its native form (for example the Excel spreadsheet where the formulae for the calculations can be viewed), together with a signed pdf version.</li> </ul> <p>All information received to align with the requirements of the Eskom Drawing Standard (240-86973501), Smart Plant Take-On Strategy (240-107305502), Engineering Drawing Office and Engineering Documentation Standard (36-943) and Document and Management Procedure (32-6) as applicable.</p>
4.5.3.4	<p>The <i>Contractor</i> is required to submit the following additional information with general arrangement drawing to the <i>Employer</i> for acceptance:</p> <p>The Contractor submits the same documents as stated under 4.5.3.2</p>
4.5.3.6	<p>For the portion of the works designed by the Contractor, the <i>Contractor</i> is required to submit all <i>as-built drawings to the Employer for his acceptance</i>.</p> <p>For the portion of the works designed by the <i>Employer</i>, the <i>Contractor</i> submits marked up redlined drawings showing all deviations of the as-built plant to the <i>Employer's construction drawings to the Employer for his acceptance</i>.</p>
4.7.9	<p>The requirements for the provision and erection of sign boards are:</p> <ul style="list-style-type: none"> <li>• 240-103414344 Summary of Corporate Identity Manual</li> <li>• SANS 1186 Symbolic safety signs</li> <li>• SANS 23601 Safety identification - Escape and evacuation plan signs</li> </ul>
4.10.2	<p>The requirements for the protection, termination, diversion or maintenance of existing services are:</p> <ul style="list-style-type: none"> <li>• The <i>Contractor</i> may not affect existing services on Site without prior acceptance from the <i>Project Manager</i>.</li> </ul>
4.11.1	The specific health and safety requirements are as per the South African

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Clause/No	Specification Data
	Occupational Health and Safety Act No. 85 of 1993 and Eskom Safety, Health, Environment and Quality (SHEQ) Policy (32-727).
4.11.3	The <i>Contractor</i> is required to submit a report on the assessment and management of risk.
4.11.4	The <i>Contractor</i> is required to enclose steelwork for the protection of others in cases when exposed steelwork poses a safety risk.

### 3.2.2.2 Concrete works

#### 3.2.2.2.1 List of applicable standards

All references to standard/codes/publications are to be the latest issue of each, together with the latest additions and/or amendments thereto, as of the date of contract, unless otherwise indicated. This list is not all-inclusive and does not relieve the *Contractor* from complying with all applicable codes.

**Table 11: List of applicable standards for concrete works**

Code	Description
<b>Admixtures</b>	
SANS 50934-1	Admixtures of concrete, mortar and grout, Part 1, Common requirements
SANS 50934-2	Admixtures of concrete, mortar and grout, Part 2, Concrete admixtures: definitions, requirements, conformity, marking and labelling
SANS 50934-3	Admixtures for concrete, mortar and grout, Part 3, Admixtures for masonry mortar - definitions, requirements, conformity and marking and labelling
SANS 50934-4	Admixtures for concrete, mortar and grout, Part 4, Admixtures for grout for prestressing tendons - definitions, requirements, conformity, marking and labelling
SANS 50934-5	Admixtures for concrete, mortar and grout, Part 5, Admixtures for sprayed concrete - definitions, requirements, conformity, marking and labelling
SANS 50934-6	Admixtures for concrete, mortar and grout, Part 6, Sampling, conformity control and evaluation of conformity
<b>Aggregates</b>	
SANS 195	Sampling of aggregates
SANS 197	Preparation of Test Samples of Aggregates
SANS 201	Sieve Analysis, Fines Content and Dust Content of Aggregates
SANS 202	Chloride Content of Aggregates
SANS 794	Aggregates of low density
SANS 1083	Aggregates from natural sources – Aggregates for concrete
SANS 1090	Aggregates from natural sources - Fine aggregates for plaster and mortar
SANS 3001-AG1	Civil engineering test methods. Part AG1, Particle size analysis of aggregates by sieving
SANS 3001-AG2	Civil engineering test methods. Part AG2, Determination of the average least dimension of aggregates by direct measurement

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<b>Code</b>	<b>Description</b>
SANS 3001-AG3	Civil engineering test methods. Part AG3, Determination of the average least dimension of aggregates by computation
SANS 3001-AG4	Civil engineering test methods. Part AG4, Determination of the flakiness index of coarse aggregate
SANS 3001-AG5	Civil engineering test methods. Part AG5, Sand equivalent value of fine aggregates
SANS 3001-G10	Civil engineering test methods. Part AG10, ACV (aggregate crushing value) and 10% FACT (fines aggregate crushing test) values of coarse aggregates
SANS 3001-G12	Civil engineering test methods. Part AG12, Soundness of aggregates (magnesium sulphate method)
SANS 3001-G13	Civil engineering test methods. Part AG13, Determination of the soundness of mudrock aggregates
SANS 3001-G14	Civil engineering test methods. Part AG14, Determination of the ethylene glycol durability index for rock
SANS 3001-G15	Civil engineering test methods. Part AG15, Determination of rock durability using 10% FACT (fines aggregate crushing test) values after soaking in ethylene glycol
SANS 3001-G16	Civil engineering test methods. Part AG16, Determination of the durability mill index values for aggregates
SANS 3001-G23	Civil engineering test methods. Part AG23, Particle and relative densities of aggregates
SANS 5831	Presence of chlorides in aggregates
SANS 5832	Organic impurities in fine aggregates (limit test)
SANS 5833	Detection of sugar in fine aggregates
SANS 5834	Soluble deleterious impurities in fine aggregates (limits test)
SANS 5835	Estimation of the effect of fine aggregates on the water requirement of concrete
SANS 5836	Effect of fine and coarse aggregate on the shrinkage and expansion of cement: aggregate mixes (mortar prism method)
SANS 5837	Low density materials content of aggregates
SANS 5838	Sand equivalent value of fine aggregates
SANS 5840	Shell content of fine aggregate
SANS 5841	Aggregate crushing value of coarse aggregates
SANS 5842	FACT value (10% fines aggregate crushing value) of coarse aggregates
SANS 5844	Particle and relative densities of aggregates
SANS 5845	Bulk densities and voids content of aggregates
SANS 5846	Abrasion resistance of coarse aggregates (Los Angeles machine method)
SANS 5847	Flakiness index of coarse aggregates
SANS 5848	Polished-stone value of aggregates
SANS 5849	Total water-soluble salts content of fines in aggregates
SANS 5850-1	Sulphates content of fines in aggregates. Part 1, Water-soluble sulphates in fines in aggregates
SANS 5850-2	Sulphates content of fines in aggregates. Part 2, Acid-soluble sulphates in fines in aggregates
SANS 5851	Liquid limit of fines in aggregates for base-courses

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<b>Code</b>	<b>Description</b>
SANS 5854	pH value of fines in aggregates for base-courses
SANS 5855	Free water content of aggregates
SANS 5856	Bulking of fine aggregates
SANS 6239	Aggregate impact value of coarse aggregate
SANS 6240	Electric conductivity of fine aggregate
SANS 6241	Particle size distribution of material of diameter smaller than 75 micron in fine aggregate (hydrometer method)
SANS 6242	Acid insolubility of aggregates
SANS 6243	Deleterious clay content of the fines in aggregate (methylene blue adsorption indicator test)
SANS 6244	Particles of diameter not exceeding 20micron and not exceeding 5micron and smaller, respectively, in fine aggregate (pipette method)
SANS 6245	Potential reactivity of aggregates with alkalis (accelerated mortar prism method)
SANS 6246	Treton impact value of aggregates
<b>Cementitious Materials</b>	
SANS 1745	Cementitious grouting capsules for use with tendon-based support systems
SANS 5748	Specific surface of cement
SANS 5754	Autoclave expansion of cement
SANS 6151	Free water content of Portland cementitious materials
SANS 6152	Available alkali content of cement extenders (complying with SANS 50197-1)
SANS 6154	Glass content of granulated metallurgical slag (transmitted-light microscopy method)
SANS 6155	Effect of extenders, used with cement, on the reduction of expansion caused by alkali-silica reaction (accelerated mortar prism method)
SANS 50196-1	Methods of testing cement. Part 1, Determination of strength
SANS 50196-2	Methods of testing cement. Part 2, Chemical analysis of cement
SANS 50196-3	Methods of testing cement. Part 3, Determination of setting times and soundness
SANS 50196-4	Methods of testing cement. Part 4, Quantitative determination of constituents
SANS 50196-5	Methods of testing cement. Part 5, Pozzolanicity test for pozzolanic cement
SANS 50196-6	Methods of testing cement. Part 6, Determination of fineness
SANS 50196-7	Methods of testing cement. Part 7, methods of taking and preparing samples of cement
SANS 50197-1	Cement. Part 1, Composition, specifications and conformity criteria for common cements
SANS 50197-2	Cement. Part 2. Conformity evaluation
SANS 50413-1	Masonry cement. Part 1, Composition, specifications and conformity criteria
SANS 50413-2	Masonry cement. Part 2, Test methods
SANS 50450-1	Fly ash for concrete. Part 1, Definition, specifications and conformity criteria
SANS 50450-2	Fly ash for concrete. Part 2, Conformity evaluation
SANS 50451-1	Method of testing fly ash. Part 1, Determination of free calcium oxide content
SANS 50451-2	Method of testing fly ash. Part 2, Determination of fineness by wet sieving

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<b>Code</b>	<b>Description</b>
SANS 53263-1	Silica fume for concrete. Part 1, Definitions, requirements and conformity criteria
SANS 53263-2	Silica fume for concrete. Part 2, Conformity evaluation
SANS 55167-1	Ground granulated blast furnace slag for use in concrete, mortar and grout. Part 1, Definitions, specifications and conformity criteria.
SANS 55167-2	Ground granulated blast furnace slag for use in concrete, mortar and grout. Part 2, conformity evaluation
<b>Concrete</b>	
SANS 878	Ready-mixed concrete
SANS 5860	Concrete tests - Dimensions, tolerances and uses of cast test specimens
SANS 5861-1	Concrete tests - Mixing fresh concrete in the laboratory
SANS 5861-2	Concrete tests -Sampling of freshly mixed concrete
SANS 5861-3	Concrete tests - Making and curing of test specimens
SANS 5862-1	Concrete tests - Consistence of freshly mixed concrete - slump test
SANS 5862-2	Concrete tests - Consistence of freshly mixed concrete - flow test
SANS 5862-3	Concrete tests - Consistence of freshly mixed concrete - vebe test
SANS 5862-4	Concrete tests - Consistence of freshly mixed concrete. Part 4, Compacting factor and compaction index
SANS 5863	Concrete tests - compressive strength of hardened concrete
SANS 5864	Concrete tests - flexural strength of hardened concrete
SANS 5865	Concrete tests - the drilling, preparation, and testing for compressive strength of cores taken from hardened concrete
SANS 6085	Concrete tests - initial drying shrinkage and wetting expansion of concrete
SANS 6250	Concrete tests - density of compacted freshly mixed concrete
SANS 6251	Concrete tests - density of hardened concrete
SANS 6252	Concrete tests - air content of freshly mixed concrete - pressure method
SANS 6253	Concrete tests - tensile splitting strength of concrete
SANS 6254	Mortar tests - initial drying shrinkage and wetting expansion of mortar
SANS 6255	Mortar tests - compressive strength of mortar
SANS 50206	Concrete – Specification, performance, production and conformity
<b>Design</b>	
SANS 993	Modular co-ordination in building
SANS 10100-1	The structural use of concrete. Part 1, Design
SANS 10160	Basis of structural design and actions for buildings and industrial structures.
<b>Construction</b>	
SANS 2001 CC1	Construction works: Part CC1: Concrete works (structural)
SANS 2001 CC2	Construction works: Part CC2: Concrete works (minor works)
SANS 10100-2	The structural use of concrete. Part 2, Materials and execution of work
SANS 10109-1	Concrete floors. Part 1, Bases to concrete floors
SANS 10109-2	Concrete floors. Part 2, Finishes to concrete floors
SANS 10155	Accuracy in buildings
SANS 53670	Execution of concrete structures

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<b>Code</b>	<b>Description</b>
SANS 55392	Sustainability in building construction: general principles
<b>Reinforcement</b>	
SANS 282	Bending dimensions and scheduling of steel reinforcement for concrete
SANS 920	Steel bars for concrete reinforcement
SANS 1024	Welded steel fabric for reinforcement of concrete
SANS 10144	Detailing of steel reinforcement for concrete
<b>Water</b>	
SANS 51008	Mixing of water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete
<b>Concrete and Related Products</b>	
SANS 266	Gypsum plasterboard
SANS 470	Concrete poles for telephone, power and lighting purposes
SANS 508	Concrete retaining blocks
SANS 541	Precast concrete paving slabs
SANS 676	Reinforced concrete pressure pipes
SANS 677	Concrete non-pressure pipes
SANS 685	Fibre-cement sheets (flat and profiled)
SANS 803	Fibre-cement boards
SANS 819	Fibre-cement pipes, couplings and fittings for sewerage, drainage and low-pressure irrigation
SANS 927	Precast concrete kerbs, edgings and channels
SANS 975	Prestressed concrete pipes
SANS 986	Precast reinforced concrete culverts
SANS 1058	Concrete paving blocks
SANS 1215	Concrete masonry units
SANS 1223	Fibre-cement pressure pipes and couplings
SANS 1294	Precast concrete manhole sections and components
SANS 1372	Prefabricated concrete components for fences
SANS 1504	Pre-stressed concrete lintels
SANS 1879	Precast concrete suspended slabs
SANS 1882	Polymer concrete surface boxes, manhole and inspection covers, gully gratings and frames
SANS 50771-3	Specification for masonry units. Part 3, Aggregate concrete masonry unite (dense and lightweight aggregates)
SANS 50771-4	Specification for masonry units. Part 4, Autoclaved aerated concrete masonry units
SANS 10904	Fibre-cement corrugated sheets and fittings for roofing and cladding
<b>Laboratory Practice and Equipment in General</b>	
SANS 1649	Non-automatic self-indicating, semi-self-indicating and non-self-indicating

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Code	Description
	weighing instruments with denominated verification scale intervals
SANS 2859-1	Sampling procedures for inspection by attributes. Part 1, Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
SANS 3310-1	Test sieves - technical requirements and testing. Part 1, Test sieves of metal wire cloth
SANS 3310-2	Test sieves - Technical requirements and testing. Part 2, Test sieves of perforated metal plate
SANS 6150	Verification of compression testing machines for concrete: calibration of load scale
SANS 10378	General requirements for the competence of verification laboratories
SANS 17025	General requirements for the competence of testing and calibration laboratories
<b>Other Standards</b>	
SANS 53584	Products and systems for the protection and repair of concrete structures – Test methods – Determination of creep in compression for repair products
SANS 1200 G	Standardized specification for civil engineering construction Section G: Concrete (structural)

### 3.2.2.2.2 Specification data associated with SANS 2001 CC1 – Concrete works (Structural)

**Table 12: Specification data associated with SANS 2001 CC1 – Concrete works (structural)**

Clause/No	Specification Data
<b>Essential data</b>	
<b>4.2</b>	<b>Materials</b>
4.2.1.1	Cementitious binders are common cements that comply with SANS 50197-1 or be blends of certain common cements and extenders <sup>1</sup> that comply with SANS 55617-1, SANS 50450-1 and SANS 50450-2 or SANS 53263-2, SANS 50934-6 and SANS 50934-2.
4.2.2	Water complies with the requirements of SANS 51008.
4.2.3.1 <sup>2</sup>	The coarse aggregate has a nominal size of 19mm. The nominal maximum size of coarse aggregate does not exceed: <ul style="list-style-type: none"> <li>one-quarter of the minimum thickness of the concrete cross section, and</li> <li>the specified cover over reinforcement. In elements with closely spaced reinforcement, the use of a nominal size of 9,5 mm or 13,2 mm should be considered.</li> </ul>
4.2.3.4 4.7.10.11	Plums are not permitted.
4.2.3.5	The following tests are required: <ul style="list-style-type: none"> <li>Drying shrinkage on fine and coarse aggregates</li> <li>Drying shrinkage of concrete</li> </ul>

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Clause/No	Specification Data
	<ul style="list-style-type: none"> <li>Flakiness index of the stone</li> <li>Alkali-silica reaction</li> </ul>
	<p>The use of admixtures is permitted, provided that the results of trial tests which demonstrate their suitability and the following are submitted to the <i>Project Manager</i> for his acceptance:</p> <ul style="list-style-type: none"> <li>The trade name of the admixture, its source and the manufacturers' recommended method of use</li> <li>Typical dosages and possible detrimental effects of under and over doses.</li> <li>Whether compounds are likely to cause corrosion of the reinforcement or deterioration of the concrete.</li> <li>The average expected air content of freshly mixed concrete containing an admixture that causes air to be entrained when the admixture is used at the manufacturer's recommended dose.</li> </ul>
4.2.6	<p>The grade of concrete is as follows:</p> <ul style="list-style-type: none"> <li>The minimum concrete grade for structural concrete is 35/19MPa.</li> <li>The minimum grade of blinding is 15/19MPa.</li> <li>The minimum grade of mass concrete is 15/19MPa.</li> <li>Mass concrete is defined as unreinforced concrete cast for fill in voids etc.</li> </ul>
4.2.7	<p>The material requirements for grout are as follows:</p> <p>Cement complies with SANS 50196-1.</p> <ul style="list-style-type: none"> <li>Sand-cement grout <ul style="list-style-type: none"> <li>The grout has a minimum crushing strength of the concrete. The sand aggregate is capable of freely passing a filter mesh of 1.5 mm.</li> </ul> </li> <li>Non-shrink grout <ul style="list-style-type: none"> <li>A grout is regarded as non-shrink if its volume is not less than the initial volume, after hardening for 28 days. During this period, the test specimens are completely protected against drying, evaporating, carbonation and exposure to temperatures outside the range 23 °C ± 3 °C.</li> </ul> </li> </ul> <p>The type and brand of non-shrink grout, after approval, are indicated on the drawings and/or specification for concrete work.</p> <p>In general, one of the following types of non-shrink grout are used:</p> <ul style="list-style-type: none"> <li>Cement-based non-shrink grout is not less than the strength of the concrete.</li> <li>Special proprietary non-shrink or expansive grout is not less than the strength of the concrete.</li> </ul>
4.2.11.1	Joint fillers, sealants, waterstops, bearings, and accessories complies with the

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Clause/No	Specification Data
	<p>following requirements:</p> <ul style="list-style-type: none"> <li>Expansion joints are generally be filled with closed cell expanded polyethylene foam and sealed against the ingress of dirt or water with a gun grade sealant material all as detailed on the Drawings.</li> </ul>
4.3.1.5	Where Earth cuts are to be used as forms for vertical surfaces acceptance from the Project Manager is required.
4.3.1.8	<p>Formed Concrete</p> <p>The formed surfaces are as follows:</p> <ul style="list-style-type: none"> <li>Foundations (below 150 mm from finished floor level) – Rough finish is acceptable.</li> <li>All concrete from 150 mm below finished floor level which receives and additional finish – Smooth finish is required</li> <li>Off-shutter concrete (not receiving any further finishes) – Smooth special finish is required.</li> </ul>
4.3.1.8	The degree of accuracy required is II.
4.3.2.1.4	The design and drawings for the formwork and false work is submitted to the <i>Project Manager</i> for acceptance.
4.3.8.3	<p>The false work and supporting formwork on continuously reinforced concrete structures are removed as follows:</p> <p>-On acceptance by the <i>Supervisor</i> that the false work and formwork may be removed.</p>
<b>4.4</b>	<b>Reinforcement</b>
4.4.1.3	Bars may not be bent hot.
4.4.2.2	Welding of bars is not permitted.
4.4.3.1	<p>The cover is as follows:</p> <ul style="list-style-type: none"> <li>Severe exposure conditions as listed in Table 3 or as shown on the <i>Employer's</i> Drawings</li> </ul>
<b>4.5</b>	<b>Holes, chases and fixing bolts</b>
4.5.1	Fixtures to be embedded in the concrete are as per the drawings.
<b>4.6</b>	<b>Embedded items</b>
4.6.2.1	The type and location of waterstops are as specified on the Drawings.
<b>4.7</b>	<b>Quality of concrete</b>
4.7.3.2	Pumping of concrete is permitted.
4.7.4.1	Efflorescence on exposed concrete surfaces is not permitted
4.7.12.1.1	Construction joints are required and the location and details are submitted for acceptance to the <i>Project Manager</i> prior to construction.
4.7.12.1.4	Proprietary bonding compounds between old and new concrete is permitted.
4.7.14.6	Concrete is not to be placed during periods of heavy or prolonged rain.
4.7.15.1	<p>Exposed surfaces of concrete not finished against forms have the following surface finishes:</p> <ul style="list-style-type: none"> <li>The surface, after the concrete has hardened sufficiently, is floated by hand or</li> </ul>

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Clause/No	Specification Data
	machine sufficient only to produce a uniform surface free from screed marks.
<b>5</b>	<b>Compliance with the requirements</b>
<b>5.1</b>	<b>Testing</b>
5.1.1.7	The test results from a ready-mix production facility, as part of its quality control system, are used.
5.1.1.8	The test for the percentage of alkali-aggregate is ASTM C289 – Potential reactivity of aggregate (chemical method) or alternative method proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
5.1.2.3	The test results may be assessed statistically.
<b>5.2</b>	<b>Tolerances</b>
5.2.1.1	The degree of accuracy is III for surfaces cast against earth cuts and II for other concrete surfaces.
<b>Variations</b>	
CC1.V.1	Add the following to clause 4.7.8.2: The uninterrupted supply of the correct volume to Site is guaranteed if “ready-mixed” concrete is used.
CC1.V.2	Add the following to clause 4.6.3: The space between pipes and ducts that are to be cast into reinforced concrete and any adjacent reinforcement is not smaller than the larger of the following: <ul style="list-style-type: none"> <li>• 40mm, or,</li> <li>• 5mm plus the maximum size of the coarse aggregate.</li> </ul>
CC1.V.3	Add the following to clause 4.7.8.2: The <i>Project Manager</i> may permit production of concrete at a central production facility other than on the Site of construction and reserves the right to inspect for acceptance of these central production facilities. The <i>Contractor</i> is responsible for conducting all control testing.
CC1.V.4	Add the following to clause 4.7.10: Concrete may not be placed before the <i>Supervisor</i> has given permission in writing. A minimum written notice period of 24 hours prior to pouring is required for each part of the structure.
CC1.V.5	Add the following to clause 5.1.1.7: the <i>Contractor</i> receives from the ready-mixed concrete Supplier, a certificate with the following information: <ul style="list-style-type: none"> <li>• The nature and source of each constituent material.</li> <li>• The proposed quantity of each constituent material per m<sup>3</sup> of supply compacted concrete.</li> </ul>
<b>Additional clauses</b>	
CC1.A.1	Cement and cement extenders are free flowing and free of lumps, and are supplied in the manufacturer's sealed unbroken bags or in bulk. Material that has become hardened or lumpy or fails to comply with the relevant standards in any way is removed from the Site, without delay.
CC1.A.2	The materials used in the construction of falsework and formwork are suitable for

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Clause/No	Specification Data
	the purpose for which they are required and is of such a quality that will produce the standard of work specified. The <i>Contractor</i> submits his proposal of the materials that is used for the construction of the falsework and formwork to the <i>Project Manager</i> two weeks prior to use for his acceptance.
CC1.A.3	The minimum blinding thickness is 75mm.
CC1.A.4	All reinforcement is hot rolled steel grade 450MPa.
CC1.A.5	<p>All cement and cement extenders used in the works are tested by the manufacturer or the <i>Contractor</i> in a laboratory. Copies of all test results so obtained accompany each delivery of cement and cement extender to the site and included As Executed records.</p> <p>The <i>Contractor</i> keeps full records of all data relevant to the manufacture, delivery, testing and use of all cement and cement extenders used in the <i>Works</i>.</p>
CC1.A.6	<p>Prevention of plastic shrinkage cracks</p> <p>The <i>Contractor</i> takes measures as necessary to prevent plastic shrinkage cracking in the concrete. Particularly on dry windy days or hot sunny days, the <i>Contractor</i> makes provision for fine spraying of the concrete surface with water as soon as it has taken its initial set or covers the concrete with plastic sheeting. It may be necessary to change the aggregates or the concrete mix proportions. In order to deal with shrinkage cracking, it may be necessary to change the time at which, or the manner in which, floating is carried out.</p> <p>If plastic shrinkage cracking occurs, the cracks are be closed up by re-vibrating the concrete while the concrete is still in a plastic state. Once the cracks have been closed, the concrete is kept thoroughly wet, or covered with plastic sheeting for at least a further three hours.</p>
CC1.A.7	<p>Curing of concrete</p> <p>Details of the <i>Contractor's</i> proposals for curing concrete are submitted to the <i>Supervisor</i> for acceptance before the placing of concrete commences.</p> <p>Membrane curing compounds are not permitted, where the aesthetic appearance of the finished surface is of importance and there is any danger of the membrane becoming difficult to remove.</p>
CC1.A.8	<p>Add the following to clause 5.1:</p> <p>The average strength of the 3 cubes crushed is referred to as one test result. The results are submitted to the <i>Supervisor</i> for his acceptance.</p>
CC1.A.9	<p>Add the following to clause 4.7.14</p> <ul style="list-style-type: none"> <li>• Provided the ambient air temperature does not fall below 10°C, no special precautions need be taken to protect concrete from the effects of cold weather.</li> <li>• If the ambient air temperature is in the range 0°C to 10°C and freezing conditions are confined to ground frosts during the night, the <i>Contractor</i> takes the necessary precautions to ensure that concrete is placed and compacted at a concrete temperature of not less than 5°C and that it is subsequently covered</li> </ul>

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Clause/No	Specification Data														
	<p>and protected from cold winds and frosts to ensure that its temperature does not fall below that shown in Table CC1.A.9 for at least the period shown in the table. Such precaution must be presented to the <i>Supervisor</i> for his approval.</p> <ul style="list-style-type: none"><li>When it is likely that the ambient air temperature will fall below 0°C, the <i>Contractor</i> ceases with placing of concrete when the air temperature falls to 2°C and does not resume until it rises to 5°C,</li></ul> <p><b>Table CC1.A.9: Concrete temperature during early life</b></p> <table><tr><th rowspan="2">Characteristic Strength of Concrete</th><th colspan="2">Concrete to be maintained at not less than temperature shown for a minimum period of :</th></tr><tr><th>2°C</th><th>5°C</th></tr><tr><td>10 MPa</td><td>10.0 days</td><td>8.0 days</td></tr><tr><td>20 MPa</td><td>4.5 days</td><td>3.5 days</td></tr><tr><td>30 MPa and above</td><td>3.0 days</td><td>2.5 days</td></tr></table> <p>Notes:</p> <ol style="list-style-type: none"><li>The above periods are those estimated as necessary for the concrete to gain a compressive strength of 5 MPa.</li><li>The periods required for other concrete strengths and temperatures may be interpolated, but in no case shall the maturing temperature fall below 2°C.</li><li>The temperature referred to is the minimum at any part of the concrete.</li></ol> <p>Concrete not placed within formwork or in contact with reinforcement with a temperature which is at or below 0°C and it is not placed against any surface bearing frost or ice.</p>	Characteristic Strength of Concrete	Concrete to be maintained at not less than temperature shown for a minimum period of :		2°C	5°C	10 MPa	10.0 days	8.0 days	20 MPa	4.5 days	3.5 days	30 MPa and above	3.0 days	2.5 days
Characteristic Strength of Concrete	Concrete to be maintained at not less than temperature shown for a minimum period of :														
	2°C	5°C													
10 MPa	10.0 days	8.0 days													
20 MPa	4.5 days	3.5 days													
30 MPa and above	3.0 days	2.5 days													
CC1.A.10	<p>Add the following to clause 4.7.14:</p> <p>No placing of concrete takes place if the ambient temperature exceeds or is likely to exceed 32°C or if there are hot drying winds during the casting period, without the acceptance of the <i>Supervisor</i>.</p> <p>Fresh concrete having a temperature exceeding 32°C are not placed in the <i>works</i>. For pours of large volume where control of temperature rise or temperature differential is critical, a lower maximum placing temperature, to be agreed with the <i>Supervisor</i>, may be imposed. The <i>Contractor</i> takes all measures necessary to ensure that the specified maximum placing temperature is not exceeded and that loss of moisture during transporting and placing is reduced to the minimum. Such measures are agreed with the <i>Supervisor</i>.</p> <p>Areas in which concrete is to be placed are shielded from direct sunshine and rock or concrete surfaces are thoroughly wetted if instructed by the <i>Supervisor</i> to reduce absorption of water from the concrete placed on or against them.</p> <p>After placing of concrete in any part of an area, the specified curing process commences as soon as possible. If any interval occurs between completion of</p>														

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Clause/No	Specification Data
	placing and start of curing, the concrete are covered for this interval with polythene sheet to prevent loss of moisture.
CC1.A.11	Particular attention will be paid to heat of hydration, especially for large pours.
CC1.A.12	<p>Cement extenders are only used where specified - an accepted cement extender is only blended with a CEM1 Portland Cement. The use of Fly Ash is preferred.</p> <p>Blending of CEM1 cement with an extender may be done in the batch plant, or at an accepted commercial blending plant.</p> <p>All cement extenders used comply with SANS 1491 Parts 1, 2 or 3 as appropriate for Ground Granulated Blast - Furnace Slag (GGBS) or Ground Granulated Corex Slag (GGCS), Fly Ash (FA) or Condensed Silica Fume (CSF) respectively, and carries the SANS mark, or similar accepted.</p>
CC1.A.13	If mixing concrete on Site, the <i>Contractor</i> prepares trial mixes using the approved material, and the Plant used for these trials is the Plant used in the <i>works</i> .
CC1.A.14	The <i>Contractor</i> submits full details of the trial mixes and test results and of the mixes proposed for use in the <i>works</i> , which are based on the satisfactory results of these preliminary tests and on the methods of mixing and placing the concrete in the <i>works</i> .
CC1.A.15	<p>Commencing of concreting:</p> <p>No concreting commences in any portion of the <i>works</i> until the preparations have been accepted and written permission given by the <i>Project Manager</i> that concreting in such portion of the <i>works</i> may commence.</p> <p>The <i>Contractor</i> provides to the <i>Project Manager</i> an accepted checklist for concrete pours at least four hours before the placing of any concrete. All relevant items are checked by the <i>Contractor</i> and the checklist signed off by the <i>Contractor's</i> representative as to its completeness and correctness.</p> <p>The following information is recorded by the <i>Contractor</i> and forms part of the data books in respect of each delivery of concrete:</p> <ul style="list-style-type: none"> <li>• Position in the structure where the concrete is placed.</li> <li>• Results of workability tests.</li> <li>• Details of test cubes taken.</li> </ul> <p>The concrete is compacted and placed in its final position within 2 hours of the introduction of cement to the aggregates. The time of such introduction is recorded on the delivery note. When truck mixed concrete is used, water is added under supervision either at the Site or at the central batching plant, but in no circumstances is water added in transit.</p>
CC1.A.16	<p>Check Tests on Hardened Concrete</p> <p>The <i>Contractor</i>, if directed by the <i>Project Manager</i>, carries out the following tests on hardened concrete either for routine inspection, quality control or as a verification of defects found by visual inspection or low cube strengths:</p> <ul style="list-style-type: none"> <li>• Tests on drilled cores, sawn beams or other elements of the structure in accordance with SANS 5863, SANS 5864 and SANS 5865. Loading tests on a completed structure or on precast elements are conducted if there is reasonable</li> </ul>

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Clause/No	Specification Data
	<p>doubt as to the adequacy of the structure.</p> <ul style="list-style-type: none"> <li>Tests to determine the ingredients used, permeability, loss of pre-stress, resistance to damage by other materials.</li> </ul>
CC1.A.17	<p>Placing and compaction of concrete is carried out under supervision of suitably qualified Personnel. Control procedures are established to cover all aspects of workmanship including placing, compacting, finishing, curing, hot and cold weather concreting, large concrete pours, etc. The concrete consistence is appropriate to the location in which it is to be placed and suitable placing and compacting equipment and procedures are employed to ensure that a high level of compaction without segregation is achieved. It is particularly important that full compaction is achieved in areas close to construction and movement joints, embedded water bars, reinforcement and against previously placed, hardened concrete.</p> <p>The following precautions are taken by the <i>Contractor</i>:</p> <ul style="list-style-type: none"> <li>Placing and compacting procedures ensure that reinforcing bars and built-in fittings (embedments) are not displaced and that damage is not caused to the face of the formwork.</li> <li>Concrete is placed in one continuous operation, rising uniformly in the formwork at a rate of at least 2m per hour. Concrete is not placed directly against vertical formwork; it flows to this surface during the compaction process.</li> <li>The depth of lift to be concreted, is to the acceptance of the <i>Supervisor</i>. Concrete is not dropped freely more than 1.5 m unless adequate precautions have been taken to prevent segregation, displacement of reinforcing bars, tendons and built-in fittings (embedments) and damage to formwork. The design and slope of chutes are to the acceptance of the <i>Employer</i>; chutes are kept clean and in good repair.</li> <li>Concrete is thoroughly compacted by vibration or other means during placing, to ensure that it is homogeneous. The concrete is worked around the reinforcing bars, tendons and built-in fittings (embedments), etc. and into corners of the formwork to form a solid void-free mass having the required surface finish. Vibration is applied in a manner that does not promote segregation, until all the air has been expelled. Vibrators are only used to compact concrete; they are not used to move concrete across the formwork. Over-vibration is avoided. When external vibrators are used, the design of formwork and vibrator characteristics ensures efficient compaction while avoiding surface defects.</li> <li>Overworking of the concrete is avoided and the addition of water to aid in finishing is not permitted.</li> <li>Where permanent formwork is incorporated in the structure, its energy absorption is taken into account when deciding on the method of vibration to be used. Extra precautions are taken to ensure full compaction of the concrete since this cannot be checked when the formwork is removed.</li> </ul>

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Clause/No	Specification Data
	<ul style="list-style-type: none"> <li>Concrete is not placed in flowing water. Underwater concrete is placed in position by tremies or by pipeline from the mixer and is not allowed to fall freely through water.</li> <li>Air-entraining admixtures and plasticizing admixtures, to improve the handling and placing characteristics of fresh concrete, are in accordance with this Works Information and are used only if accepted by the <i>Project Manager</i>.</li> <li>Concrete is not placed against concrete which has been in position for more than one hour, unless a construction joint is formed. The concrete in each section between joints or corners are placed in successive pours, working away in both directions from the centre-most panel of that section. The minimum interval between placing adjacent panels is 3 days, unless directed otherwise.</li> <li>Where it is specified that concrete is placed directly in contact with the ground, the ground surface is suitably prepared and protected against intermixing, water suction, etc, and the concrete is placed before this surface has deteriorated.</li> </ul> <p>Once placed, the concrete is not subsequently disturbed and not vibrated or rammed.</p>
CC1.A.18	All vibrating is carried out under the direction of a Specialist and to a plan accepted by the <i>Project Manager</i> . No workman is allowed to operate a vibrating tool without having received instruction and training in its use. Vibrators are immersion-type, of approved pattern, and they may be electrically or pneumatically driven. Care is taken to avoid segregation and excessive vibrating.
CC1.A.19	<p>Defective Concrete</p> <p>No repairing of any concrete is done without the written permission of the <i>Project Manager</i> and then only in such manner as he accepts.</p> <p>Concrete which does not comply with this Works Information is removed and replaced with sound concrete. This may involve the removal and replacement of otherwise satisfactory concrete associated with the defective material.</p>
CC1.A.20	<p>Formwork</p> <p>Formwork with damaged edges or faces is not used. Open joint in timber forms are sealed. Plywood surfaces and cut edges are sealed to prevent the absorption of moisture.</p> <p>Immediately before concreting, the forms and all other surfaces which are in contact with the fresh concrete, are cleaned of loose materials and debris including shavings, woods chips, sawdust, pieces of wire, nails, foamed plastic, fragments of hardened concrete and mortar.</p>
CC1.A.21	In the case of precast concrete units constructed in a factory or yard remote from the Site, details of the concrete ingredients, mix design, and compression test cube results are made available on delivery to Site
CC1.A.22	Corners to concrete items which are permanently exposed, are chamfered to avoid sharp edges which are liable to be damaged
CC1.A.23	<p>Holding Down Bolts and Embedded Fixtures</p> <p>Threads of holding down bolts are protected with "Densotape" or similar material</p>

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Clause/No	Specification Data
	<p>accepted by the Project Manager, during delivery and storage. After concreting, the bolt projections with attached nuts and washers, are protected against corrosion with similar sealing tape and protected against mechanical damage with a timber shield or as otherwise approved, until the erection of the steel works or other Plant or fixtures commences.</p> <p>Holding down bolts, embedded fixtures and recesses are located in the correct position by means of templates. These are constructed using steel sections fabricated to 1mm tolerance, or as otherwise approved and are held rigidly in position during concreting.</p> <p>Particular attention is directed to the placing of reinforcement around bolt assemblies and embedded fixtures.</p> <p>Holding down bolts and holding down bolt assemblies are located in the position shown on the Drawings.</p>
CC1.A.24	<p>All reinforcement is cleaned of salt depositions, loose mill scale, rust, grease, set mortar or other harmful matter, by power brushing or acid dipping. The <i>Contractor</i> ensures that such reinforcement is protected against chemical deposits at all stages of the work, until the concrete is poured.</p> <p>Reinforcement placing is checked against the design drawings before concreting is permitted.</p>

### 3.2.2.3 Site clearance

As part of site clearance, the *Contractor* adheres to the latest revision of the *Employer's* Execution of Site Preparation and Earthworks Standard, document number 240-57127953.

#### 3.2.2.3.1 Specification data associated with SANS 2001 BS1 – Site clearance

**Table 13: Specification data associated with SANS 2001 BS1 – Site clearance**

Clause/No	Specification Data
<b>Essential data</b>	
<b>3</b>	<b>Definitions</b>
3.2	The designated area on which work is carried out is shown on the drawings; this includes areas identified by the <i>Contractor</i> to suit the <i>Works</i> including temporary works and laydown areas.
3.4	The levels of the finished earthworks are as shown on the drawings.
<b>4.2</b>	<b>Clearing</b>
4.2.2 (table 1 – activity 6)	The following reusable materials are stacked as specified below: <i>Top Soil</i>
<b>4.4</b>	<b>Disposal of material</b>
4.4.1	Materials from clearing and grubbing operations are disposed of at a suitable disposal site.

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Clause/No	Specification Data
	Cleared combustible materials are taken to an approved waste disposal site. The <i>Contractor</i> keeps disposal certificates on record.
4.4.2	Tree trunks and cleared tree debris are taken to a suitable waste disposal site.
4.4.3	Fencing material is stacked at a site proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
4.4.4	The material which is to be reused is stacked at a site proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
4.6	<i>The Employer's acceptance is required prior to the removal of any trees</i>
4.7	<i>The Employer's acceptance is required prior to the removal of any turf, plants, bushes and shrubs</i>
4.9	Topsoil together with any grass and other suitable vegetation are removed and placed in stock piles not higher than 1.5 and placed in <i>areas accepted, in writing, by the Project Manager</i> .  Material suitability is determined by the intended re-use of the material. Where temporary stockpiles hold materials intended for rehabilitation of ground, stockpiles that can deteriorate if exposed are protected against erosion and weathering.  Unsuitable materials not intended for re-use are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i> . Materials are disposed of in accordance with local and national laws and regulations.
<b>Variations</b>	
BS1.V.1	Add the following:  Topsoil stripping is scheduled for the dry season, as far as possible.  Topsoil is handled twice only - once to strip and stockpile, and secondly to replace, level, shape and scarify.  Topsoil stripped from different sites is stockpiled separately and clearly identified as such.
<b>Additional Clauses</b>	
CS1.A.1	The size of areas subjected to land clearance is kept to a minimum.
CS1.A.2	All vegetation not required to be removed is protected against damage.
CS1.A.3	No trees are removed without prior permission in writing from the <i>Project Manager</i> .
CS1.A.4	Scanning and marking of underground works precedes site clearance.  <i>[Omit if this has already been done and provide the Contractor locations of any known underground works.]</i>
CS1.A.5	The <i>Contractor</i> does not excavate before a method statement is submitted and accepted by the <i>Project Manager</i> .
CS1.A.6	In areas of known shallow water table or perched seasonal water table conditions, caution is exercised with regard to the removal of trees and/or shrubs which may contribute to the overall water balance of the site.

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Clause/No	Specification Data
CS1.A.7	Site clearance works are planned and executed in a manner such that the safety of personnel, the work and adjacent property is guaranteed and such that minimum inconvenience is caused.

### 3.2.2.4 Earthworks

As part of Earthworks, the *Contractor* adheres to the latest revision of the *Employer's* Execution of Site Preparation and Earthworks Standard, document number 240-57127953.

#### 3.2.2.4.1 Specification data associated with SANS 2001 BE1 – Earthworks

**Table 14: Specification data associated with SANS 2001 BE1 – Earthworks**

Clause/No	Specification data
<b>Essential data</b>	
<b>4.1</b>	<b>Materials</b>
4.1.5.1	Topsoil is conserved.
4.1.5.2	Materials from excavation is disposed of as follows:  Suitable materials intended for re-use are stock-piled in areas accepted, in writing, by the Project Manager  Material suitability is determined by the intended re-use of the material. Where temporary stockpiles hold materials intended for rehabilitation of ground, stockpiles that can deteriorate if exposed are protected against erosion and weathering.  Unsuitable materials not intended for re-use are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i> . Materials are disposed of in accordance with local and national laws and regulations.
<b>4.2</b>	<b>Methods and procedures</b>
4.2.1.1	All areas in which excavation is to take place or that are to be covered by terraces, banks or structures is cleared in accordance with the requirements of SANS 2001-BS1.
4.2.1.2	Topsoil is conserved for later use in the following manner:  Vegetation intended for re-use is removed to a location <i>accepted by the Project Manager</i> and is neatly stacked and regularly watered and tended until required for replanting.  Top soil intended for re-use is stock-piled and/or spread to a location <i>accepted by the Project Manager</i>
4.2.1.3	The overburden is stripped and removed to depth of 300mm.
4.2.3	Surplus and unsuitable material are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i> . Materials are disposed of in accordance with local and national laws and regulations.
<b>5</b>	<b>Compliance with the requirements</b>
5.2.1	A degree of accuracy I is required in respect of position, dimensions, levels, etc.

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Clause/No	Specification data
5.2.2	A degree of accuracy I is required in respect of moisture content and density.
<b>Variation</b>	
BE1.V.1	With reference to clause 4.2.2.1.1: Materials from excavation will not be used.
<b>Additional Clauses</b>	
BE1.A.1	<p>Design of Excavations:</p> <p>The <i>Contractor</i> is solely responsible for the design and installation of all temporary works to ensure the stability of the excavations. The <i>Contractor</i> provides his proposals to the Project Manager for acceptance before excavation work commences on site.</p> <p>The macro and micro stability of cuttings, excavation and embankment slopes and the related soil/rock deformations is analysed in accordance with the SAICE Code (2010).</p> <p>Design of cuttings, excavation and embankment slopes includes erosion protection of slopes, Soil deformation with respect to settlements due to consolidation, compression of soil structure, movements required to develop shear resistance, the consequence of sliding and squeezing, etc., are analysed.</p>
BE1.A.2	<p>Excavation Classification</p> <p>The <i>Contractor</i> uses any method he chooses to excavate any class of material but his chosen method of excavation does not determine the classification of the excavation. The <i>Contractor</i> uses guidelines for excavation classification and methods set out by SANS 1200D Section 3.1.</p> <p>Sides off excavations are not used for formwork</p>
BE1.A.3	<p>The <i>Contractor</i> notifies the <i>Supervisor</i> of his intention to excavate 7 days prior excavation, no excavation work to commence without the presence of the <i>Supervisor</i>.</p> <p>The <i>Contractor</i> does not excavate before a method statement is submitted and accepted by the <i>Project Manager</i>.</p>
BE1.A.4	<p>Ground improvement, where required, are designed to conform to BS 8004 and the Institution of Civil Engineers "Specification for Ground Treatment" (latest edition).</p> <p>The <i>Contractor</i> submits design calculations, including settlement calculations, to meet specified acceptable settlements, and drawings for proposed ground treatment works.</p>
BE1.A.5	<p>The effect of earthworks on neighbouring structures, services, etc., are analysed (for both short and long-term effects) and detrimental effects are avoided or appropriate measures taken to safeguard the integrity of the item in question. Similarly the effects of dewatering or disturbance of the existing geohydrological conditions as a result of earthworks on neighbouring structures, services, etc., are taken into account.</p>

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### 3.2.2.4.2 Specification data associated with SANS 1921-5: Earthworks and management requirements for works contracts

Clause/No	Specification Data
<b>Essential data</b>	
<b>4.1</b>	<b>Material excavatable by hand</b>
4.1.1	The depth of trenches which are to be excavated by hand is 1.5m

### 3.2.2.5 Masonry walling

#### 3.2.2.5.1 List of applicable standards

All references to standard/codes/publications are to be the latest issue of each, together with the latest additions and/or amendments thereto, as of the date of contract, unless otherwise indicated. This list is not all-inclusive and does not relieve the Contractor from complying with all applicable codes.

**Table 15: List of applicable standards for masonry works**

Code	Description
SABS 029	Comprehensive model building regulations Chapter 8: Masonry and walling
SANS 1206	Masonry units
SANS 227	Burnt clay masonry units
SANS 285	Calcium silicate masonry units
SANS 1215	Concrete masonry units
SANS 2001 CM1	Construction works Part CM1 – Masonry walling
SANS 10073	The safe application of masonry-type facings to buildings
SANS 10145	Concrete masonry construction
SANS 10249	Masonry walling
SANS 50413	Masonry cement
SANS 50771	Specification for masonry units
SANS 50934-3	Admixtures for concrete, mortar and grout Part 3: Admixtures for masonry mortar – Definition, requirements, conformity, marking and labelling

#### 3.2.2.5.2 Specification data associated with SANS 2001 CM1 – Masonry walling

**Table 16: Specification data associated with SANS 2001 CM1 – Masonry walling**

Clause/No	Specification Data
<b>Essential data</b>	
<b>4.1</b>	<b>Materials</b>

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Clause/No	Specification Data
4.1.1.2	<p>Burnt Clay masonry units complies with the requirements of SANS 227 and have the following properties:</p> <ul style="list-style-type: none"> <li>• Foundation brickwork: NFX</li> <li>• Internal brickwork: NFP</li> <li>• Face Brick: FBS</li> <li>• Work size: 222 x 106 x 73mm</li> <li>• Colour of the face units: <ul style="list-style-type: none"> <li>○ Dark: Country Meadow Satin</li> <li>○ Light: Opal Satin</li> </ul> </li> <li>• Nature of the unit: Manufacturer's Specification</li> <li>• Uniformity of colour and texture: Required</li> <li>• Nominal compressive strength: <ul style="list-style-type: none"> <li>○ Foundation brickwork: NFX – 14 MPa</li> <li>○ Internal brickwork: NFP– 14 MPa</li> <li>○ Face Brick: FBS – 17 MPa</li> </ul> </li> <li>• Grade (efflorescence): <ul style="list-style-type: none"> <li>○ Foundation brickwork: Normal</li> <li>○ Internal brickwork: Normal</li> <li>○ Face Brick: Special</li> </ul> </li> <li>• Limit of water absorption: Less than 7% determined in accordance with SANS 10164-1 or SANS 227</li> <li>• Limit of water soluble salts content: Refer to 4.7 of SANS 227</li> <li>• Limits of selected radicals: Refer to 4.7 of SANS 227</li> <li>• Limits of pH value of water extracts: Refer to 4.7 of SANS 227</li> <li>• Limits of moisture expansion: Refer to 4.7 of SANS 227</li> </ul> <p>The quality verification are as follows: See Appendix F of SANS 227 The test for efflorescence is required.</p>
4.1.4.1	Sands that comply with the requirements of SANS 1090 are required.
4.1.6	Mortar plasticizers and set-retarder admixtures are permitted.
4.1.9.1.2	Brickforce are galvanised.
4.1.9.2.2	Rod reinforcement are galvanised
4.1.12.1	Wall ties in cavity walls are of the butterfly type.
4.1.12.1	Only galvanised steel wall ties are used.
4.1.13.2	Internal steel door frames are galvanised.
<b>4.2</b>	<b>Mortar</b>
4.2.1.1	Mortar is required to be Class I for all masonry
4.2.1.2	Mortar plasticizers and set-retarder admixtures are permitted
4.6.3.1	Reference panels are required

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Clause/No	Specification Data
4.16	Roof anchors are in accordance with the requirements of SANS 10400
<b>5</b>	<b>Compliance with Requirements</b>
5.1.1	The degree of accuracy is II.
<b>Variations</b>	
CM1.V.1	With reference to Clause 4.1.13: All other door and window frames are bronzed anodised aluminium.
<b>Additional clauses</b>	
None	

### 3.2.3 Electrical Design and Installation

An Electrical design and installation is required to support the mechanical process plant as described in Section 3.1.1. The summary of electrical loads for this process is provided as Appendix F “Electrical Load List”. The *Contractor* updates the load list based on the final pump/motor design parameters. These are four (x4) RWR Pressure Sump Pumps and another four (x4) ADDD Submersible Sump Pumps. The *Contractor* provides detailed engineering design, procurement, manufacture, factory testing, storage, supply, delivery to Kusile Power Station, off-loading, erection, installation, site testing and commissioning of these pumps, including all relevant power supply systems as well as all electrical accessories.

#### 3.2.3.1 Power Supplies for the ADDD Sump Pumps

These pumps will be supplied from the Ash Dump Dirty Dam Pump Building Mini-sub (02BBS). The electrical scope required to instate these power supplies is as follows:

- Feeder MCBs (x2) to be installed in the mini-sub
- Supply cables (x2) from the mini-sub to the sump.
- Excavations (x1) from the mini-sub to the sump locations.
- Local control/starter panels (x4)

#### 3.2.3.2 Power Supplies for the RWR Sump Pumps

These pumps can be supplied from Mini-sub 03 (00BBN03). The electrical scope required to instate these power supplies is as follows:

- Feeder MCBs (x2) to be installed in the mini-sub
- Supply cables (x2) from the mini-sub to the sump.
- Excavations (x1) from the mini-sub to the sump locations.

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- Local control/starter panels (x4)

The *Contractor* designs and provides all miscellaneous equipment required to execute the electrical scope of work, this include but not limited to the following:

- Installation of all power and control cables, routing and terminations of cables, cable racking, hangers and supports including labelling, cable rack earthing, and earthing clamps.
- Provide all termination lugs, connectors, cable glands, and cable and conductor identification labels.
- Design, furnish and install lightning protection system equipment for miscellaneous areas, structures and buildings, includes above grade earthing.
- Fire rated sealing of all cable openings in floors and walls.
- All nuts, bolts, gaskets, special fasteners, etc., between components and equipment furnished, erected or as specified under these specifications.
- Maintain and furnish mark up of as-built/as-installed mark-up of the design documentation.

### **3.2.3.3 ENGINEERING AND THE CONTRACTOR'S DESIGN**

#### **3.2.3.3.1 Employer's Design**

The *Employer* provides the following documentation/drawings for this works:

- a) Single line drawing for mini-substation (02BBS) - 0BBS-E1285
- b) Single line drawing for mini-substation (00BBN03) - 0UYX-E1903
- c) Electrical load list – Appendix F
- d) Site Electrical Underground Facilities : Area 6 - 0UYX-S3816
- e) Site Electrical Underground Facilities : Area 87 - 0UXC-E2289B
- f) Relevant Eskom standard specifications and templates

All *Employer* information and property made available to the *Contractor*, including the *work* done by the *Contractor* for the *Employer*, is confidential and may not be disclosed to anyone unless authorised by the *Project Manager*. All drawings provided by the Employer as a design baseline, are for the Contractor use in doing their designs. It is the responsibility of the Contractor to notify the Employer of updates required on these designs in the event of discrepancies noted, construction clashes or process plant design changes during detail design detail design.

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### **3.2.3.3.2 Parts of the Works Which the Contractor Is To Design**

The *Contractor* provides for detailed engineering design, procurement, manufacture, factory testing, storage, supply, delivery to Kusile Power Station, off-loading, erection, installation, site testing and commissioning of the following for the ADDD and RWR leakage detection systems:

- a) Pump motors as per the electrical load list
- b) Feeder MCBs to be installed in the mini-sub
- c) Power supply cables from the mini-sub to the sump.
- d) Earth conductor and connections
- e) Detailed cable routing and trench layout
- f) Excavations from the mini-sub to the sump local control panels.
- g) Local control/starter panels including concrete footings and galvanized structural steel supports.

All electrical works shall be in accordance with the following Eskom standards and specifications:

- 240-56356396 - Earthing And Lighting Protection Standard
- 240-55714363 - Coal-Fired Power Stations Lighting and Small Power Installation Standard
- 240-57617975 - Low Voltage Motors Procurement Standard
- 240-56227443 - Requirements for Power and Control Cables for Power Station Standard
- 240-56227516 - LV Switchgear Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V
- 240-56360387 Storage of Power Station Electric Motors Standard
- 240-56361435 Transport of Power Station Electric Motors Standard
- 240-56536505 Hazardous Location Standard and relevant standards.
- 240-56356411: Fire Barrier Seals for Electrical Cable Installations at Power Plants Standard
- 474-11542: Generation Plant General Electrical Specification

In addition, templates below must be fully populated and submitted by the Contractor for acceptance by the engineer:

- 240-56227927 Electrical Load List Template
- 240-56176097 Electrical Cable Schedule Template
- 240-77301384 Electrical LV Load Schedule Template
- 240-77302094 Electrical Termination Schedule Template
- 240-77100923 LV Motor Technical Schedule AB Template
- 240-95138097 Standard Electric Motor Test Certificate Template

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### **3.2.3.3.3 General Requirements**

#### **3.2.3.3.3.1 Electric Motors**

The *Contractor* provides motors that are designed and purchased with the pumps, in accordance with Eskom Standard 240-57617975. Motor sizes are to be as required by the defined processes requirements. All LV motors are rated at 400V. The motors are provided for being submerged in the sump along with the pump.

#### **3.2.3.3.3.2 DC/Battery Systems**

The control system that will come with the pumping system is envisaged to be a complete system which will cater for all its power requirements, from the 400/230V AC interface that will be provided at the LCPs. The *Contractor* provides any DC or battery backed or conversion equipment that will cater for special power requirements as required.

#### **3.2.3.3.3.3 Earthing and Lightning Protection**

A connection will be required for each pump LCP. The *Contractor* provides earth continuity conductors from the supplying mini-sub earth bar to the earth bar of each LCP in line with the Eskom Standard 240-56356396. The *Contractor* connects the sump area earthing system to the earth mat of the Ash Dump Pump Building and Perimeter Fence for the ADDED and RWR Leakage Detection Systems respectively.

#### **3.2.3.3.3.4 Cabling and Racking**

The plant cabling and racking will follow the recommendations of applicable SANS standards, and meet requirements of Eskom Standard 240-56227443. The contractor does the cable sizing, specification and routing in line with the Eskom standards. The design is submitted to the *Project Manager* for acceptance. The *Contractor* provides suitably sized cable racking for all above grade cable routing. Redundancy must be provided for the power supply to the electric pumps, such that the risk of losing power supply to all pumps at the same time is minimised.

#### **3.2.3.3.3.5 Feeder MCBs and Local Control Panels**

Mini-substations (02BBS and 00BBN03) have been identified to provide the bulk power supply for the new plant. The Contractor provides all the required MCBs and wiring to supply both the electric pumps as well as the local control stations. All the *works* comply with the requirements of 240-56227516 - LV Switchgear Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V.

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The *Contractor* provides 400V AC, 10kA local control panels that will house switchgear/controlgear which will be used to fulfil the following functions:

- Facilitate control of the power supply to each pump through Direct on Line (DOL) starter circuits.
- Provide power for the pumping system controller.
- Provide power to any other system auxiliaries not defined in this document.

The *Contractor* ensures that all LV switchgear is designed and implemented in compliance with Eskom Standard 240-56227516. LCPs to be correctly rated for the outdoor environment, as a minimum IP66.

### **3.2.4 Control and Instrumentation (C&I) Design and Installation**

#### **3.2.4.1 General Requirements**

As a minimum, the Contractor shall provide the following:

- Design, supply and install Local Control Panels and associated instrumentation and instrumentation cabling for the plant.
- The LCP's provided shall be used for the operation, control, protection, interlocking and monitoring of the lifting station.
- The Works shall include the engineering, design, procurement, manufacturing, factory acceptance testing, delivery, off-loading at site, storage, installation and testing, commissioning and as-built documentation.
- The Works shall comply with professional engineering practice and standards for fossil fuel power plants, and shall be designed for the environmental conditions prevailing at Kusile Power Station Site.
- Excavations (x1) from the local control panel to the sump locations at the ADDD and from the local control panel to the JoJo tanks' locations at the RWR. Suitable underground cable sleeves shall be used in all excavations.

#### **3.2.4.2 Design Input Requirements**

The Contractor shall use the following as input design documentation for completion of his designs:

- LPS System Description (Refer to Section 3.1.1)
- Equipment Load List (Refer to Appendix F)

#### **3.2.4.3 Design Output Requirements**

The Contractor shall supply the following as part of his design (as a minimum):

- Cable schedules
- Location diagrams

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- Wiring diagrams
- Power supply and distribution drawing
- Panel layout drawings
- Plant schedules: drive & actuator schedule, instrument list, panel interface list
- Licenses to be provided
- Testing and commissioning to be carried out

#### **3.2.4.4 Design Standardisation Requirements**

The Contractor shall adhere to the following in order to standardise his design with that which exists at Kusile Power Station:

- C&I Standards and Guidelines
- Control and operating philosophies (including system descriptions)

The Contractors design shall adhere to all relevant C&I standards, guidelines, and best practices already used at Kusile Power Station. This will include (but not limited to): field related standards, environmental conditions standards, KKS standards, lightning protection standards, cabling standards, and alarm standards. Refer to Appendix E for a complete list of applicable standards.

#### **3.2.4.5 Operating Strategy Requirements**

The system provided for the sump pumps shall be a locally operated system. No interface shall exist between the existing DCS at Kusile Power Station and the sump pump controllers. All operation shall be achieved via Local Control Panels. The Local Control Panels shall be capable of interfacing to the DCS for future usage.

The operating and control of the new plant shall not hinder the existing operating and control philosophy of the existing plant.

Abnormal conditions shall be assisted with appropriate indications and alarms in order to assist the local operator to control the plant to a safe state.

#### **3.2.4.6 Operational Technology Requirements**

The following requirements shall be adhered to:

- Only wired communication technology (i.e. hardwired) shall be used.
- Local mode of operation will be employed as per the operating philosophy of the plant.
- The latest technology shall be used that meets Eskom's standards.
- Expandability and spare capacity shall be adequately addressed for future use.
- The control panels installed shall include the capacity to perform a certain degree of self-diagnosis.

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### 3.2.4.7 Local Control Requirements

The LCP to be used for the control and operation of the lifting station to be installed at the ADDD and RWR shall be configured for local automatic and manual operation. The pump sequencing shall be configured on running hours and the pump controls (i.e. start and stop signals) shall be via hardwired level switches.

As a minimum, each LCP shall have the characteristics or features as per Table 17 below.

**Table 17: LCP Characteristics**

<b>Enclosure type</b>	Protection degree : IP 66
	Front access
	Material: Stainless Steel 2mm 3CR12.
	Powder Coat: Orange B26
<b>Alarms and Indications (Local)</b>	Beacon lights
	Sirens
<b>Power supply</b>	400VAC/230VAC/24VDC redundant supply
	Intelligent power distribution units
<b>Cabling</b>	All cable(s) inlet from bottom
	Horizontal and vertical cable management (40x60mm internal trunking)
	Network raceways separated from power raceways
	Cabinet earth bar
	Cable compression glands to prevent air leakage
	Cable clamps
<b>Other specifications</b>	Blanking plugs for unused slots
	Provision (spare slots) must be made available for installation of media converters
	Cabinet to be installed underneath a hood to protect against elements
	Cabinet shall have two hinged doors that form two compartments. <ul style="list-style-type: none"> <li>The inner compartment houses the LCD, terminal blocks etc.</li> <li>The outer door is opened to give access to the operator interface side of the LCD.</li> </ul>

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### **3.2.4.8 Field Equipment Requirements**

#### **3.2.4.8.1 General Requirements**

The following standards shall be followed for all field equipment and installation:

- 240-56355754 - Field Instrument Installation Standard
- 240-56355815 - Junction Boxes and Cable Termination Standard
- 240-56227443 - Requirements for Control and Power Cables for Power Stations

The following requirements shall be met:

- All field equipment shall operate over an ambient temperature range of: -10°C to 70°C.
- All field equipment shall be installed in a suitable location ensuring that it operates in an environment within the parameters stipulated by the manufacturer.
- Where harsh environmental conditions are not avoidable, the field equipment shall be designed for operation in that environment must be used.
- All IP ratings shall be as per SANS 60529.
- Additional protection hoods and enclosures shall protect the LCP and instrumentation situated outdoors or in adverse environments.
- The equipment layout shall be such that when mechanical work is performed, no C&I equipment is damaged.
- The Contractor shall ensure that all level measurement installations are to be done in accordance to the manufacturer's specification/installation guide. The Contractor shall ensure that the manufacturer approves each installation.
- In addition to the above mentioned requirements, the Contractor shall provide his best practices regarding the installation of level measurement instrumentation, for the approval by the Engineer.
- All field instrument and equipment shall be mounted onto a suitable stand or suitably supported to aid easy access for maintenance.

#### **3.2.4.8.2 Cabling and Wiring**

##### **General:**

- The 240-56227443 - Requirements for Control and Power Cables for Power Stations standard shall apply for control and power cabling.
- All field cabling entering enclosures shall be bottom entry.
- Cable block diagrams shall be provided by the Contractor as part of Detailed Design.

##### **Cabling:**

Instrument Cabling – This includes cabling between an instrument and the junction box. Instrument cabling is generally UVG02ACM or UVG04ACM.

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#### **3.2.4.8.3 Cable Routing and Racking**

The cable route shall be provided such as to not hinder any existing equipment or structures within the plant. Direct buried cables shall be predominantly used for this plant. All direct buried cables shall be suitably armoured.

Where above grade cable racks are used, the following shall apply:

- Separate cable racks shall be used for power and instrument cables.
- Cable rack covers shall be used in dust prone areas and outside plant areas for protection.
- No crossing of cables within racks shall be accepted.

#### **3.2.4.8.4 Earthing, Lightning, Surge (Overvoltage), and EMI Protection**

All earthing and surge protection shall as a minimum be in accordance with the following standards and specifications:

- 240-56356396 - Earthing and Lightning Standard
- SANS 10142 - Part 1 - The Wiring of Premises Part 1: Low-voltage installations
- 240-55714363 - Coal Fired Power Stations Lighting and Small Power Installation Standard
- 200-11757 - Earthing and Lightning Protection

#### **3.2.4.8.5 Environmental Conditions**

The following standards shall be adhered to:

- 240-56355731 Environmental Conditions for Process Control Equipment Standard
- 240-56355541 Control System Computer Equipment Habitat Requirements Guideline

The following requirements shall be met:

- The equipment panel doors shall be adequately sealed via a rubber sealer.
- No C&I equipment and field instrumentation shall be placed within the plant if it is not rated for the hazardous environment.
- The controller panels shall be designed to prevent ingress of dust, grit, rain water, wash-down water or other foreign matter to all parts where such ingress shall be detrimental to its operation.
- The controller panels shall be equipped with on-board surge protection.

#### **3.2.4.9 Power Supply and Power Distribution**

- Power for the C&I system shall be from the mini-sub installed within the field.
- The Contractor shall supply a power supply and distribution drawing as part of his design deliverables.

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#### **3.2.4.10 Maintenance Strategy Requirements**

The Contractor shall develop a maintenance concept and strategy after detailed design is established. This shall cover the following:

- Recommended spares holding
- Required maintenance schedule of C&I equipment over the life of the plant
- Required level of on-site repairs
- Overall maintainability requirements, including special tools required

The maintenance strategy shall align with existing philosophies followed at Kusile.

#### **3.2.4.11 Expandability Requirements**

The C&I design shall conform to the following expandability requirements:

- 20% unused terminals in the field boxes.
- 10% spare installed terminals in the field boxes.

#### **3.2.4.12 Life Expectancy Requirements**

- All new equipment and control components installed shall be supported and maintainable for a minimum of 15 years.
- The latest power plant proven technology shall be provided for the new C&I system.
- No unproven technology shall be provided.
- All control equipment shall be available in South Africa as commercially- off- the-shelf (COTS) products.

### **3.3 OTHER REQUIREMENTS OF THE *CONTRACTOR***

#### **3.3.1 Maintenance Requirements**

The *Contractor* shall make sure all works completed are easily maintainable and accessible by the *client* for maintenance purpose.

#### **3.3.2 Welding Codes, Standards and Specifications**

Welding procedure qualification for welds shall be in accordance with the appropriate welding standard incorporated into the relevant design and construction code. Combination or mixing of different codes shall not be permitted.

A Welding Procedure Specification (WPS) supported by a valid Welding Procedure Qualification Record (WPQR)/Procedure Qualification Record (PQR) shall be required for all welding work on the Employer's

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plant. The WPQR/PQR shall be approved by a registered International Welding Engineer (IWE) or International Welding Technologist (IWT) with minimum qualifications as defined in section 11.2. The Employer shall reserve the right to review a WPS and associated weld maps prior to commencement of fabrication.

Weld build-ups for pressure boundary thickness restoration shall not be permitted.

Mechanical tests conducted during welding procedure qualifications shall be performed at an accredited mechanical test laboratory conforming to the requirements of ISO/IEC 17025.

Welding and testing (destructive and non-destructive) of the test pieces shall be witnessed by an AIA or Notified Body.

### **3.3.3 Qualification and Accreditation**

#### **3.3.3.1.1 CONSTRUCTION CODE QUALIFICATION**

Welders and welding operators working on the Employer's plant shall be qualified in accordance with the latest applicable health and safety standard.

#### **3.3.3.1.2 WELDING COORDINATOR**

Welding coordinators shall have one of the following minimum requirements for education, examination and qualification:

- IWE in line with IIW document IAB-252R2-14
- IWT in line with IIW document IAB-252R2-14

In addition the Welding Engineer/Technologist shall be registered with ECSA as Professional Engineer/Technologist. Registration with other professional bodies shall be subject to approval by the Employer.

#### **3.3.3.1.3 WELDING SUPERVISOR**

Welding supervisors shall have at least one of the following minimum requirements for education, examination and qualification:

- International Welding Specialist (IWS) in line with IIW document IAB-252R2-14
- International Welding Practitioner (IWP) in line with IIW document IAB-252R2-14

#### **3.3.3.1.4 WELDING INSPECTOR**

Welding inspectors shall have at least one of the following minimum requirements for education, examination and qualification.

Minimum requirements for welding inspection on Employer's plant:

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- SAIW Welding and Fabrication Inspector Level 2
- IIW International Welding Inspector: Comprehensive (IWI- C)
- IIW International Welding Inspector: Standard (IWI- S)

#### **3.3.3.1.1.5 COMPANIES ACCREDITATION PERFORMING WELDING ON EMPLOYERS PLANT**

The Contractor shall ensure that the parties performing welding related activities on the Employer's plant shall have accreditation to ISO 3834 Part 2 – Standard.

### **3.3.4 Documentation Management and Communication**

For detailed documentation requirements refer to Section 4 part 3 of *Employers* policies and procedures.

#### **3.3.4.1.1.1 Submittal Requirements**

*Contractor* engineering program shall allow a minimum of 21 days for mailing, processing, and review of drawings and data by Employer. The *Contractor* is responsible for the compilation and the supply of all the documentation required during the various project stages and to provide the documentation programmed to link with the milestone dates. Documentation and drawings are programmed for delivery to meet the milestone dates and in accordance with the agreed Vendor Document Submittal Schedule (VDSS) Appendix B.

*Contractor* documents submittals are provided in accordance with the Vendor Document Submittal Schedule (VDSS) which is included in Appendix B. *Contractor* documents all documentation that will be sent to the Employer in the Master Document List (MDL) as provided by the Employer in Appendix C. All documentation, including reports, manuals, etc. is in the English language.

If the *Contractor* makes further changes to the equipment and materials shown on submittals that have been reviewed by the Employer, the changes shall be clearly marked on the submittal by the *Contractor* and the submittal process shall be repeated. If changes are made by *Contractor* after delivery to the Plant, as-built drawings indicating the changes shall be prepared by *Contractor* and submitted to Employer for review. Any resubmittal of information shall clearly identify the revisions by footnote or by a form of back-circle, with revision block update, as appropriate.

1. All document exchange shall be done using formal Transmittals. The following is the minimum information required for sending transmittals:

- Title of the document
- Reason for issuing/submission
- Transmittal Number
- Transmittal Name
- Transmittal Description
- Contract Number:
- Package Number
- Transmittal purpose
- Sender Name
- Sender E-Mail
- Sender Organisation
- Recipient Name
- Recipient E-Mail
- Recipient Organisation

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- Disclosure Classification
  - Date received
  - Quantity of documentation referenced on the transmittal
  - Number of copies
  - Format/medium submitted (e.g. paper, USB, etc.)
  - Sender signature
  - Recipient signature, once submitted, to acknowledge receipt
2. If a transmittal is in response to an Eskom communication via transmittal, the Eskom Transmittal Number shall be referenced in the transmittal response and shall be provided in addition to the required meta-data.
  3. The *Contractor* shall follow a structured and standard definition for Transmittal Descriptions, i.e. a subject line convention of **YYYYMMDD – <Contract & Package Number> – <Vendor> – <Short Description> – <Sender Initials>**.
  4. The *Contractor* shall follow a structured method of communication as defined within Communication Interface Memorandum (CIM) for any correspondence
  5. The *Contractor* shall follow a structured and standard definition for email subjects i.e. a subject line convention of **YYYYMMDD – < Package File Number> – > – <Email Subject line>**.
  6. The *Contractor* shall select the purpose for transmittal in line with the standard Eskom Selection Criteria:
    - Issued for Approval
    - Issued for Award
    - Issued for Basic Design
    - Issued for Commissioning
    - Issued for Concept Design
    - Issued for Consideration
    - Issued for Construction
    - Issued for Detail Design
    - Issued for Document Review
    - Issued for Handover
    - Issued for Information
    - Issued for Installation
    - Issued for Manufacturing
    - Issued for Procurement
    - Issued for Review
    - Issued for Tender
  7. Issuing of documents with different transmittal purposes shall be done separately and shall not combined into one transmittal. This will ensure fast and efficient processing of incoming and outgoing transmittals and information exchange.

Electronic technical data submittals shall be made using the Eskom Document Control email address (KusileDocControl@eskom.co.za) and Zendto, a Web-based file transfer service. If *Contractor* does not already have Zendto transmittal capability, information is available at <https://zendto.eskom.co.za/>. (The Uniform Resource Locator [URL] to be used for electronic file submittals will be made available upon Contract award.)

*In case of email submission, the Contractor should note that if a single file to be transmitted is over 20MB in size, then the document shall be uploaded on Zendto portal.*

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Notification to Engineer that submittals have been posted to Zendto shall be in accordance with the correspondence requirements of this Contract. *For the Zendto submission, a transmittal record must be submitted to the project email document control address information the Employer of such a submission.*

The hard copy prints shall be submitted to the address indicated for Technical Documents in the Supplementary Terms and Conditions of this Contract. The following number of prints shall be submitted unless otherwise indicated in the Schedule of Submittals:

**Table 18. Number of prints to be submitted**

<b>Submittal Description</b>	<b>Copies Required</b>
Performance Curves	2
Design Data	2
Test and Inspection Data	2
Drawings	2

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

- Electronic copies can be submitted to Eskom Documentation Centre through generic email address agreed to by the project. Electronic copies large for email will be delivered in a USB or any external drive, 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 will be copied on the email as well.
- Hard copies shall be submitted to the Eskom Representative accompanied by the Transmittal Note.

#### **3.3.4.1.1.2 Drawings**

The creation, issuing and control of all Engineering Drawings will be in accordance to the latest revision of 240-86973501 (Engineering Drawing Standards – Common Requirements) to be supplied as part of the enquiry documents. All drawings must be issued to Eskom in both native CADD format and PDF format as per 240-86973501 (Engineering Drawing Standards – Common Requirements).

Drawings shall be in sufficient detail to indicate the kind, size, arrangement, component weight, breakdown for shipment, and operation of component materials and devices; the external connections, anchorages, and supports required; the dimensions needed for installation and correlation with other materials and equipment; and the information specifically requested in the Schedule of Submittals.

*Contractor* shall fully complete and certify drawings for compliance with the Contract requirements. Drawings shall have title block entries that clearly indicate the drawing is certified.

Each submitted drawing shall be project unique and shall be clearly marked with the name of the project, unit designation, Employer's Contract title, Employer's Contract file number, project equipment or structure nomenclature, component identification numbers, and Employer's name. Equipment, instrumentation, and other components requiring Engineer-assigned identification tag numbers shall be clearly identified on the drawings. If standard drawings are submitted, the applicable equipment and devices furnished for the project shall be clearly marked.

Transmittal letters shall identify which Schedule of Submittals item (by item number) is satisfied by each drawing or group of drawings. The transmittal letter shall include the manufacturer's drawing number, revision number, and title for each drawing attached. Each drawing title shall be unique and shall be descriptive of the specific drawing content. Transmittal letters for resubmitted drawings shall include the Employer's drawing numbers.

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The *Contractor* includes 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 does not apply to drawings developed by manufacturers for equipment and material such as valves, instruments, etc. Drawing numbers will be assigned by the *Employer* as drawings are developed.

The project name shall be listed on all drawings, including manufacturers' drawings. Tag numbers and equipment names shall be listed on all 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 it.

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

The *Contractor* retains project design calculations and information for the entire life cycle of the plant and provides these to the *Employer* on prior written notice at any time notwithstanding the expiry or termination of the contract.

#### **3.3.4.1.1.3 Drawing Submittal**

All documents and records management will be performed according to Project/Plant Specific Documents and Records Process. Any uncertainty regarding this should be clarified with the *Employer*. The *Contractor* shall comply with all minimum document metadata as specified in Technical Documentation Classification and Designation Standard (240-54179170).

The *Contractor* shall use Smartplant Owner Operator (SPO) for documents and records management. *Contractor* shall submit electronic copies of the documents using a fully secure web based solution providing carefully controlled access to appropriate project information for authorized personnel. All electronic design data and documents shall be in such a form which will enable importing such data, documents and drawings, including 3-dimensional drawings, seamlessly into the Intergraph SPF (Smart Plant Foundation) system. Hard copy submittals will only be required for the IOM Manuals and final as-built submittals.

Transmittal letters shall be provided with each document submittal. The transmittal letter shall include the *Contractor* drawing number, revision number, and title for each drawing attached. Each drawing title shall be unique and shall be descriptive of the specific drawing content.

Catalog pages are not acceptable, except as drawings for standard non engineered products and when the catalog pages provide all dimensional data, all external termination data, and mounting data. The catalog page shall be submitted with a typed cover page clearly indicating the name of the project, unit designation, specification title, specification number, component identification numbers, model number, *Contractor* drawing number, and *Employer's* name. Drawings shall be submitted with all numerical values in metric units.

#### **3.3.4.1.1.4 Information Requirements**

The *Employer* requires drawings, documentation, plans, information and data (collectively "Information") from the *Contractor* for two fundamental purposes; namely for the management and execution of the Contract and for the operation, maintenance and support of the Works during its entire operational phase until disposal and decommissioning.

The *Contractor* shall, during the progress of and upon completion of the Works, supply the Information required in terms of the Contract and all such Information as may usually be supplied in connection with similar Works, including, whether or not specified in the Contract, all Information necessary or useful for:

1. Design reviews and the interface management of the Works with the Project Works;
2. Quality assurance and control; and

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3. The operation, maintenance, support, inspection, integrity management, training and technical optimization of the Works, over the lifecycle thereof.

The scope of supply of Information from the *Contractor* shall include drawings, documents, lists and data according to the types defined in Table 10 below:

<b>Table 19: Typical Document Requirement List</b>	
<b>Document Group</b>	<b>Description of document type (includes information data sets)</b>
General	Equipment arrangement drawings Piping & Instrument Diagrams (P&ID's) Material handling flow diagrams Engineering and procurement schedule Equipment list Drawings Valve list Pipeline list Hanger list 3D model Interface list Equipment specifications & data sheets Drawings and data for all equipment and material Installation, Operation, and Maintenance (IOM) Manuals Spare parts list Factory Acceptance Test (FAT) report
Quality Assurance	Quality assurance manual Quality control plans Quality control reports Weld summary index Material traceability certificates Manufacturing test reports Manufacturing Non-Conformance Reports (NCR's)

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<b>Table 19: Typical Document Requirement List</b>	
<b>Document Group</b>	<b>Description of document type (includes information data sets)</b>
Civils & Structures	Site Layout Geotechnical Investigation Report Building arrangement and floor layouts Structural drawings Architectural drawings Structural analysis and design report Foundation drawings Structural support drawings Access Platform/Walkway Drawings
Construction	Transportability study/report (including heavy haul study) Site management plan (QA, Safety, Environmental etc.) Construction schedule Site storage requirements for major equipment Construction test records (hydrotest, concrete strength, pile integrity test, etc.) Maintenance records for all equipment while stored on site Constructability report
Commissioning	Commissioning schedule Test & Evaluation Master Plan (TEMP) Commissioning procedures Commissioning database Performance test procedure Performance test reports Field test reports and certificates

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<b>Table 19: Typical Document Requirement List</b>	
<b>Document Group</b>	<b>Description of document type (includes information data sets)</b>
Operations	Operating procedures Plant operational documentation Plant tech specs Incident & upset mitigation procedures Operating scenarios (for C&I control purposes)
Logistic Support	Maintenance concept Plant maintenance documentation ISI plan/program Spare parts assessment Equipment access and removal paths assessment Fault finding diagrams
Training	Training plan Training manuals and instructions
Safety & Protection	Fire hazard analysis Waste management plan
Design Analyses	Reliability model and analysis Transient / Transition Analysis Flow dynamics analysis Thermo-hydraulic analysis Pipe Stress Analysis Maintainability analysis 3D model interference checks

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Table 19: Typical Document Requirement List	
Document Group	Description of document type (includes information data sets)
Electrical	<ul style="list-style-type: none"> <li>Motor list</li> <li>Electrical load list</li> <li>Circuit list</li> <li>Raceway list</li> <li>Single line diagram</li> <li>Protection schematic diagram</li> <li>Electrical load flow and fault studies report</li> <li>Cable block diagrams</li> <li>Cabling routing and cable racking layout diagrams</li> <li>Cable termination diagrams</li> <li>EMC and earthing standards report</li> <li>Earthing layout drawings</li> <li>Lighting layout drawings</li> </ul>
C&I	<ul style="list-style-type: none"> <li>Alarm and set-point schedule</li> <li>Instrument schedule</li> <li>Instrument data sheets</li> <li>Mechanical hook-up drawings</li> <li>Electrical hook-up drawings</li> <li>Cable Schedule</li> <li>Termination Schedules</li> <li>Junction Box GA and Internal Layout</li> <li>Junction Box and Instrument location drawings</li> <li>Instrument Stand GA</li> <li>Maintenance Manuals and procedures</li> <li>Operating and Control Philosophies</li> <li>Functional Logic diagrams</li> <li>Field device calibration certificates</li> <li>Level measurement installation report</li> </ul>

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In addition to the official documentation submittals listed in Appendix D, the *Contractor* shall provide additional information for review and design coordination as requested by the Employer from time to time.

The *Contractor* shall use the Employer's SmartPlant Environment and all design tools as the delivery mechanism for all project data and document deliverables. The EDMS and design tools shall be provided to the *Contractor* pre-configured based on Employer's data handover requirements. Any project data and document deliverables not generated from design tools provided by the Employer shall be supplied in a format specified by the Employer.

#### **3.3.4.1.1.5 Design Review Documentation**

The Employer reviews the *Contractors* submitted documents and ensures adherence to the Works and that a technically sound design approach is incorporated. Specific information required from the vendors during tender phase is set-out in the Vendor Document Submittal Schedule, Appendix B.

After a contract is established, the *Contractor* proceeds in the detail design phase. Each document requires a transmittal note from the vendor. Employers review cycle is in-line with FIDIC contract requirements and is finalized during contract negotiations with the *Contractor*. Appendix D lays out the specific documents requiring Employers approval before the *Contractor* can proceed with design, fabrication and construction activities.

The *Contractor* is the Design Authority as defined in the Design Review Procedure (240-53113685). The *Contractor* is responsible for following this design procedure and conducts all the design reviews as specified in this procedure. The *Contractor* is responsible for conducting the following design reviews:

1. Design Freeze Review
2. System Integrated Design Review
3. Pre-Commissioning Review
4. Acceptance testing Review
- 5 Handover Review

The *Contractor* shall conduct design reviews as per the *Contractors* official design review procedure. *Contractor* further takes note of the Employers Design Review Procedure (240-53113685) and participates in all design reviews as specified by the Employer. The Employer may "Accepted"; "Accept with Comments" or "Rejected". If required, the *Contractor* makes the necessary revisions on the documentation and ensures acceptance is obtained from Employer. The *Contractor* includes these design reviews as part of the schedule and suggests appropriate timing for such reviews.

#### **3.3.4.1.1.6 Identification of the Documentation**

The *Contractor* shall ensure that document has the following minimum attribute on the cover page:

- Title of the document
- Document Unique Identification number (Eskom number)
- *Contractor* Document number, if applicable
- Document status
- Revision number
- Document Type
- Document security level

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- Document revision table/history
- Page number on the footer
- Document Author/Authoriser/
- Document Originator *Contractor*

The following additional attributes are important for technical documents:

Package/System name, sub-system if applicable

- Unit/s number
- *Contractor* name
- *Contractor* number
- Plant Identification Codes

#### **3.3.4.1.1.7 Format and Layout of Documents**

For consistency it is important that all documents used within a specific domain follow the same layout, style and formatting standard.

#### **3.3.4.1.1.8 Layout and Typography**

Every document should comply with the following font specifications:

- Font Colour: Black
- Main Headings Font Type: Arial, Bold, Capital Letters
- Main Heading Font Size: 12pt
- Sub Headings Font Type: Arial, Bold, Title Case
- Sub Headings Font Size: 11pt
- Body Font Type: Arial, Sentence Case i.e., only the first letter of the first word is a capital letter.
- Body Text Font size: 11pt
- Line Spacing: 1.5 line spacing
- Margins: standard
- Alignment: full justification to be used
- Paragraphing: one line skip between paragraphs
- Pagination: centred page numbers (about 0.5 inches from bottom)
- Indentations: standard tab for all paragraphs (about 0.4 to 0.5 inches)

#### **3.3.4.1.1.9 Document Headers**

The header should include the project name, document title, document number, revision number and page number.

#### **3.3.4.1.1.10 Naming of files**

The *Contractor* will comply with the Eskom standard for naming documentation files. The standard is as follows:

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For documents that have approval date and signature

(YYYYMMDD\_DocType\_DocumentTitle\_UniqueIdentifier\_Revision.FileExtention)

For documents that do not necessarily require the 'Approved Date' and 'Revision & Versioning', use the date of update

(YYYYMMDD\_DocType\_DocumentTitle\_UniqueIdentifier\_Revision.FileExtention)

All further requirements shall be according to IEC 61355 – 1:2008 (Edition) Classification and designation of documents for plants, systems and equipment – Part 1: Rules and classification tables.

### 3.3.5 Configuration Management

The *Contractor* supplies a comprehensive configuration management program according to ISO 10007 (2<sup>nd</sup> Edition) to ensure that plant structures, components and computer software conform to approved design requirements. However, a project specific Configuration Management Plan document will be developed which will be aligned to ISO 10007. In addition, the Works as-built physical and functional characteristics shall be accurately reflected in selected documents and databases, including those for design, procurement, construction, operation, testing and training. The configuration program shall be applicable for use throughout all phases of the project life cycle, including management of spare parts, replacement parts and product upgrades, and shall form part of deliverables for hand-over to the Employer for use during the operation and maintenance phases of the plant.

#### 3.3.5.1.1.1 KKS Classification System

##### I. Plant Codification

The KKS system shall be used by the *Contractor* for classifying and designating both plant and their associated documents. All technical documentation as per "Technical documentation classification and designation standard – 240-54179170" shall contain a KKS code as part of the documentation identification relevant to the plant equipment. All plant (Process, electrical, C&I and Civil) shall be coded to KKS breakdown level 3. The KKS code shall contain break down level 1, break down level 2 and breakdown level 3. Omission of any break down level shall not be permitted. The system shall be applied from the concept stage until project closeout. The rules specified in the VGB guidelines will be used but all rules specified in Eskom documents will take precedence.

Detailed nameplate or label list with the service legends and including the KKS Code shall be prepared by the *Contractor* and submitted to the Project Manager for review and comment before commencing manufacture of the labels. All maintainable plant equipment and components shall be labelled including pipework.

The rules for applying the KKS and the KKS codes are contained in the Eskom Standard 240-93576498 and in the publication KKS power plant classification (B105e) 5th Edition 2003 published by Verlag VGB PowerTech Service GmbH (Essen), and the KKS Applications: Guideline and explanations A, B1-4 (B106e).

The *Contractor* shall use Eskom –specific interpretations of the KKS standards, which will be reviewed and agreed on after Contact Award. The following variations relating to 240-93576498 are noted.

- Breakdown level 3 component code -> not used in P&ID's and PFUP's, only used by control hardware supplier
- Breakdown level 0: will be shown as a general remark on the P&ID not on the individual KKS number
- F0-level is not used; FN level is free -> no general decoding system

The *Contractor* shall code all plant within scope of supply according to the KKS Classification System to Breakdown Level 3 where possible. The relevant KKS codes thus allocated shall appear on all plant related documentation, drawings, lists and correspondence.

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The *Contractor* shall be responsible for ensuring the accuracy, completeness and consistency of the designations in all documents. This applies both to designations within documents (plant designations) and of Documents (documents designations). The *Contractor* shall submit these for the Engineer's approval.

A list of the KKS designations allocated shall be drawn up by the *Contractor* for each scope of delivery. Methods of KKS designation, list formulation and submission format shall be proposed by the *Contractor* and agreed by the engineer.

The *Contractor* shall, as soon as possible after the contract has been placed, provide the engineer with the following: -

- Outline drawings or diagrams showing the *Contractor* reference
- Coding for systems and equipment.
- In respect of items procured by the *Contractor* from another
- Manufacture or vendor, the *Contractor* shall provide the name of
- The actual manufacturer and his coded drawing or reference
- Numbers and relevant technical data for identification purposes.

## **II. Plant Labelling**

The *Contractor* manufactures and installs labels according to 240-71432150 - KKS Plant Labelling and Equipment Descriptions Standard. Any abbreviations to plant descriptions shall be prepared in accordance to Eskom standard. VGB 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.

Any abbreviations to plant descriptions shall be prepared in accordance to the Employer's abbreviation standard, 240-109607332. 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.

### **3.3.6 Materials**

The *Contractor* is to provide the necessary resources, equipment and materials required for the performance of *Works* specified herein.

### **3.3.7 Project Schedule**

As *Works* need to be assessed by The *Engineer* for issuance of Certificates of Compliance, the *Engineer* must monitor the *Works*. The *Contractor* shall submit a proposed work schedule and timeline for carrying out the *Works* to the *Engineer* for the purposes of assigning an observer or dedicated person to oversee the *Works*. The *Contractor* shall notify the *Engineer* timeously should there be any changes in the submitted programme. The *Contractor* shall also acquaint themselves with the work involved and verify all quantities, materials etc. necessary to undertake the *Works*, for proper programming and co-ordination.

### **3.3.8 Reporting**

The *Contractor* shall inform the *Engineer* of any defects that are noted and not detailed in the inspection reports. Issues identified during implementation of works shall be raised with the *Engineer*. Meetings shall be held between the *Engineer* and the *Contractor* as and when required to discuss matters relating to the remedial *Works*. The *Contractor* shall also advise on changes or modifications should these be

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necessitated. The *Contractor* shall notify the *Engineer* before any modifications are carried out in the plant. The *Contractor* shall also submit to the *Engineer* the following documentation during implementation/completion of *Works*:

- i) Updated work schedules/programmes
  - Changes to the schedule shall be communicated to the *Engineer* timeously
- ii) Drawings used to complete the works
  - The *Contractor* shall specify all drawings required to complete the *Works* and also ensure that the latest revisions of drawings are used when performing work.
- iii) Quality assurance checklist
  - The *Contractor* shall keep and submit all test results records, commissioning programs, procedures and results
- iv) Photographic record of works done showing the condition of the structure
  - Photographs showing the remedial works done on the structures shall be submitted to the *Engineer*

### **3.3.9 Codes and Standards**

*Works* shall be done in accordance with prescribed Eskom standards, applicable codes of practice, specifications and regulations. Reference to standards or manuals of any society, organization, or association, whether such reference is specific or by implication, shall mean the latest standard, manual, or code in effect at the time of Contract Award. All works shall also be conducted in terms of the OHS Act, Eskom Kusile Project Specific Safety Plan etc.

### **3.3.10 Tolerances**

Tolerances shall be as specified in the relevant clauses of the applicable sections of the SANS standards and specifications. The *Contractor* shall ensure that tolerances are complied with.

### **3.3.11 Testing**

#### **3.3.11.1 Testing Requirements**

During the progress of *Works*, tests will be conducted on materials to ensure compliance with the requirements of the specifications as well as provide assurance of the quality of construction. The following tests shall be conducted but not be limited to the following;

- i) Field and laboratory testing associated with the construction i.e. concrete and earthworks
- ii) Operability of the system i.e. flow tests

The *Contractor* shall be responsible for the specified testing of the *Works*. The use of materials without the *Engineer's* written approval constitutes a default on the part of the *Contractor*. The *Engineer* shall take or conduct independent testing should it be necessary. The *Contractor* shall be liable for reinstatement of works in areas requiring this.

#### **3.3.11.2 Test Procedures, Records and Equipment**

The *Contractor* is responsible to supply copies of the following:

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- i) All soils and stones laboratory and field test results
- ii) All dimensional and level measurements
- iii) All field moisture content measurements and compaction densities
- iv) Calibration Certificates of all testing equipment

The *Contractor* is to ensure that all testing equipment have a valid calibration certificate. No testing equipment is to be used with an expired calibration certificate. Any *Works* that have been tested with such equipment will require retesting. Any rework required after testing will be the expense of the *Contractor*.

### **3.3.12 Cost of Testing**

The cost of testing undertaken by the *Contractor* in terms of his obligations under the contract for purposes of process control, including the taking of samples, reinstating where samples have been taken and all testing equipment, labour, materials, etc. is included in the rates tendered for the various items of work supplied and will not be paid for separately.

### **3.3.13 Certification of All Structures**

Upon completion of remedial *Works*, the *Contractor* shall submit to the *Engineer*, all the necessary documentation as specified herein. If works are done to the satisfaction of the *Engineer*, a Certificate of Completion shall be issued.

### **3.3.14 General**

- i) The *Contractor* shall carry out works as per applicable drawings, codes of practice, standards, specification and regulations
- ii) All *Works* performed by the *Contractor* will be subject to an inspection
- iii) The *Contractor* shall execute the *Works* as per the submitted schedule or as agreed between the *Contractor* and *Engineer*.
- iv) Meetings shall be held between the *Contractor* and *Engineer* as and when required, to discuss matters relating to the *Works*.
- v) Remedial *Works* shall be performed at the highest standard and satisfaction of the *Engineer*. The *Engineer* shall have the authority to reject any work and materials, which is not in full accordance with best practices and approved standards and codes.

### **3.3.15 Quality Requirements**

- i) The *Contractor* shall submit a copy of their ISO 9001:2008 or 2015 certificate (If certified)
- ii) The *Contractor* shall submit a copy of an internal management system report. This should include non-conformities, corrective and preventive actions.
- iii) The *Contractor* shall submit a copy of an external management system audit report. This should include non-conformities, corrective and preventive actions.
- iv) The *Contractor* shall provide a draft quality plan, addressing the minimum requirements as per ISO 10005

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- v) The *Contractor* shall provide an example of an inspection and test plan (ITP) or quality control plan (QCP) addressing the minimum requirements as per ISO 10005
- vi) The *Contractor* shall provide an appointment letter and curriculum vitae/resume of its Quality Management representative.
- vii) The *Contractor* shall provide a signed organisational structure & quality department reporting structure.
- viii) The *Contractor* shall provide copies (minimum three) of its customer satisfaction survey reports – these reports must not be more than two years old.
- ix) The *Contractor* shall supply evidence in the form of a proposal and/ assessment results of any recognised national or international business excellent model, should it exist.

## **4 COMMISSIONING & HANDOVER**

The *Contractor* shall be responsible for commissioning of all *Works* associated with the contract as per this scope of *Works*.

### **4.1 C&I COMMISSIONING REQUIREMENTS**

The new C&I system shall be tested and commissioned using the existing strategies at Kusile. The standard that shall be followed is: IEC 62381: Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT). Namely, the following activities will be carried out:

- FAT – Factory Acceptance Testing
- SIT – Site Integration Testing
- Cold Commissioning
- Hot Commissioning
- Final Acceptance Testing

A testing procedure and plan shall be developed and carried out during the testing and commissioning phase of the project. Defects shall be noted and addressed by the relevant parties. Commissioning the entire control loop shall also be done using commissioning procedures that will be developed within the testing and commissioning phase of the project.

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## **4.2 LPS COMMISSIONING REQUIREMENTS**

Contractor is fully responsible for all commissioning and start-up activities for the BOP mechanical systems installed by the Contractor, including, but not limited to, all craft labour and supervision. The Employer will provide assistance for coordination with other interfacing packages. Instrument calibration and checkout for instruments not furnished by the Contractor will be performed by others.

Contractor shall field performance test all centrifugal pumping systems. The system's pumps shall be tested in single and parallel operation. Contractor shall furnish all labour, materials and test equipment inclusive of temporary piping, valves, instruments, etc. Testing shall be performed in accordance with ISO 9906 and any allowances made for inaccuracies due to site testing shall be approved by the Engineer.

## **5 DESIGN REVIEWS AND CHANGE MANAGEMENT**

### **5.1 DESIGN REVIEWS**

The *Employer* reviews the *Contractors* submitted documents and ensures adherence to the Works and that a technically sound design approach is incorporated. Specific information required from the vendors during tender phase is set-out in the Vendor Document Submittal Schedule, in Appendix D

After a contract is established, the *Contractor* proceeds in the detail design phase. Each document requires a transmittal note from the vendor. *Employers* review cycle is in-line with contract requirements and is finalised during contract negotiations with the *Contractor*. Appendix D lays out the specific documents requiring *Employers* approval before the *Contractor* can proceed with design, fabrication and construction activities.

The *Contractor* is the Design Authority as defined in the Design Review Procedure (240-53113685). The *Contractor* is responsible for following this design procedure and conducts all the design reviews as specified in this procedure. The *Contractor* is responsible for conducting the following design reviews:

- Design Freeze Review
- System Integrated Design Review
- Pre-Commissioning Review
- Acceptance testing Review
- Handover Review

The *Contractor* conducts design reviews as per the *Contractors* official design review procedure. *Contractor* further takes note of the *Employers* Design Review Procedure (240-53113685) and participates in all design reviews as specified by the *Employer*. The *Employer* may "Accepted"; "Accept with Comments" or "Rejected". If required, the *Contractor* makes the necessary revisions on the documentation and ensures acceptance is obtained from *Employer*. The *Contractor* includes these design reviews as part of the schedule and suggests appropriate timing for such reviews.

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## **5.2 ENGINEERING CHANGE PROCEDURE**

All Design change management shall be performed in accordance to the latest revision of the Kusile Engineering Change Management Work Instruction (240-132735850) and the *Employer* shall ensure that *Contractor* is provided with latest revisions of this procedure. Any uncertainty regarding this procedure should 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).

## **5.3 HANDOVER**

Apart from any statutory data packages required, the *Contractor* also compiles and supplies a data package of the relevant drawings, test certificates etc. to the *Employer's* Representative for acceptance.

- 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
- Pile Integrity Test Results (if required)
- Pile Load Test Results (if required)
- Foundation Certificate
- Welding procedure specifications
- Welder qualifications
- Non-destructive weld test results
- Weld test certificates
- Steel grade certificates
- Bolt grade certificates
- Hydrostatic tests of the pipe and tank
- Pre-concrete and post concrete surveys
- As-built data and drawings of the completed Works upon handover. As-built drawings are submitted in PDF and DWG formats
- Structural Certificate signed by the *Contractor's* Professionally Registered Engineer confirming that structure has been constructed in accordance with the design

Detailed handover requirements will be as per the requirements defined in the Kusile Project "240-128515850 - Documentation Handover Specification". As a minimum the *Contractor* will provide the *Employer* with the back-ups and information to completely replicate the *Contractor's* SmartPlant instance on the *Employer's* environment. Any uncertainty regarding this process should be clarified with the *Employer*.

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SPEL and SPI Data will be captured as defined by the both the Electrical and Control & Instrumentation Centre of Excellence, respectively, during contracting phase. All terminations will be captured as per the *Employer's* data template.

The *Contractor* shall use the documentation list to compile the MDL.

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## 6 DRAWINGS

The latest revisions of the following listed drawings are included as Attachments and shall form part of the Employer's Documents.

**Table 20 : Manhole Drawings/Tables**

Drawing No.	Rev No.	Title
P146838-0GME-M1646L	0	ADDD Leak Detection Sump Pumps Piping Details – Sump 2
P146838-0GME-M1646M	0	ADDD Leak Detection Sump Pumps Piping Details – Sump 1
P146838-0GME-M1646J	0	RWR Leak Detection Sump Pumps Piping Details – Station 2
P146838-0GME-M1646K	0	RWR Leak Detection Sump Pumps Piping Details – Station 1
P146838-0GME-M2646W	0	Pumping and Instrument Diagram – Leak Detection Sumps
146838-0GME-M4646EI	0	Detailed Piping Isometric Ash Dirty Dam Leakage Detection Piping
146838-0GME-M4646EJ	0	Detailed Piping Isometric Ash Dirty Dam Leakage Detection Piping
146838-0GME-M4646EL	0	Detailed Piping Isometric Raw Water Reservoir Leakage Detection Piping
146838-0GME-M4646EM	0	Detailed Piping Isometric Raw Water Reservoir Leakage Detection Piping
146838-0UXC-S3300	19	Terrace Underground Facilities-Site Keyplan, General Gotes and Legend
146838-0UXC-S3387	1	ADDD Leak Detection Sump Pumps - Pipe Routing
146838-0UXC-S3393	1	RWR Leak Detection Sump Pumps – Pipe Routing
146838-0UXC-S3397	0	RWR Leak Detection Sump Pumps – Pipe Routing
146838-0GUA-S3152	4	Terracing – Site Drainage Details
0BBS-E1285		Single line drawing for mini-substation (02BBS)
0UYX-E1903		Single line drawing for mini-substation (00BBN03)
0UYX-S3816		Site Electrical Underground Facilities : Area 6
0UXC-E2289B		Site Electrical Underground Facilities : Area 87
P146838-0ETN-M2662C		Pumping and Instrument Diagram- Ash System Dust Suppression
P146838-0ETN-		Pumping and Instrument Diagram- Ash System Dust

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<b>Drawing No.</b>	<b>Rev No.</b>	<b>Title</b>
M2662D		Suppression
P146838-0ETN-M4662UA	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UB	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UC		Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UD	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UE	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UF	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UG	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UH	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UI	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UJ	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UK	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0ETN-M4662UL	0	Detailed Piping Isometric Ash System Dust Suppression
P146838-0UXC-S5480	13	Pipe pedestals at the Ash Dump Pump House
P146838-0UXC-S9480D	2	Rebar details for pedestals
P146838-0UXC-S5459	0	Plan view of the pedestal location for the piping
P146838-0UXC-S3387	R11	Pipeline routing as per cross hatched section
P146838-0ETN-M4662-4L Model	0	Pipe Support Ash Systems Dust Suppression
P46838-0ETN-M4662-4Q Model	0	Sysem Isometric Ash Systems Dust Suppression

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## 7 SPECIFICATIONS FOR THE WORKS

### General codes and standards:

Work performed under these specifications is done in accordance with the following codes and standards or equivalent International codes and standards approved by the Engineer. In the event codes and standards are listed in the table below but not listed in technical sections, Contractor shall comply with the codes and standards in the table below. The *Contractor* is required to adhere to the latest editions and the normative references within the following SANS and Eskom standards and other codes of practice, regulations & standards:

**Table 21. General codes and standards**

Code	Description
(OHASA) 85	Occupational Health and Safety act
National Water Act 36	National Water Act 36, 1998, Section 19 and Section 20.
IWULA	IWULA technical report
ESK AM AAA 1	Eskom Corporate Identity Manual
ESK AM AAA 1	Interior Specifications
DSP 0024	Eskom Specification: Specification for security fences at distribution substations and buildings
32/1163	Water Management Policy
QM58	Supplier Quality Management: Specification

**Table 22. Civil & Structural codes and standards**

In addition to the standards listed in Section 3.1.2 the latest revisions of the following documents are adhered to.

SANS	All relevant South African National Standards – to be detailed further in Concept Design Phase
240-57127953	Execution of Site Preparation and Earthworks Standard
240-57127955	Geotechnical and Foundation Engineering Standard
240-56364545	Structural Design and Engineering Standard
	A Guide to Practical Geotechnical Engineering in Southern Africa 4th Edition 2008 – “Franki”
203-770	Kusile Specification for Structural Concrete

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**Table 23.** Mechanical codes and standards

<b>Work</b>	<b>In Accordance With</b>
Materials for piping and application of piping materials	The most current edition of the ASME Code for Pressure Piping, B31.1, Power Piping, including all addenda thereto
Sizes, schedule numbers, and dimensions of carbon steel and alloy steel pipe, and stainless steel pipe schedules not covered by ANSI B36.19M	ASME B36.10M
Sizes and dimensions of stainless steel pipe designated as Schedule 5S, 10S, 40S, or 80S	ASME B36.19M
Wall thickness tolerances for carbon steel and alloy steel pipe	ASTM A530
Manufacturing standard for mechanical joint and push-on joint ductile iron pipe	ANSI/AWWA C151/A21.51
Manufacturing standard for flanged ductile iron pipe	ANSI/AWWA C115/A21.15
Polyethylene tubes for protection of ductile iron pipe that will be installed underground	ANSI/AWWA C105/A21.5
Cement linings for ductile iron pipe	ANSI/AWWA C104/A21.4
Manufacturing standards for plastic lined pipe and fittings	
High density polyethylene (HDPE) pipe	ASTM F714
Butt weld fitting manufacturing standard	ASME B16.9 and ASME B16.28
Socket-weld and threaded forged steel fittings manufacturing standard and minimum pressure class ratings	ASME B16.11
Steel castings for pipe system components	In accordance with Technical Supplemental Specification Q400
Cast iron fittings for use with plastic lined or rubber lined pipe	ASME B16.1, Class 125
Ductile iron fittings for use with plastic lined or rubber lined pipe	ANSI/AWWA C110/A21.10
Welding specification	EN 288
Class II welding	BS 2971
Welding adapters	Paragraph 104.3 of ANSI/ASME B31.1
Mild steel pipe fittings	JIS B 2311-82
Manufacturing standard for cast iron fittings for use with lined steel pipe	ASME B16.1

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Manufacturing standard for ductile iron fittings for use with lined steel pipe	ANSI/AWWA C110/A21.10
Manufacturing standard for cast iron and ductile iron flanged fittings	ANSI/AWWA C153/A21.53
Manufacturing standards for mechanical joint and push-on joint ductile iron and cast iron fittings	ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.1
Petroleum asphaltic coatings for cast iron and ductile iron pipe fittings	ANSI/AWWA C153/A21.53
Cement linings for cast iron and ductile iron pipe fittings	ANSI/AWWA C104/A21.4
PVC fittings	ASTM D2466 or ASTM D2467 corresponding to the pipe schedule with which they will be used
CPVC fittings	ASTM F438 or ASTM F439 corresponding to the pipe schedule with which they will be used
Braze joint fittings for use with copper tubing	ASME B16.22
Steel flange construction requirements	ASME B16.5
Cast iron and ductile iron flange construction requirements	ANSI/AWWA C115/A21.15
Compressed fibre gaskets and rubber gaskets	ASME B16.21
Ring joint gaskets	ASME B16.20
Flange bolting requirements - alloy steel bolting	ASME B16.5
Flange bolting requirements - carbon steel bolting	ASME B16.1
Carbon steel bolting dimensional standards	ASME B18.2.1 and ASME B18.2.2
Cleaning interior surface of carbon steel pipe	PFI Standard ES-5, Articles 4.2.1 and 4.2.2
Abrasive shot blast cleaning	PFI Standard ES-29 (sand or silica bearing blasting materials are not allowed)
Piping and materials used for potable water service	NSF 61
Occupational Health and Safety Act	No. 85 of 1993
Pressure Equipment	Pressure Equipment Regulations
Cast iron fittings threaded to ISO 7-1	SANS 14
Steel Pipe up to 150 NB	SANS 62
Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles Specification and Test Method	SANS 121
Cast Steel Gate Valves	SANS 191
Radiographic Examination	SANS 394
Code of Practice for Thermal Insulation of Pipework and Equipment in the Temperature Range -100C to +870C	SANS 612
Cast Iron Gate Valves for Waterworks	SANS 664

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Cast Iron Gate Valves for General Purpose	SANS 665
Electric welded low carbon steel pipe 200 NB and above	SANS 719
PVC-M fittings	SANS 966 Part 2
Ball Valves Part 1: Fire-Safe Valves	SANS 1056-1
Ball Valves Part 2: Heavy Duty Valves (Not fire-safe)	SANS 1056-2
Ball Valves Part 3: Light Duty Valves (Not fire-safe)	SANS 1056-3
Pipe Threads Where Pressure Tight Joints are Made on the Threads	SANS 1109
Steel Pipe Flanges	SANS 1123
Symbolic Safety Signs	SANS 1186
Check Valves	SANS 1551
Fasteners	SANS 1700
Water Supply & Distribution System Components Part 31: Automatic Control Valves	SANS 1808-31
Butterfly Valves for General Purpose	SANS 1849
Part 1: Storage and Distribution of Petroleum Products in Above-Ground Bulk Installations	SANS 10089-1
Above-Ground Storage Tanks for Petroleum Products	SANS 10131
HDPE Piping	SANS 4427
240-123801640	Standard for Low Pressure Pipelines
240-105020315	Standard for Low Pressure Valves
240-106628253	Standard for Welding Requirements on Eskom Plant
240-83539994	Standard for Non-Destructive Testing (NDT) on Eskom Plant
240-123801640	Standard for Low Pressure Pipelines

**Table 24.** Electrical codes and standards

<b>Code</b>	<b>Description</b>
240-55714363	Coal Fired Power Station Lighting & Small Power Installation Standard
240-56227443	Requirements for Control and Power Cables for Power Station Standard
240-56356396	Earthing and Lightning Protection Standard
240-56355888	Temperature Measurement System Installation Standard

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240-57617975	Procurement of Power Station low Voltage Motors Specification.
240-56360387	Storage of Power Station Electric Motors Standard
240-56361435	Transport of Power Station Electric Motors Standard
240-56227516	LV Switchgear Cntr Gear Assembly Associated Equipment for Voltage 1000V A 1500V
240-56227589	List of Approved Electronic Devices to be Used on Eskom Power Stations Stan
240-56227516	LV Switchgear and Control Gear Assemblies and Associated Equipment for Vo Up To and Including 1000V AC and 1500V Standard
474-11542	Generation Plant General Electrical Specification
IEC 62381	FAT and SIT Requirements
IEC 62382	Electrical and Instrumentation Loop Checks

**Table 25. C&I codes and standards**

<b>Code</b>	<b>Description</b>
32-373	Remote Access Standard
200-16714	Commissioning Procedure (Medupi)
240-43156827	Introduction to the Welding Rulebook (Rev 0)
240-49230046	Failure Mode and Effects Analysis Guideline
240-49230111	Hazard and Operability Analysis Guideline
240-56227443	Requirements for Control and Power Cables for Power Stations
240-56355466	Alarm Management System Guideline (Rev 1.0)
240-56355729	Plant Control Modes Guideline
240-56355731	Environmental Conditions for process control equipment
240-56355754	Field Instrument Installation Standard
240-56355815	Junction Boxes and Cable Termination Standard
240-56355843	Pressure Measurement Systems Installation Standard
240-56356396	Earthing and Lightning Standard
IEC 62381	FAT and SIT Requirements
IEC 62382	Electrical and Instrumentation Loop Checks

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240-56356411	Fire Barrier Seals for Electrical Cable Installations
203-336	Station Cable and Racking
200-11757	Medupi Earthing Concept

**Table 26.** System Integration codes and standards

<b>Code</b>	<b>Description</b>
240-53114186	Document and Record Management Procedure
240-132735850	Kusile Engineering Change Management Procedure
ISO 10007:2003	Guidelines for Configuration Management
ISO 10007:2003	Guidelines for configuration management
VGB-B 105 E	KKS Guidelines
VGB-R 171e	VGB Guideline - Supply of Technical Documentation for Fossil-fired and Regenerative Powers Stations
240-86973501	Engineering Drawing Standard Common Requirements
240-4417997	Documentation Preservation Standard
240-52843902	Engineering Terms and Abbreviation Standard for Eskom Power Plants
240-71432150 Rev 2	KKS Plant Labelling and Equipment Descriptions Standard
240-72273656	Power Generation Asset Criticality Classification Standard
TBG	KKS Key Part - Fossil Power Plant
TBG	Plant Breakdown Structure Guideline
240-64550692	Labelling Specification and Plant Coding Procedure
IEC 61355-1	Classification and designation of documents for plants, systems and equipment
VGB-B 106A E	KKS - Application Explanations Part A - Identification system for Power Stations
VGB-B 106 B1 E	KKS - Application Explanations Part B & Part B1 - Identification in Mechanical Eng.
VGB-B 106 B2 E	KKS - Application Explanations Part B & Part B2 - Identification in Civil Engineering.
VGB-B 106 B3 E	KKS - Application Explanations Part B & Part B3 - Identification in Elec and Control and instr. Eng.
VGB-B 106 B4 E	KKS - Application Explanations Part B & Part B4 - Identification of instrumentation and control tasks

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240-53113685	Design Review Procedure
240-49230111	Hazard and Operability Analysis Guideline
240-54179170	Technical Documentation Classification and Designation Standard
240-107305502	Data Take on Standard
240-53114186	Technical Documents and Records Management Work Instruction
240-132735850	Kusile Engineering Change Management Work Instruction
240-86973501	Engineering Drawing Standards – Common Requirements
240-54179170	Technical Documentation Classification and Designation Standard
240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
240-53114186	Project / Plant Specific Technical Documents and Records Management Procedure
240-58552870	SmartPlant for Owner Operators (SPO) Documentation Metadata Standard
240-107305502	SmartPlant Data Take-On Standard
240-109607332	Abbreviation Standard for Labelling of Plant at Power Stations
240-93576498	Eskom KKS Standard
PGZ 45-25	Eskom FMECA Guideline
SANS 10143	
IEC 61355– 1:2008	Classification and designation of documents for plants, systems and equipment – Part 1
	KKS Power Plant Classification (B105e) 5th Edition 2003 Published by Verlag VGB PowerTech Service GmbH (Essen)
ISO 10007(2nd Edition)	
240-52844017	System Reliability, Availability and Maintainability Analysis Guideline

**Table 27: General Codes & Standards**

<b>Number</b>	<b>Title</b>
240-56364545	Structural Design and Engineering Standard
240-84418186	Road Specification Manual
240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
240-86973501	Engineering drawing Standard

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240-56356396	Eskom Earthing and Lightning Protection standard
240-66920003	Documentation Management Review and Handover Procedure for Gx Coal Projects
203-103437	Technical Document Submission and Review Work Instruction
AWS D1.1	American Welding Society - Structural Welding Code - Steel
SANS 10044-1	Welding Part 1: Glossary of terms
SANS 2553	Welded, brazed and soldered joints - Symbolic representation on drawings
SANS 9606-1	Approval testing of welders - Fusion welding Part 1: Steels
SANS 10064	The preparation of steel surfaces for coating
SABS 471/ SANS 50413 & SANS 50196	Portland cement (ordinary, rapid hardening and sulphate resisting)
SANS 50196-1	Methods of testing cement Part 1: Determination of strength (EN 196-1:2005, IDT, Ed. 2)
SANS 50196-2	Methods of testing cement Part 2: Chemical analysis of cement
SANS 50196-3	Methods of testing cement Part 3: Determination of setting times and soundness
SANS 50196-4	Methods of testing cement Part 4: Quantitative determination of constituents
SANS 50196-5	Methods of testing cement Part 5: Pozzolanicity test for pozzolanic cement
SANS 50196-6	Methods of testing cement Part 6: Determination of fineness
SANS 50196-7	Methods of testing cement Part 7: Methods of taking and preparing samples of cement
SANS 50197-1	Cement Part 1: Composition, specifications and conformity criteria for common cements
SANS 50197-2	Cement Part 2: Conformity evaluation
SANS 1083	Aggregates from natural sources - Aggregates for concrete
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 2001-CS1	Construction works Part CS1: Structural steelwork
SANS 2001-EM1	Construction works Part EM1: Cement plaster
SANS 5831	Presence of chlorides in aggregates
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

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SANS 5864	Concrete tests - Compressive strength of hardened concrete
SANS 10400	The Application of the National Building Regulations
240-106365693	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
240-101712128	Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings
TRH 14	Guidelines for Road Construction Materials
SANS 1200 DM	Standardized specification for civil engineering construction Section DM: Earthworks (roads, subgrade)
SANS 1200 G	Standardized specification for civil engineering construction Section G: Concrete (structural)
SANS 1200 GA	Standardized specification for civil engineering construction Section GA: Concrete (small works)
SANS 1200F	Standardized specification for civil engineering construction Section F: Piling
SANS 10120-2F	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 2: Project specification Section F: Piling
SANS 10120-3F	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 3: Guidance for design Section F: Piling
SANS 10120-4F	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 4: Typical schedule of quantities Section F: Piling
SANS 10120-5F	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 5: Contract administration Section F: Piling
SANS 10085-1	The design, erection, use and inspection of access scaffolding Part 1: Steel access scaffolding
SANS 10100-1	The structural use of concrete Part 1: Design
SANS 10400-H	The application of the National Building Regulations Part H: Foundations
SANS 282	Bending dimensions and scheduling of steel reinforcement for concrete
EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges
ASME/ ANSI B16.5	Pipe Flanges and Flanged Fittings
API 650	Welded Tank for Oil Storage
AWWA D100-05	American Water Works Association – Welded Carbon Steel Tanks for Water Storage

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## **8 AUTHORISATION**

This document has been seen and accepted by:

<b>Name &amp; Surname</b>	<b>Designation</b>
Tumiso Railo	Kusile Project Engineering Manager
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Preshen Moodley	Kusile C&I Engineer
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Yuvir Gokul	Kusile Engineering EDWL
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Ruan Beneke	Kusile Civil Engineer

## **9 REVISIONS**

<b>Date</b>	<b>Rev.</b>	<b>Compiler</b>	<b>Remarks</b>
August 2020	0	R. Beneke	Draft Document

## **10 DEVELOPMENT TEAM**

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

- Ruan Beneke
- Jean Van Zyl
- Sihle Mbatha
- Preshen Moodley

## **11 ACKNOWLEDGEMENTS**

Not applicable

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## APPENDIX A– SPECIFICATIONS FOR SUBMERSIBLE SUMP PUMPS

### Submersible Sump Pumps

#### General

Each sump pump shall be a submersible unit and shall be complete with a waterproof junction box, or acceptable equal. The pumps shall be suitable for the application and capable to withstand the water quality as specified and attachments to this document

Each pump shall be furnished complete with lift-out sealing flanges, guide rails, guide rail supports, pump discharge piping and valves, lifting chains, liquid level sensors with relays, and control panel.

Each pump and motor assembly shall be connected to and supported by the discharge elbow and guide rails to permit pump unit removal without requiring personnel to enter the sump.

One pump in the sump will normally act as a backup for the other. Operation will be automatically controlled by water level in the sump or manually controlled at the control enclosure.

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction depths. Each pumping unit shall be designed so that reverse rotation at rated head will not cause damage to any component.

The casing nozzles shall be flanged and rigid enough to support the complete pump units with the discharge elbows and the guide rails.

**Lift-Out Systems.** The lift-out systems shall be self-sealing with a simple up and down motion required to remove and reinstall the pumps in the sump. Upper and lower guide rail supports shall be provided to ensure proper fit. Intermediate guide rail supports shall be provided as required. Each pump shall be furnished with a galvanized chain of sufficient strength and length to raise and lower the pump and motor assembly.

**Piping and Valves.** Separate discharge piping and valves shall be furnished for each pump. Valves shall be located in the Purchaser-furnished sump pit. One common discharge line shall be furnished for the discharge piping that exits the sump pit.

Discharge base elbows shall be furnished by the pump manufacturer. Each discharge elbow shall have a foot for anchoring to the sump floor and a means for firmly supporting the guide rails. The design and mass of each discharge elbow shall be sufficient for rigidly supporting the eccentric load of the pump unit and discharge piping. The discharge elbow inlet flange face shall make a perpendicular metal-to-metal contact with the pump discharge nozzle flange face. Sealing of the discharge interface by means of a diaphragm, O-rings, or other devices is not acceptable. The discharge elbow outlet shall connect to the discharge piping riser.

**Accessories.** A sliding guide bracket shall be an integral part of each pump unit. The design of the bracket shall obtain a pure vertical shearing action at the pump to discharge flange face when connecting or disconnecting the pump and discharge elbow. The bracket design shall obtain a wedging action at the flange faces as the final alignment of pump to piping occurs.

Each pumping unit support shall be equipped with at least two galvanized pipes to fit the discharge elbow and guide bracket. The pipes shall extend from the pump up to the access frame at the top of the sump. The pipes shall be hot dip galvanized per DCS 100 and shall be medium-class wall thickness per SANS 62-1.

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A galvanized chain, sized by the pump manufacturer for installing and removing the pump unit, shall be furnished with each pump.

#### **02626.1.1 Scope of Supply**

Scope of supply shall include the furnishing and installation of submersible sump pumps including motor drives, cabling & terminations, local control starter panel, and discharge piping complete with controls and all accessories required for proper operation:

Leakage detection Sump Pumps and Motors

Detailed equipment, layout, system drawings, and design documentation.

Testing and inspection as defined in these specifications.

Contractor assistance on Site during commissioning.

Sufficient on Site training resulting in Employer's ability to operate and maintain equipment unsupervised.

All materials, equipment, accessories, and structures defined herein shall be provided as a complete skid mounted system.

#### **02626.1.2 Items Furnished by Others and Interfaces**

Items furnished by others and not in this scope of supply include the following:

Power supply and DCS alarm monitoring cabling from Employer's proximity Substation and DCS to Contractor's local control starter panel.

Concrete manholes for installation of the Contractor-furnished equipment.

#### **02626.1.3 Performance and Design Requirements**

Performance and design requirements for the equipment to be furnished under this section of these specifications are indicated herein.

Each Sump Pump shall be sized for the following conditions.

The pumps for the leakage detection sumps shall be sized as follows:

**Table 28. Pump specification**

<b>Pump Name</b>	<b>Ash Dump Dirty Dam Sump Pump</b>
Pump identification number(s)/KKS Tags	00GME10AP005 00GME10AP006 00GME10AP007 00GME10AP008
Rated capacity, m <sup>3</sup> /h	5.426
Rated total head, meters of water	26
Pumped Fluid	Process water

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Specific gravity at rated conditions – (referenced to water at 15 °C)	998
Minimum water depth in sump, m	0.150
Maximum water depth in sump, m	By contractor
Maximum solids diameter, mm	25
Power feed cable length, m	20 or longer as per contractor design
Maximum rotative speed	1500 rpm
Power supply	400 volt, 50 Hz, 3-phase plus neutral.

Where possible the pump shall be selected to the left of the best efficiency point on the pump curve. Impeller size should be such that at least a 5% increase in head at rated capacity can be obtained by installing a larger impeller of the same pattern. Minimum allowable impeller diameter shall be 105% of manufacturer's minimum catalogue diameter for the specific pump model.

Contractor shall confirm that a permanent, locally available representative is available to provide operation, maintenance, troubleshooting, and other technical assistance as requested by Employer. The representative shall have sufficient experience which will be reviewed and approved by Employer.

#### **02626.1.4 Codes and Standards**

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally accepted edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Employer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Should a conflict occur between requirements in this specification and referenced Employer Standards or applicable EN/South African Standards, the most conservative interpretation from a safety, equipment capability, etc. standpoint shall apply. Conservative equipment capability requirements would typically imply greater capability, larger margins or size, etc. Conflicts shall be identified by the Contractor and the resolution accepted by the Employer.

**Table 29. Governing standards**

<b>Work</b>	<b>In Accordance With</b>
Personnel protection	OHS Act
Centrifugal Submersible Pump	BS EN ISO 5199*
Pipe Flanges	SANS 1123
Fasteners	SANS 1700
Induction motors	SANS 1804-2
Piping	SANS 62-1
Engineering drawing office and Engineering documentation standard	N.PSZ 45-698

\* Alternative industry acceptable standards would also be accepted, i.e. Hydraulic Institute

#### **CONTROLLED DISCLOSURE**

#### 02626.1.5 Materials

The following materials shall be used:

**Table 30. Materials required**

Component	Material
Motor enclosure	Cast iron
Pump casing	28% Chrome
Impeller	28% Chrome
Shaft	416 Stainless steel
Pipe	SANS 62-1 standard weight galvanized; SANS 121;
Fittings	ISO 49
Check valves and ball valves	Stainless Steel

#### 02626.1.6 Acceptable Manufacturers of Components

Manufacturer to advise if a suitable alternative is available to the material specified in Section 02626.1.5 of this specification

#### 02626.1.7 Test Requirements

The manufacturer shall allow for a workshop performance test or at least a run test prior to the release of the pump.

At the end of 10 days of level controlled operation, the pump will be accepted if, in the opinion of the Employer, the pump has operated satisfactorily without excessive motor overheating, power input, wear, lubrication, or undue attention required for operation, and if all rotational parts operate without excessive vibration or noise at any operating head, including shutoff.

#### 02626.1.8 Technical Attachments

The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under the defined Scope of Work:

**Table 31. Technical attachments**

Document Number/Description	Title	Revision
146838-OGME-M2646W	PIPING AND INSTRUMENT DIAGRAM LEAK DETECTION SUMPS	1

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## **Centrifugal Pumps**

### **General**

Each sump pump shall be a submersible unit and shall be complete with a waterproof junction box, or acceptable equal. The pumps shall be suitable for the application and capable to withstand the water quality as specified and attachments to this document

Each pump shall be furnished complete with lift-out sealing flanges, guide rails, guide rail supports, pump discharge piping and valves, lifting chains, liquid level sensors with relays, and control panel.

Each pump and motor assembly shall be connected to and supported by the discharge elbow and guide rails to permit pump unit removal without requiring personnel to enter the sump.

One pump in the sump will normally act as a backup for the other. Operation will be automatically controlled by water level in the sump or manually controlled at the control enclosure.

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction depths. Each pumping unit shall be designed so that reverse rotation at rated head will not cause damage to any component.

The casing nozzles shall be flanged and rigid enough to support the complete pump units with the discharge elbows and the guide rails.

**Piping and Valves.** Separate discharge piping and valves shall be furnished for each pump. Valves shall be located in the Purchaser-furnished sump pit. One common discharge line shall be furnished for the discharge piping that exits the sump pit.

Discharge base elbows shall be furnished by the pump manufacturer. Each discharge elbow shall have a foot for anchoring to the sump floor and a means for firmly supporting the guide rails. The design and mass of each discharge elbow shall be sufficient for rigidly supporting the eccentric load of the pump unit and discharge piping. The discharge elbow inlet flange face shall make a perpendicular metal-to-metal contact with the pump discharge nozzle flange face. Sealing of the discharge interface by means of a diaphragm, O-rings, or other devices is not acceptable. The discharge elbow outlet shall connect to the discharge piping riser.

### **Accessories.**

N/A

### **02626.1.1 Scope of Supply**

Scope of supply shall include the furnishing and installation of closed coupled centrifugal pumps including motor drives, cabling & terminations, local control starter panel, and discharge piping complete with controls and all accessories required for proper operation:

4 x Leakage detection Pumps and Motors

Detailed equipment documentation.

Testing and inspection as defined in these specifications.

Contractor assistance on Site during commissioning.

Sufficient on Site training resulting in Employer's ability to operate and maintain equipment unsupervised.

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All materials, equipment, accessories, and structures defined herein shall be provided as a complete skid mounted system.

#### **02626.1.2 Items Furnished by Others and Interfaces**

Items furnished by others and not in this scope of supply include the following:

Pump foundations

#### **02626.1.3 Performance and Design Requirements**

Performance and design requirements for the equipment to be furnished under this section of these specifications are indicated herein.

Each Sump Pump shall be sized for the following conditions.

The pumps for the leakage detection sumps shall be sized as follows:

**Table 32. Pump specification**

<b>Pump Name</b>	<b>Raw Water Reservoir Pumps</b>
Pump identification number(s)/KKS Tags	0GME10AP013 0GME10AP014 0GME10AP015 0GME10AP016
Number of pumps	4
Type designation	Closed coupling End Suction centrifugal
Pump location	Out doors
Rated capacity, m <sup>3</sup> /h	3.46
Rated total head, meters of water	37
Pumped Fluid	Process water
Specific gravity at rated conditions – (referenced to water at 15 °C)	998
Minimum suction level, m	0.2
Maximum water depth in sump, m	By contractor
Maximum solids diameter, mm	20
Power feed cable length, m	20 or longer as per contractor design
Maximum rotative speed	1500 rpm
Power supply	400 volt, 50 Hz, 3-phase plus neutral.

#### **02626.1.4 Pump Characteristics**

Each pump shall be designed with a head-capacity characteristic which rises steadily from the rated capacity to shutoff.

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It is preferred that each pump have low shutoff head and maximum efficiency at the design condition.

All pumps shall be of nonoverloading design.

Impellers shall not be the minimum or maximum size for the pump casing furnished. Where specified, each pump shall accommodate an increase in impeller size of the percent indicated on the General Service Horizontal Pumps Specification Sheets without changing the pump casing or shaft.

Where possible the pump shall be selected to the left of the best efficiency point on the pump curve. Impeller size should be such that at least a 5% increase in head at rated capacity can be obtained by installing a larger impeller of the same pattern. Minimum allowable impeller diameter shall be 105% of manufacturer's minimum catalogue diameter for the specific pump model.

Contractor shall confirm that a permanent, locally available representative is available to provide operation, maintenance, troubleshooting, and other technical assistance as requested by Employer. The representative shall have sufficient experience which will be reviewed and approved by Employer.

Pump characteristic curves shall be submitted for each pump. The curves shall indicate required NPSH, head, efficiency, and brake power as ordinates, with capacity as the abscissa.

Curves to be submitted shall include the following:

Individual pump characteristic curves indicating performance from zero delivery to maximum capacity.

Characteristics of the maximum and minimum diameter impellers which may be fitted in the pump casings with pump operating at the design speed.

Speed-torque curves and WK2 for the pumps.

#### **02626.1.5 Codes and Standards**

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally accepted edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Employer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Should a conflict occur between requirements in this specification and referenced Employer Standards or applicable EN/South African Standards, the most conservative interpretation from a safety, equipment capability, etc. standpoint shall apply. Conservative equipment capability requirements would typically imply greater capability, larger margins or size, etc. Conflicts shall be identified by the Contractor and the resolution accepted by the Employer.

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**Table 33. Governing standards**

Work	In Accordance With
Personnel protection	OHS Act
Centrifugal Submersible Pump	BS EN ISO 5199*
Pipe Flanges	SANS 1123
Fasteners	SANS 1700
Induction motors	SANS 1804-2
Piping	SANS 62-1
Engineering drawing office and Engineering documentation standard	N.PSZ 45-698
End Suction Centrifugal Pumps	EN 733
End-suction centrifugal pumps	ISO 2858
Pump design and fabrication	ANSI/HI 1.1-1.4, American National Standard for Centrifugal Pumps
Definitions of duplicate and identical pumps	ANSI/HI 1.1-1.2, American National Standard for Centrifugal Pumps
Design, construction, and dimensions of centerline mounted vertically split pumps	API Standard 610 (10 <sup>th</sup> Edition)
Design, construction, and dimensions of frame mounted end suction pumps	ANSI/ASME B73.1M
Life rating for antifriction bearings	ABMA (American Bearing Manufacturers Association) L-10
Personnel protection	OSHA

\* Alternative industry acceptable standards would also be accepted, i.e. Hydraulic Institute

#### 02626.1.6 Materials

The following materials shall be used:

**Table 34. Materials required**

Component	Material
Casing	
Cast iron	ASTM A48
Ductile iron	ASTM A395 or ASTM A536, Grade 60-45-12
Carbon steel	ASTM A216, Grade WCB
12 percent chromium alloy	ASTM A743, Grade CA-15 or ASTM A743, Grade CA6NM

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<b>Component</b>	<b>Material</b>
Stainless steel	ASTM A744, Grade CF-8M
Iron-chrome-nickel	ASTM A744, Grade CD-4MCu, 250 Brinell hardness minimum
Abrasion resistant	ASTM A532 Class 3 Type A, 550 Brinell hardness minimum
Impeller	
Bronze	ASTM B584
12 percent chromium alloy	ASTM A743, Grade CA-15 or ASTM A743, Grade CA6NM
Stainless steel	ASTM A744, Grade CF-8M
Iron-chrome-nickel	ASTM A744, Grade CD-4MCu, 250 Brinell hardness minimum
Abrasion resistant	ASTM A532 Class 3 Type A, 550 Brinell hardness minimum
Shaft	
Carbon steel	ASTM A576, Grade 1045; ASTM A321 or ASTM A322, Grade 4140
12 percent chromium alloy	ASTM A276, Type 410 Condition T
Stainless steel	ASTM A276, Type 316
Shaft sleeves	
12 percent chromium alloy	ASTM A276, Type 410
Stainless steel	ASTM A276, Type 316
Iron-chrome-nickel	ASTM A744, Grade CD-4MCu, 250 Brinell hardness minimum
Wearing rings	
Bronze	ASTM B584
12 percent chromium alloy	ASTM A276, Type 410
Stainless steel	ASTM A276, Type 316
Iron-chrome-nickel	ASTM A744, Grade CD-4MCu
Minimum flow orifices	
Stainless steel	ASTM A276, Type 316
Mechanical seals	
Metals	Type 316 stainless steel
Faces	One carbon, the other silicon carbide or tungsten carbide
Elastomers	Viton

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Component	Material
Seal water heat exchanger tube materials	Type 304 stainless steel
Seal water flush piping	Type 316 stainless steel

#### 02626.1.6 Acceptable Manufacturers of Components

Manufacturer to advise if a suitable alternative is available to the material specified in Section 02626.1.5 of this specification

#### 02626.1.8 Test Requirements

At the end of 10 days of level controlled operation, the pump will be accepted if, in the opinion of the Employer, the pump has operated satisfactorily without excessive motor overheating, power input, wear, lubrication, or undue attention required for operation, and if all rotational parts operate without excessive vibration or noise at any operating head, including shutoff.

#### 02626.1.8 Technical Attachments

The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under the defined Scope of Work:

**Table 35. Technical attachments**

Document Number/Description	Title	Revision
146838-0GME-M2646W	PIPING AND INSTRUMENT DIAGRAM LEAK DETECTION SUMPS	1

#### 02626.1.9 Guarantees

The pumps shall be guaranteed to perform as specified herein and as indicated by the performance curves. The pumps shall be guaranteed to operate satisfactorily without pitting, cavitation, excessive vibration, or excessive noise at design conditions.

The following shall be guaranteed within the tolerances permitted by the standards referenced in Article 15228.1.4:

Capacity at the design point.

Total head at the design point.

NPSH values shown on the pump characteristic curves.

Efficiency at the design point.

Power input at the design point, shutoff, and maximum power requirement.

Ability to operate in parallel under the conditions specified if parallel operation capability is a requirement specified on the General Service Horizontal Pumps Specification Sheets.

#### CONTROLLED DISCLOSURE

Ability to operate under all operating conditions from minimum recirculation flow to 125 percent of design capacity.

Maximum shutoff head.

No vibration transmitted from the pump to the motor through the coupling.

No critical speed within  $\pm 25$  percent of the pump operating speed or reverse rotation speed.

Maximum noise level as specified in the Supplemental Specifications located in Section 01400.

Ability to operate, without harmful effects, for extended periods of time at the minimum continuous recirculation flows stated on the performance curve and pump data sheets.

**02626.1.10 Supplemental Specifications**

Technical supplemental specifications that are applicable to the work covered under this technical specification section are as follows

**Table 36. Supplemental specifications**

240-56355754	Field Instrument Installation Standard	2015, v1.0
240-56355815	Junction Boxes and Cable Termination Standard	2015, v1.0
240-56355888	Temperature Measurement System Installation Standard	2015, v1.0
240-71432150	Plant Labeling Standard	2017 V3.0
240-57617975	Procurement of Power Station low Voltage Motors Specification.	2015, V1.0
203-56356396	Earthing and lightning protection standard	2015, V1.0
240-56227443	Requirement for Control and Power Cables for Power Stations	2015, V1.0
240-56227516	LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltages Up To and Including 1000V AC and 1500V Standard	
<u>240-57617975</u>	Procurement of Power Station Low Voltage Electric Motors Specification Standard	2016, V2.0

## **02626.2 Products**

### **02626.2.1 Drawings and Data**

Technical datasheets, selection curves and manufacturer's specifications covering the sump pumps, drive motors, local control starter panel, cabling, and other accessories shall be for approval before purchasing equipment.

All the technical documents of the pump, motor and accessories shall also be supplied in hard copy manufacturing data books (2 sets) once all documents have been reviewed and approved.

### **02626.2.2 Controls**

Sump pumps shall be provided with a level control system to automatically start and stop the pumps locally as sump level changes.

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Sump pump motors shall also be provided with water ingress and winding temperature protection system to automatically trip and stop the pumps.

Except as modified herein, it is intended that the Contractor's standard level control system be provided. All control system components, including level sensors, pump controllers, and annunciation devices, shall be furnished. The controllers shall be furnished in a local free standing IP 66 local control starter panel.

The control system shall use ON-OFF selector switches for each pump. In the ON mode, the level controls shall start the pump on increasing level. The second pump shall start if the level continues to increase within  $\pm 5$  minutes time delay. The level controls shall stop the pumps as each respective level switch is reset. Initial start and stop levels shall be as required for pump protection and as indicated on the specification sheets. Levels shall be field adjustable, for optimal conditions.

Indicating lights shall be provided for each pump running status (red for pump running and green for pump stopped) and control power available (amber). Trouble shall also be annunciated locally by a beacon-style indicating lamp, audible alarm with silence pushbutton, and a white lamp on the front of the panel.

A single common dry contact shall be provided to indicate control panel trouble, loss of power, lag pump start (high-high sump level), or high-high-high sump level. The contacts shall open on detecting a trouble condition.

Level detection shall use cable-mounted displacement style level switches. A minimum of 4 switches shall be furnished as follows.

Low Level- turns respective pump off.

High level- turns 1st pump on.

High-high level- turns 2nd pump on and activates alarm.

High-High-High level- activates alarm.

Level switches shall be suitably rated for the process conditions, including temperature, and include mercury-free snap acting contacts (no rolling ball contact elements permitted). Mounting hardware shall be furnished by the Contractor. Switch extension cable from the switch manufacturer shall be furnished in suitable lengths (20 meters minimum for each switch) from the switch element back to the Contractor's local control starter panel. Switch contacts shall be single pole, double-throw rated for 10 A and 230 VAC.

Terminal blocks shall be provided for all external connections.

The local control starter panel shall include motor starters for all associated pump motors. A disconnect switch, suitably sized motor starter, and motor overload protection shall be provided for each motor. The panel shall include a 230 VAC control power transformer or obtain 230 VAC control power from main supply. A single 400 VAC, three-phase power source plus Neutral will be provided by the Employer to each dam or reservoir sump pump main local control starter panel.

### **02626.2.3 Discharge Piping**

Discharge piping and check valve shall conform to the requirements specified in Section 02626.1. Check valve shall be regrounding horizontal swing type with threaded ends.

## **CONTROLLED DISCLOSURE**

#### **02626.2.4 Motors**

Motors shall be designed and fabricated in accordance with the requirements of the Purchaser's Motor Specifications included in GGS 0802 Rev04 and the requirements herein.

Motors shall be arranged for vertical mounting integral with the driven equipment. Enclosure shall be waterproof submersible type. External surfaces shall be coated with moisture corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. Metal-to-metal fits shall be coated with corrosion-resistant compound. Shaft and hardware shall be of corrosion-resistant material. The shaft shall be threaded for attaching the impeller.

Pre-lubricated sealed antifriction bearings with provisions for re-lubrication shall be furnished. Bearings shall be designed and fabricated to have an ABMA minimum L-10 life rating of not less than 130,000 hours under the load, speed, and thrust requirements for coupled service provided the pumps are maintained in accordance with the guidelines set out by the OEM Instruction Manuals. If the bearing fails during the warranty period, the Contractor shall be responsible for the replacement of the bearing as well as the equipment and manpower needed to replace the bearing. Should the bearing fail prior to the minimum hour requirement, but after the warranty period, the Contractor shall only be responsible for replacement of the bearing.

Rotors shall be dynamically balanced and coated with a corrosion-resistant polyester paint.

Motors shall be furnished with provisions for earth cable connection in accordance with relevant sections of Employer's Earthing & Lightning Specification included in 203-334 Rev 0.

Routine tests shall be performed on each motor at the manufacturer's factory to confirm that there are no electrical or mechanical defects. The motor shall be able to operate above the water level without overheating.

#### **02626.2.5 Other Accessories**

The pumps shall be shipped with the necessary accessories installed for rail travel. Connections shall be provided at the top of the pumps for lifting by Contractor provided means (chains, wire ropes, etc.).

#### **02626.3 Execution**

Each sump pump and waterproof junction box shall be installed in accordance with the manufacturer's instructions and placed in successful operation. Power supply conductors to the waterproof junction boxes will be installed under relevant IEC and SANS specifications.

A check valve and ball isolation valve shall be installed in the discharge piping of each submersible pump. Unions shall be installed as required to facilitate valve maintenance.

The Contractor shall furnish and install pump discharge piping from each sump to the return the leakage to the associated dam in accordance with drawings to be supplied later.

The Contractor shall core drill penetrations through sump walls as required for the pump discharge piping, pump power cable and level switch cables.

#### **CONTROLLED DISCLOSURE**



APPENDIX B - VENDOR DOCUMENT SUBMITTAL SCHEDULE

Table 37. Submittal schedule

VENDOR DOCUMENT SUBMITTAL SCHEDULE												
ITEM	SUBMITTAL ITEMS	CALANDER DAYS	PROJECT STAGES									
			PROCUREMENT SPECIFICATION FOR SUB CONTRACTORS	CONTRACT AWARD	ORDER	DESIGN FREEZE	MANUFACTURING AND ASSEMBLY	FACTORY ACCEPTANCE TESTING (FAT)	FACTORY RELEASE	DELIVERY	INSTALLATION	SITE ACCEPTANCE TESTING (SAT)

APPENDIX C - MASTER DOCUMENT LIST

Table 38. Master document list

Kusile Power Station – COMPANY NAME														
DRAWINGS AND SPECIFICATION SCHEDULE														
ALSTOM Doc Code	Doc Code	Doc Code	Doc Code	Rev.	Cust. Doc No.	Title	Action	Tslip N°	Actual tSlip date	Client receipt date	Client Document status	Client ref letter for doc status	ALSTOM Document status	Identical Document for Medupi

## APPENDIX D– DOCUMENTATION REQUIREMENTS FOR FINAL HANDOVER

Table 39. Documentation requirements

Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
Engineering Documentation	1.6	1.6	Risk Assessments
	1.7	1.7	Non-Conformance Management
Final System Design Package	2C	2.38	Functional Descriptions (Control)
	2A	2.39	Alarm Response Procedures
	2C	2.40	Control System Functional Specification/Design
	2B, 2C, 2D, 2E, 2F	2.41	Design Philosophy
	2A	2.42	Material, Mass & Energy Balance Diagrams
	2C	2.43	Control System IT Architecture
	2C	2.44	Plant Protection Logics
	2B	2.45	Safety Studies
	2B	2.47	Plant System/Process Description
			Technical Tender Evaluation Reports
			Functional Descriptions (Control)
Operating and Maintenance Documentation	3.6	3.6	Maintenance Instructions
	3.7	3.7	Operating Instructions
	3.8	3.8	Commissioning/Shutdown Procedures
	3.9	3.9	Storage and Handling Instructions
	3.10	3.10	Installation, Operating & Maintenance Manuals (IOM's)
	3.11	3.11	Datasheets and Product Brochures
	3.12	3.12	Licences & Approvals (Regulatory, Statutory)
Commissioning Documentation	4.1	4.1	Commissioning Procedure / Manual

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Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
	4.2	4.2	Handover Certificate
	4.3	4.3	Commissioning Certificate
Project Execution	Mechanical	5.1.1	<i>Contractor</i> Application for Eskom's Inspection of the Works/Part of the Works
		5.1.2	Data Pack (e.g. Material Certificates, Qualifications, NDE and Welding Documentation, Drawings, Cutting Instructions, Factory Design Review Reports, C&I Loop checks, etc.)
		5.1.3	Partial/final Inspection certificate
		5.1.4	Defects Notification Certificate/Clearance
		5.1.5	Safety and Housekeeping Certificate
		5.1.6	Safety Clearance Certificate
		5.1.7	Completion Certificate
		5.1.8	Defects Certificate
		5.1.9	Take over Certificate
		5.1.10	Specific Requirements
		5.1.11	KKS and Labelling Certificate
	C&I	5.2.1	<i>Contractor</i> Application for Eskom's Inspection of the Works/Part of the Works
		5.2.2	Data Pack (e.g. Material Certificates, Qualifications, NDE and Welding Documentation, Drawings, Cutting Instructions, Factory Design Review Reports, C&I Loop checks, etc.)
		5.2.3	Partial/final Inspection certificate
		5.2.4	Defects Notification Certificate/Clearance
		5.2.5	Safety and Housekeeping Certificate
		5.2.6	Safety Clearance Certificate
		5.2.7	Completion Certificate
		5.2.8	Defects Certificate
		5.2.9	Take over Certificate
		5.2.10	Specific Requirements

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Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
Test and Statutory Certificates	Electrical	5.2.11	KKS and Labelling Certificate
		5.3.1	<i>Contractor</i> Application for Eskom's Inspection of the Works/Part of the Works
		5.3.2	Data Pack (e.g. Material Certificates, Qualifications, NDE and Welding Documentation, Drawings, Cutting Instructions, Factory Design Review Reports, C&I Loop checks, etc.)
		5.3.3	Partial/final Inspection certificate
		5.3.4	Defects Notification Certificate/Clearance
		5.3.5	Safety and Housekeeping Certificate
		5.3.6	Safety Clearance Certificate
		5.3.7	Completion Certificate
		5.3.8	Defects Certificate
		5.3.9	Take over Certificate
		5.3.10	Specific Requirements
		5.3.11	KKS and Labelling Certificate
	Civil	5.4.1	<i>Contractor</i> Application for Eskom's Inspection of the Works/Part of the Works
		5.4.2	Data Pack (e.g. Material Certificates, Qualifications, NDE and Welding Documentation, Drawings, Cutting Instructions, Factory Design Review Reports, C&I Loop checks, etc.)
		5.4.3	Partial/final Inspection certificate
		5.4.4	Defects Notification Certificate/Clearance
		5.4.5	Safety and Housekeeping Certificate
		5.4.6	Safety Clearance Certificate
		5.4.7	Completion Certificate
		5.4.8	Defects Certificate
		5.4.9	Take over Certificate
		5.4.10	Specific Requirements
		5.4.11	KKS and Labelling Certificate
Test and Statutory Certificates	6.1	6.1	Factory Acceptance Test (FAT)
	6.2	6.2	Site Acceptance Test (SAT)

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Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
	6.3	6.3	Inspection Test Procedures (ITP's)
	6.4	6.4	QCP's / QIP's (signed off)
	6.5	6.5	COC (Domestic Circuits)
	6.6	6.6	Electrical Tests - Motors
	6.7	6.7	Calibration Certificate
	6.8	6.8	Erection Check Sheet
	6.9	6.9	Protection and Optimising Test Certificates
	6.10	6.10	Fire Protection Certificate
	6.11	6.11	Other Safety Valves, Ventilation, Boiler Statutory Tests, Transformer Impact Recording, Boiler Registration Certificate, Type Test Certificates)
	6.12	6.12	Synchronisation Tests
	6.13	6.13	Grid Code Compliance Certificate
	6.14	6.14	Defect List
Safety Requirements	7.1	7.1	Safety Signs, Labels and Colour Coding
	7.2	7.2	Demarcation of Hazardous Area (Certificate & Reports)
	7.3	7.3	Lighting
	7.4	7.4	Safety and Housekeeping Certificate
Guarantees & Warrantees	8.1	8.1	Related Extract from SOW of Works Information Indicating Plant area / Component
	8.2	8.2	Certificate from Supplier indicating validity of the guarantee / Warrantees Period
		9	<b>Special Tool List</b>
		10	<b>Insurance Cover (90 Days Notification Period)</b>
Plant out of Normal Status Approved	11.1	11.1	Approved Out of Normal Status
	11.2	11.2	Out of Normal Status (Pending Approval)

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Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
Training	Competency Declarations	12.1	Training Manual
		12.2	Proof of Training
		12.3.1	Plant Safety Regulations
		12.3.2	High Voltage (HV) Regulations
		12.3.3	PFFR
		12.3.4	Other
Provisional Hand over Certificate	13.1	13.1	Provisional
	13.2	13.2	Pending Approval
	13.3	13.3	Approved
Final Hand over Certificate	14.1	14.1	Provisional
	14.2	14.2	Pending Approval
	14.3	14.3	Approved
Other	15.1	15.1	Factory Acceptance Tests • Signed Protocol Release Report
	15.2	15.2	Shipment and Transportation - • Transportation test results • Transportation PQP
	15.3	15.3	Other Documentation and Reports • Design assumptions • Trade-offs
	15.4	15.4	Design Software • Software listing • Load Flows • Fault studies • Cable Routing software • CAD software data files • Simulations
	15.5	15.5	Correspondences • Engineering Instructions (EI's)

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## APPENDIX E– ESKOM STANDARDS AND GUIDELINES

CODE	DESCRIPTION
<b>INTERNATIONAL AND NATIONAL</b>	
SANS 60794-1-1	Optical Fibre Cables Part 1-1: Generic Specification – General
SANS 61312	Protection Against Lightning Electromagnetic Pulse
IEC 62381	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)
IEC 62382	Electrical and Instrumentation Loop Checks
VGB B 105e	KKS Identification System for Power Stations
VGB B 106e	KKS Application Explanations
SANS 60529	Degrees of Protection Provided by Enclosures (IP Code)
SANS 10142-1	The Wiring of Premises – Low Voltage Installations
<b>CONTROL AND INSTRUMENTATION</b>	
240-56355731	Environmental Conditions for Process Control Equipment Used at Power Stations Standard
240-56355541	Control System Computer Equipment Habitat Requirements Guideline
240-56355754	Field Instrument Installation Standard: Field Installation Requirements
240-56355815	Field Instrument Installation Standard: Junction Boxes and Cable Termination
240-56227443	Requirements for Control and Power Cables for Power Stations
240-56356396	Earthing and Lightning Protection Standard
240-55714363	Coal Fired Power Stations Lighting and Small Power Installation Standard
200-11757	Earthing and Lightning Protection Concept
240-56355466	Alarm Management System Guideline
240-56355843	Pressure Measurement Systems Installation Standard
240-56355789	Flow Measurement Systems Installation Standard
240-56355782	Human Machine Interface Design Requirements Standard
240-49230046	Failure Mode and Effects Analysis Guideline

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240-49230111	Hazard and Operability Analysis Guideline
240-52844017	System Reliability, Availability and Maintainability Analysis
240-56355729	Plant Control Modes Guideline
SPF 200-4190	The Application of KKS Plant Coding Standard
240-128515850	Documentation Handover Specification.
240-53114186	Technical Documents and Records Management Work Instruction
203-79326	Kusile Engineering Change Management Work Instruction
240-53113685	Design Review Procedure
240-71432150	KKS Plant Labelling and Equipment Descriptions Standard
240-86973501	Engineering Drawing Standards – Common Requirements
240-54179170	Technical Documentation Classification and Designation Standard
240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
240-53114186	Project / Plant Specific Technical Documents and Records Management Procedure
240-58552870	SmartPlant for Owner Operators (SPO) Documentation Metadata Standard
240-107305502	SmartPlant Data Take-On Standard
240-109607332	Abbreviation Standard for Labelling of Plant at Power Stations
240-93576498	Eskom KKS Standard
PGZ 45-25	Eskom FMECA Guideline
SANS 10143	
IEC 61355– 1:2008	Classification and designation of documents for plants, systems and equipment – Part 1
	KKS Power Plant Classification (B105e) 5th Edition 2003 Published by Verlag VGB PowerTech Service GmbH (Essen)
ISO 10007(2nd Edition)	

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APPENDIX F - ELECTRICAL LOAD LIST

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