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1. INTRODUCTION

Kusile Power Station is a National Key Point and is located in Mpumalanga approximately 10km from the existing Kendal Power Station. The Kusile fleet consist of petrol and diesel vehicles and require an on-site Fuel Filling Station with a Fuel Management System to provide fuel for these vehicles.

The Fuel Filling Station shall consist of two 30 000L approved non-flammable corrosion resistant underground tanks; one tank for 50ppm diesel and one tank for 95 octane unleaded petrol. Each tank is required to service two fuel dispensers.

Each dispenser shall be fitted with one filling point per fuel type. The dispensers shall be capable of filling vehicles simultaneously. The fuel shall be offloaded at the Fuel filling station via road tankers into the respective fuel tanks (off-loading system). There shall be one off-loading system for 50ppm diesel and one off-loading system for 95 octane unleaded petrol. The off-loading bay shall contain all the necessary off-loading piping, valves, fittings, filters and earthing to perform this operation efficient, safely and within environmental framework. The fuel dispensers and pumps shall transfer the fuel from the underground storage tanks (via necessary pipework) to the motor vehicles.

2. SUPPORTING CLAUSES

2.1 SCOPE

The purpose of this document is to provide the scope of work and technical specifications for detailed design, supply, construction, installation, commissioning, performance testing and handover of a complete, functional Fuel Filling Station

2.1.1 Purpose

The purpose of this document is to provide the scope of work and technical specifications for detailed design, supply, construction, installation, commissioning, performance testing and handover of a complete, functional Fuel Filling Station.

2.1.2 Applicability

This document shall apply to Kusile Power Station only

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

[1] 240-53113685: Design Review Procedure

2.2.2 Informative

- [2] Occupational Health and Safety Act (Act 85 of 1993)
- [3] ISO 9001: Quality Management System Requirements
- [4] Occupational Health and Safety Management Systems Requirements (OHSAS 18001)
- [5] Petroleum Products Act (120/1977)
- [6] Occupational Health, Safety and Management Policy
- [7] The National Water Act (Act No. 36 of 1998).
- [8] The Environmental Conservation Act (Act No 73 of 1989).
- [9] Government Notice 704, National Water Act 1998

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[10] Project Bravo Geotechnical Report

2.3 DEFINITIONS

Definition	Description
Automatic fuel nozzle	The fuel nozzle that automatically shut off when the vehicle/machinery tank being filled is full, preventing too much fuel from being dispensed and an overflow situation from occurring.
Automatic Tank Gauge	An Automatic Tank Gauge is a device that automatically measures the level of crude oil, LNG and petroleum products in storage tanks and raises an alarm when the level goes down or up the threshold limits. It operates electronically and keeping track of any leakages in the tank. When the upper limit of re-filling the tank is reached, it cuts off the supply from the inlet pipeline and intimates the operator on their human machine interface.
Detail Design	Process to develop and issue Approved for Construction documents and drawings in accordance with the Design Base, including Quality Control, Quality Assurance and Change Management.
Digital tyre inflator	Tyre inflating device which stops automatically once pre-set tyre pressure is reached.
Fuel Management System	Fuel Management system effectively monitors and manages the use of fuel.
Pipework	Pipes and fittings used for the conveyance of fuel, water, gases or other fluids.
Piping	Pipes, tubes or flexible pressure hose elements intended for the transport or distribution of any fluid.
Pump	A pump is a device that moves a fluid by mechanical action.
System	An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a defined objective. These pieces include people, hardware, software, firmware, information, procedures, facilities, services and other support facets.
Valve	A device for shutting-off or controlling the flow of a fluid through a pipe or duct.

2.3.1 Disclosure Classification

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

2.4 ABBREVIATIONS

Abbreviation	Description
AIA	Approved Inspection Authority
C&I	Control and Instrumentation
DA	Design Authority
EIA	Environmental Impact Assessment
FL	Floor Level

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Abbreviation	Description
HAZLOC	Hazardous Location Classification
IP	Ingress Protection
LNG	Liquified Natural Gas
MDL	Master Document List
OEM	Original Equipment Manufacturer
RACI	Responsibility, Accountability, Consult and Inform
SANS	South African National Standards
SAICE	South African Institution of Civil Engineering
SAIEG	South African Institute for Engineering and Environmental Geologists
SHE	Safety, Health & Environmental
VDSS	Vendor Document Submittal Schedule

2.5 ROLES AND RESPONSIBILITIES

Role	Responsibility
Contractor	The contractor is responsible for executing the design during the construction phase. The Contractor can perform both roles as Design Authority (DA) or Contractor appoints a DA.
Design Authority	The DA shall be responsible for - Developing the design as per requirements provided by the employer and ensuring that the design output documents accurately reflect the design basis. - Design control and ultimate technical adequacy of the design process. Important to note that the professional accountability rest with the DA. The DA also remains responsible and accountable for the correctness of the design documents, irrespective of whether these documents have been reviewed by Eskom or not.
Employer	The employer refers to Eskom. Also known as the Client.
Engineer	Refers to the Eskom Engineer and assures that the technical integrity of a fully functional and operational plant meets the user requirement and Eskom Engineering expectations and requirements. This individual is responsible to review design documentation, construction- and

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	commissioning activities and ensures that all handover requirements have been met.
Project Manager	The Project Manager shall be responsible for; • Ensuring that this Technical Specification is executed. Executing their responsibilities and powers as delegated on the contractual relationship

2.6 PROCESS FOR MONITORING

3. DESCRIPTION OF THE WORKS

3.1 SCOPE OF WORK

The *Contractor* shall be responsible for the complete detailed design, supply of materials, factory and site testing, transport to site, unloading from road, storage and preservation on site, supply of plant and earth moving equipment, construction and erection, quality control and management, testing, painting, finishing, commissioning, performance testing, training and handover of a complete, fully functional self-operated Fuel Filling Station.

The Fuel Filling Station shall be installed in accordance with SANS 10089-3 Part 3 - The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations, specified Eskom standards and relevant National Standards.

As illustrated in Figure 1, which outlines the proposed layout and location of the Fuel Filling Station in relation to adjacent buildings, the Contractor shall be responsible for the following:

- Preparation of all associated detailed designs for the facility and construction of the fuel filling stations.
- Determination of the position of underground storage tanks.
- Layout of the off-loading slab and Fuel Filling Station canopy, including dispenser locations.
- Design and construction of access roads linking the facility to existing station roads.
- Installation of a dirty drainage network with oil separator and tie-in to the existing dirty drain system.
- Positioning of the distribution board (DB) and provision of cable sleeves from the DB to the dispenser island.
- Provision and routing of compressed air supply interfacing points.
- Installation of fire protection systems.
- Installation of two potable water taps beneath the canopy.
- Provision of safety signage beneath the canopy.
- Installation of explosion-rated lighting (Ex-rated lights).
- Installation of an earthing mat and tie-in to the station earth grid.
- Provision of additional kiosk building for utilities, C&I equipment storage, security guard and admin works. Building to include lighting, HVAC, fire protection, potable water and ablution facility
- Providing professional engineering certificates and conformance certificates for the completed work

Notes:

- Use of filling station will be mainly for fleet vehicles with minority use of trucks, tractors and forklifts. (Heaviest vehicle will be 20 tons, with estimated length of 10m)

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- Refer to figures below indicating the proposed fuel filling station location.

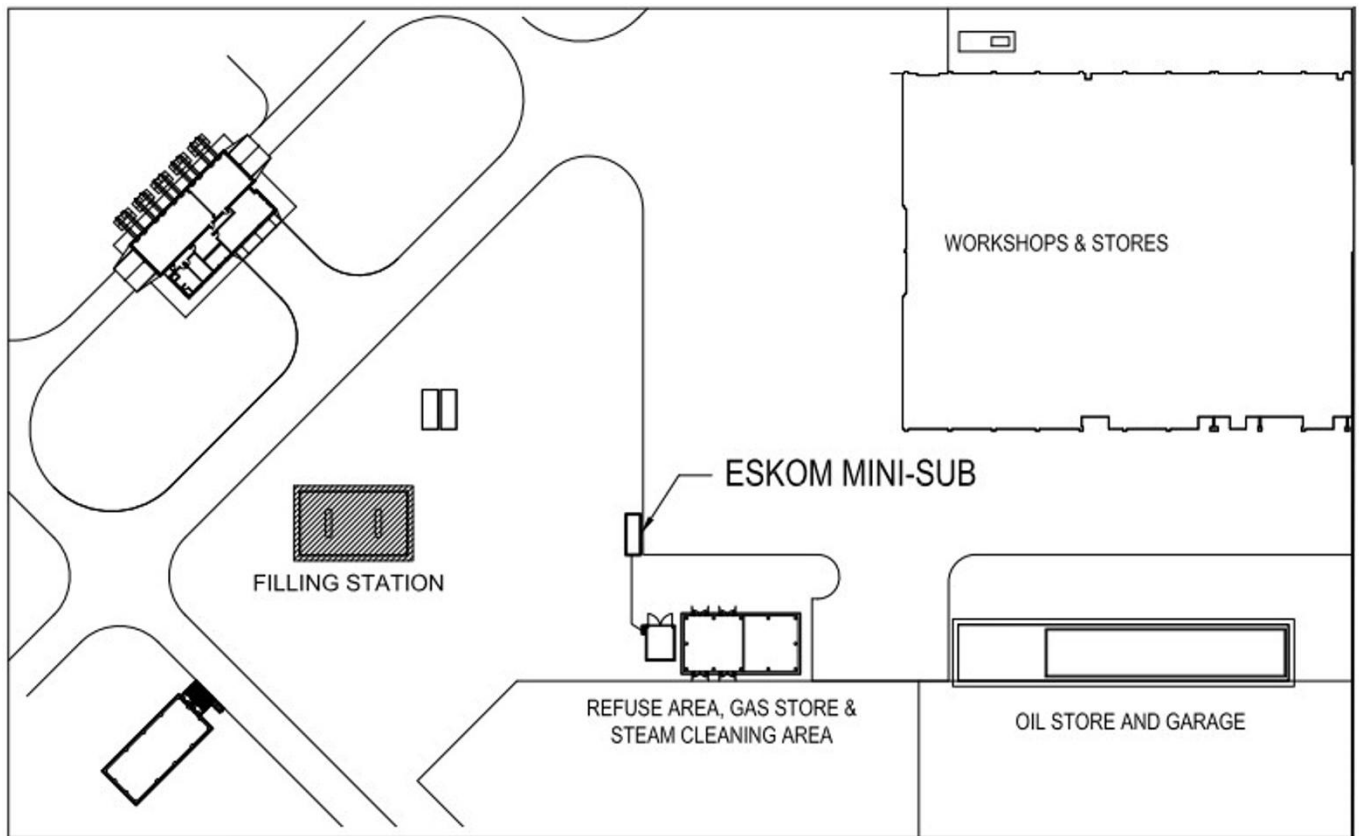


Figure 1: Fuel Filling Station Layout

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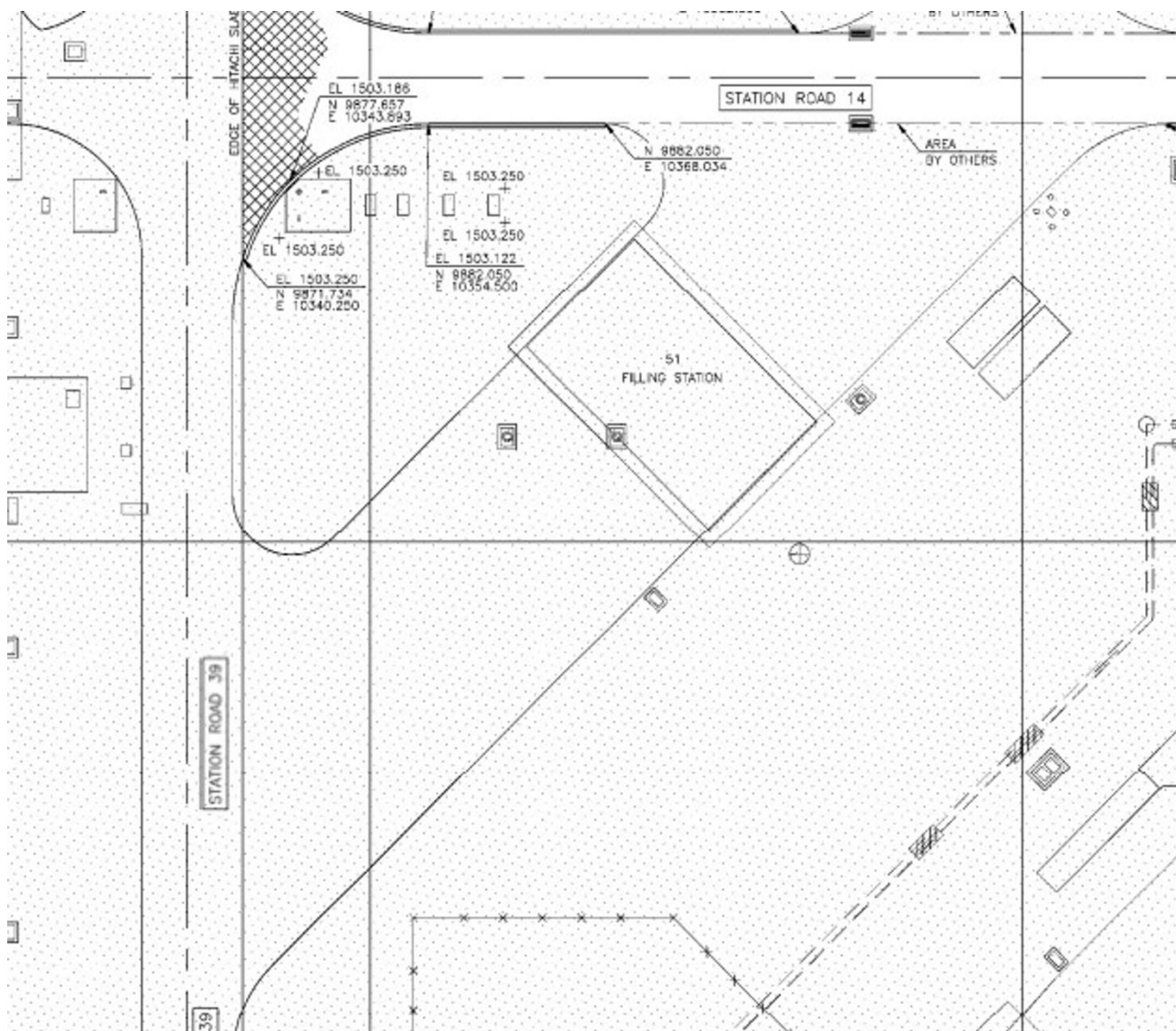


Figure 2: Fuel Filling Station relation to station roads

3.2 GENERAL REQUIREMENTS

- a) Where this document is not clear about the location of an item to be installed or work to be performed, it is the *Contractor's* responsibility to determine the correct location from the *Employer's* engineering representatives via Request for Information process. The *Contractor* shall only act upon confirmation by receipt of an Engineering Instruction via the Project Manager. Incorrectly positioned items, or incorrect work done (where Engineering Instructions were not issued) shall be moved / removed / replaced / changed / reinstalled by the *Contractor* at his cost.
- b) All referenced Eskom standards shall be made available to the *Contractor* to be used as required.
- c) The *Contractor* shall label the plant according to Kusile Power Station Label specification.
- d) Each drawing, diagram and list shall refer to the area of plant by means of the plant labelling in accordance to Engineering Drawing Standard Common Requirements.
- e) The contractor is responsible for providing a fully functional fuel filling station on site. The contractor is required to make provisions for all associated plant equipment

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- f) All Codes, Standards and Guidelines detailed in Appendix 11.2 and in section 2.2.1 Normative references are to be considered and complied with during the execution of this scope.
- g) Colour coding of pipe and vessels to be done in accordance with Eskom colour coding standards or SANS equivalent.
- h) Corrosion protection to be done in accordance with Eskom corrosion protection standards or SANS equivalent.

3.3 MECHANICAL WORKS

- Design (equipment selection), supply, install, commissioning of SANS approved 30 000L non-flammable corrosion resistant underground storage tanks for 50ppm diesel and another for standard 95 octane unleaded petrol with;
 - Approved filling points, vent pipes, tank fittings, pipework, pumps, motors, filters and valves with associated instrumentation shall be provided with the tanks.
 - Tanks shall be fitted with dipsticks for measuring fuel levels.
 - Provision of fuel leak observation wells adjacent to fuel tanks.
- Design (equipment Selection), supply, installation and commissioning of two fuel dispensers per tank.
- Design, supply and commissioning of Fire Protection System. The scope will follow the legislative route of "Deem to Satisfy" (DTS) by complying with the requirements of SANS 10089-3.
- Design (equipment selection), supply, construction and commissioning of Oil Separating System for drainage system.
- Supply of spares, including the special tools and consumables, fuel, lubricants and chemicals required for erection and commissioning.
- Supply, installation and commissioning of digital pre-set tyre inflator with necessary fittings interfacing with existing compressed air pipeline.
- The fuel cleanliness after the filter must meet ISO 4406 level of 16/13 or cleaner.
- Fuel offloading filters must be sized so that they ensure fuel offloaded meets ISO 4406 cleanliness level of 16/13 or cleaner.

3.3.1 Fuel filling Station

The Fuel Filling Station shall be designed and constructed in accordance with SANS 10089-3. The *Contractor* shall be responsible to register the installation with the local authority and shall be approved before commissioning and operation.

3.3.1.1 Fuel Off-loading system

Fuel shall be delivered to the Kusile site via road tankers. The *Contractor* shall design, supply, install and commission the fuel off-loading bay with two off-loading systems for petrol and diesel, containing all the necessary offloading pumps, meters, piping, valves, fittings and filters for off-loading of the liquid fuel safely to the fuel tanks. There shall be one off-loading system for 50ppm diesel and one off-loading system for standard 95 octane unleaded petrol.

The *Contractor* shall design of the road tanker off-loading facility paying particular attention to personnel safety and environmental requirements in accordance to SANS 10089-3.

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The off-loading facility shall allow for off-loading of fuel from road tankers to a specific underground storage tank. Duplex filters of the required rating with a differential pressure indication and alarm shall be installed on the tank filling lines from the road tanker off-loading facility. The road tanker off-loading facility shall be designed to capture and contain any spillages whilst off-loading.

The fuel off-loading facilities shall include accurate fuel metering to measure the amount of fuel off-loaded to the underground storage tanks.

3.3.1.2 Liquid Fuel Tanks

The *Contractor* shall design, supply, install and commission two 30 000L underground storage tanks. There shall be one tank dedicated for 50ppm diesel and one tank for standard 95 octane unleaded petrol.

The tanks shall be fitted with the following as a minimum:

- Floating suction
- Separate valved oil and water drain from a central sump,
- Any necessary signage relating to access to the tank,
- Overflow on each tank to low level,
- Signage on each tank indicating the KKS number and the product stored in each tank.
- Safety signage as per SANS 10089-3

The *Contractor* shall provide and install a local level indication system of approved design. A secondary containment system shall be installed under all liquid fuel tank bases. A leak detection system is required as part of the secondary containment system.

The liquid fuel storage tanks shall be subjected to all necessary tests including pressure and/or leak tests prior to the first fill of fuel as per the relevant SANS standard. Water for the hydro-tests and disposal thereof shall be the responsibility of the *Contractor*.

The *Contractor* shall include for any necessary inspection and internal tank cleaning prior to the first delivery of fuel to each tank.

The *Contractor* shall supply the necessary fuel for commissioning and testing purposes. Thereafter the *Employer* will contract the supply and delivery of fuel as per National Contract for the rest of the plant life cycle.

3.3.1.3 Fuel Pumps and dispensers

The *Contractor* shall supply, install and commission four dispensers (2 for each tank). Dispensers shall be securely mounted and be protected against damage from vehicles (e.g. by use of an island or barrier). All pipework connections to the dispensers shall be liquid and vapor tight. Electrical connections shall be made in accordance with the manufacturer's instructions and shall maintain the integrity of the explosion protection. The pump supplier shall be responsible for providing an electrical C.O.C for the pump/s as well as calibration certificates.

3.3.1.4 Non-return or check valves

Non-return or check valves are required on each line of suction system to prevent the fuel within the dispensers draining back to the storage tank resulting in the loss of pump prime. In order to reduce ground contamination and a safety hazard in the event of a suction line leak, they shall be fitted within the dispenser housing and not at the storage tank.

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3.3.1.5 Safe break (breakaway coupling)

All dispensers and offloading bay shall be fitted with a safe break (breakaway coupling) on each hose as per SANS 10089-3.

3.3.1.6 Hoses

New hoses shall be marked to indicate compliance with SANS standards. Hoses shall not exceed a length that would cause a hazard. Hose reach is typically between 3 and 4 m from the dispenser housing. The use of hoses with reach in excess of this shall be subject to a risk assessment. Manufacturers shall provide guidance on how such longer hoses can be protected from damage.

3.3.1.7 Automatic nozzle

An automatic nozzle shall be fitted to each dispenser. Automatic nozzles shall have the following safety devices:

- Automatic shut off device which stops fluid flow when the spout is immersed in the fluid.
- Attitude device which prevents the operation of the nozzle when the spout axis is above the horizontal.

3.3.1.8 Oil Separator

The *Contractor* shall supply, install and commission an oil separator in accordance to OEM specifications. All oil spillages or oil contaminated water shall go through the oil separator before discharging into DD5/DD11.

3.3.2 Compressed Air System

The *Contractor* shall supply, install and commission a digital tyre inflator with necessary fittings which shall be connected to the existing compressed air pipeline and will be used to inflate the vehicle tyres.

The compressed air supply piping has been installed and commissioned and is connected to the station compressed air system. The *Contractor* shall inspect the interface point of the compressed air supply line and install missing piping/fittings where required before commissioning the digital tyre inflator.

The commissioning of the compressed air system is conducted as per *Employer's* on-site commissioning for low pressure services.

Table 1: Compressed air terminal point details

Supply Point Data (TP-16-26-002)	
System	Service Air
Physical Location	Outside the Western End of the Workshop and Stores Building
Medium	Compressed Air
Process Data	
Design Temp (°C)	59
Design Pressure (bar)	10
Operating Temperature (°C) min/norm/max	10/40/55
Operating Pressure min/norm/max (bar)	8
Design Flow Rate (Nm ³ /min)	11.5
Operating Flow Rate (Nm ³ /min)	0-10
Pipe Outside Diameter (mm)	88.9
Nominal Bore (mm)	80
Wall Thickness (mm)	3.5
Schedule	40
Design Code	ASME B31.3
Pipe Material	Carbon Steel
Protective Coating	Galvanised
Connection Type	Flanged
Flange Pressure Rating	PN 10
Flange Type	BS 4504 RF
Arrangement Design	
Unit	0
Coordinate Type	Station
X-Coordinate (m)	10381.328
Y-Coordinate (m)	9853.769
Z-Coordinate (m)	1501.65

3.3.3 Fire Protection

3.3.4 Design Approach

The Eskom Fire Protection/Detection Assessment Standard [53] gives the possible design approaches that can be taken during a fire system design. The Fire Protection & Life Safety Design Standard [46] is to be considered during detailed design. The scope will follow the legislative route of “Deem to Satisfy” (DTS) by complying with the requirements of SANS 10089-3 [40].

The *Contractor* shall design, supply, install and commission the fire protection for the complete works. The *Contractor shall* include as a minimum the following:

- Hazardous Zone Classification as per HAZLOC [44].
- Portable fire extinguishers covering all fire risk areas, positioned at strategic fire points.
- Passive fire protection measures such as separation of flammables/ combustibles from ignition sources, enclosure and/or compartment of fire risks, fire-sealing of service penetrations, and coating of cables in potentially fire exposed areas.
- Installation of piping/fittings, pressure testing, flushing and commissioning of the fire water piping
- Provision of an emergency lighting system, emergency escape routes and exits
- Safety signage as per SANS 10089-3 [40]

The *Contractor* shall send Fire protection design to the fire chief of the Local Municipality for approval.

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3.3.4.1 Fire Risk Evaluation

A fire risk evaluation shall be initiated early in the design process, to ensure that the fire prevention and fire protection recommendations as described in SANS have been evaluated in view of the plant-specific considerations regarding design layout and anticipated operating requirements. The evaluation shall result in a list of recommended fire prevention features to be provided based on an acceptable means for separation or control of common and special hazards, the control or elimination of ignition sources, and the suppression of fires.

3.3.4.2 Pipe-work

A fire water ring main already exists and other fire protection systems are connected to this. The *Contractor* shall pressure test, flush and commission the fire water system. Existing fire water system shall be inspected, where there is missing piping/fittings the *Contractor* shall install before commissioning the system.

The on-site commissioning of the fire water system is conducted as per *Employer's* Fire Protection & Life Safety Design Standard.

Fire Water supply for the Kusile Fuel Station will be provided at the Termination Point TP-13-26-820 as shown on drawing 0.90/24977.

3.3.5 Pressure Test Requirements

The fuel filling lines shall be pressure tested to determine if there are any leaks. The fuel filling lines do not operate under high pressure however, when pressure tests are done the following shall apply:

- a) All pressure tests shall be conducted with water i.e. hydraulic pressure tests.
- b) Pressure test procedure shall be submitted to and approved by *Employer* before pressure test can commence. Pressure test procedures shall also be included in the data book.
- c) Two pressure gauges shall be used for the pressure test.
- d) All pressure gauges shall have valid calibration certificates prepared by a SANS accredited pressure laboratory for all locally manufactured items. The maximum validity of the calibration certificates shall be 6 months.
- e) Proper venting shall take place, and all air pockets shall be vented. Method statement shall be provided.
- f) The pressure inside the equipment under test shall be increased to a value of the specified test pressure as defined by the ASME B31.1 code. Thereafter, the pressure shall be increased in steps of approximately 10% per minute of the specified test pressure until the full test pressure is reached. The piping system shall be held at the test pressure for a period of at least 30 min.
- g) After the test has been completed a pressure test certificate shall be issued which shall be included in the data book

3.3.6 Potable Water

The Contractor shall procure and install piping, from the Employer's termination point (TP-W42 at GKC -13 Valve Box for potable water to the two existing taps in the fuel filling station. The Contractor shall excavate where required to connect the pipe to the Employers pipe. The Contractor shall procure and install a mechanical pressure regulator before supply to the taps. The pressure regulator shall have a setpoint of 3.5 bar. The pressure regulator shall be installed above grade.

All below grade pipe shall be HDPE and comply to SANS 4427. Piping shall be buried in accordance with SANS 1200LB

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All above grade pipe shall be carbon steel in accordance with SANS 62. Screwed fittings shall be used where possible. Screwed fittings shall be BSP threaded in accordance with ISO 7-1

All piping shall be rated for 10 bar design pressure. The Contractor shall hydrotest the pipe at 1.5 times design pressure.

3.4 ELECTRICAL WORKS

The contractor is required to:

- Design, Supply and Installation of the electrical reticulation for the filling station. The following schematic and layout can be utilised and expanded upon as per the contractors detailed design requirements:
 - Draft: 0.90/24714 (Filling Station) Schematic Diagram DB-FD
 - Draft: 0.90/24713 (Filling Station) Lighting, Small Power and Lightning Protection Layout
- Design, Supply, route, install and terminate power cables from an existing mini-sub [03BBR and 04BBR] to the filling station distribution board.
- Issue a Certificate of Compliance (CoC) for hazardous location as well as for lighting and small power.
- The equipment's ex-rating must be compatible with the type of fuel being handled.
- Design, Supply and Installation of lighting and small power shall be in accordance with the relevant Eskom and National Standards.
- Design and install earthing and bonding of equipment in accordance with earthing and lightning protection standard. The Contractor shall tie into the earth mat which is installed by others in accordance with the relevant codes, standards, and guidelines.
- The *Contractor* shall design, supply, and install a power distribution board for power supply to the filling station electrical equipment.
- All associated electrical reticulation [Cable sizing, routing, supply and install] is the responsibility of the contractor. Any excavation is the responsibility of the contractor, the Excavation Permit Application would need to be done and the relevant Procedure complied with, as detailed in section 12.2
- The *Contractor* shall install all equipment in accordance with SANS 10108 in terms of area classification, equipment selection, installation (erection), and inspection. Area classification shall be in accordance with HAZLOC Assessment report developed by the contractor in accordance with the relevant Eskom and National standards.
- Attention must be given to cable glands, junction boxes, switches and cable terminations in hazardous areas.
- Upon inspection of the plant, the *Contractor* to issue a Certificate of Compliance (CoC) for hazardous location as well as for lighting and small power.

3.5 C&I WORKS

The contractor is required to:

- Supply, install and commission the Fuel Management System. The system shall be able to perform the following:
 - Identify and log the Filling Station Operator to prevent unauthorized use of fuel. This may be done via key-fob or transponder.
 - Identify and log the vehicle being filled. Only authorized Eskom Fleet vehicles shall be filled at this Filling Station. This shall be done via key-fob, transponder, or vehicle ID.
 - Only authorized individual(s) should be able to override the system.
- The system shall cater for a minimum of 1000 identities.
- The system shall be capable of automatic tank gauging on the two tanks for inventory management with water warning limit, high water limit, lower-level limit, delivery level limit, high limit, overfill limit, maximum volume limit, tank temperature measurement, tank capacity in litres, and tank dimensions. This information must be displayed on the real time dashboard.

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- Recorded data from the Fuel Management System shall be extractable for reporting purposes in excel format. This shall include fuel dispensed into the storage tanks, fuel dispensed into vehicles per filling station unit, and batch records.
- The Contractor solution shall have a 99% system availability.
- The active dashboard shall have a built-in functionality to detect and highlight anomalies.
- The system shall enable the Employer to load new vehicle labels through the master tag, manually enter storage tank before and after fuel deliveries in case of data acquisition system failure through the master tag.
- The system shall be fully compliant to the hazardous location standard and shall have sufficient lightning protection.
- In addition, general CCTV surveillance shall be installed to monitor activity at the Filling Station.
- A local storage system shall be provided. This shall not interface to the DCS, CBMS, or PIS.
- Only hardwired systems shall be acceptable.
- The contractor shall provide adequate housing for all the associated equipment.
- Supply complete software, licensing, and special tools (where applicable).
- Supply of accurate offloading meters to measure the amount of fuel dispensed into each tank.
- An automatic tank gauging (level) device is to be fitted to each tank.
- Provide at least two dispensing speeds to cater for trucks (or larger vehicles) and normal vehicles.
- All equipment shall be IP65 as a minimum.
- All equipment shall be intrinsically safe for the identified zoning of the facility.
- The fuel management system shall contain appropriate locking mechanisms to prevent unauthorized access.
- All equipment shall comply to the following standards (as applicable):
 - 240-56355754 - Field Instrument Installation Standard
 - 240-56355789 - Flow Measurement Systems Installation Standard
 - 240-56355815 - Junction Boxes and Cable Termination Standard
 - 240-56355843 - Pressure Measurement Systems Installation Standard
- The Contractor is required to cooperate with others to integrate requirements and provide a fully functional system. This shall occur during construction, commissioning, and handover.

3.5.1 Installation Requirements

- All equipment, enclosures, and instruments shall have an ingress protection rating of at least IP65.
- All enclosures shall be mounted on racks manufactured for heavy duty galvanised Unistrut and the mounting location shall not obstruct passage of vehicles.
- Electrical distribution boxes:
 - 304L stainless steel with slanted roof
 - IP 66
 - Removable gland plate
 - 3 mm double-bar lock
 - Pad lockable lock cover
- As a minimum the Contractor solution shall be fully compliant with the requirements of the Eskom Cyber Security Standard for Operational Technology, SANS 1020:2013 Power-operated dispensing devices for flammable liquid fuels, hazardous locations standard 240 – 56536505.
- The Contractor shall supply a MIE compliance certificate.

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3.6 CIVIL & STRUCTURAL WORKS

The contractor is required to:

- Perform Geotechnical testing, investigation and provide geotechnical solutions where applicable. The purpose of the detailed investigation is to evaluate the soil and rock profiles at the site where the Fuel Filling station to be installed. The findings will inform the foundation and pavement design, providing recommendations for site preparations, including earthworks, terracing and the construction of foundations
- Perform geometric and underground surveys to verify existing infrastructure.
- Design and construction of off-loading slab, ground slab around the fuel dispensers, Filling Station Canopy and drainage system which ties into existing drainage system via an oil separator.
- Design and construction of all roads from the site main roads [station road 14 and station road 39] to the Filling Station [0.90/71685 Site Finishing - Site Plan - Area 17D].
- Design and construct earthworks for underground storage tanks, fuel off-loading area, ground slab and drainage.
- All areas, where there is a potential of spillage or floor washing required, must drain to the dirty drain network via oil separator. The *Contractor* is to design and construct these drains and cut-off drains where necessary.
- Design and construct dispensers and pumps plinths (if required) with concrete or steel barrier columns.
- Produce as-builts drawings and Professional Engineering Certificates for the complete designs.
- The following civil drawings are issued for information; however, the contractor is welcome to utilise the drawings for the associated scope. The Contractor will be required to produce the As-builts and Professional Engineering Certificates regardless if the drawings below are used.
 - 0.90/55181 Kusile Power Station Filling Station
 - 0.90/24713 (Filling Station) Lighting, Small Power, and Lightning Protection Layout
 - 0.90/71685 Site Finishing - Site Plan - Area 17D
 - 0.90/1940 Plan, Roof Plan, Sections & Elevations
 - 0.90/137 Station Layout
 - 0.90/23539 Workshop & Stores Portable Water Layout
 - 0.90/23539 Workshop & Stores Fire Water Layout
 - 0.90/23540 Workshop & Stores Clean Sw Layout
 - 0.90/23542 Workshop & Stores Clean Sw Long sections 2 Of 3
 - 0.90/23545 Workshop & Stores Platform Road Parking 1 Of 2
 - 0.90/23547 Workshop & Stores Dirty Storm Water Layout
 - 0.90/23548 Workshop & Stores Dirty Storm Water Long Sec

The Civil & Structural Technical Specifications for the project includes concrete works, brickwork, earthworks, roadworks, stormwater drainage as well as any supporting infrastructure for the Mechanical, C&I and electrical scope indicated in the sections above for the liquid fuel filling station. The *Contractor* shall be responsible for the design, construction and professional engineering certification of the Works.

- The works shall be designed and constructed for a 50 year plant life cycle.

Note: The offloading slab should not be constructed on top of underground tanks.

3.6.1 Requirements

1. The *Contractor* shall take full professional accountability for all of the Works in their scope and shall provide the following for review and acceptance:
 - Consolidated detailed design report signed by a Professional Civil Engineer which includes:
 - Survey results, outcomes of Geotechnical investigation (Geotechnical Investigation report), design criteria/parameters, specifications and standards used, loadings, assumptions,

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- calculations results including detailed design calculations, design models, sources of information and any record of other information associated with the completed Works.
- Detailed drawings for construction. Drawings shall be submitted in native CAD and PDF format.
 - Professional engineering certificate, signed by an ECSA registered professional once construction work is completed.
2. The *Contractor* shall submit as-built data and drawings of the completed works upon handover. As-built drawings shall be submitted in PDF and native CAD formats.
3. Any discrepancy or ambiguity between the *Employer's* Specifications or requirements shall immediately be brought to the attention of the Project Manager for clarification.

3.6.2 Structural Works

The structural works includes reinforced concrete, structural steelwork, and brickwork.

3.6.2.1 Initial Assessment

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

- a) Geotechnical investigation of the ground to confirm if the location is suitable for foundations and location of tanks.
- b) The topographical survey of the proposed area(s)
- c) Underground scanning and surveys in the proposed areas to locate any underground services

3.6.2.2 Structural Design Criteria

The *Contractor* shall consider all the below mentioned design criteria for the Works, and the Works shall comply with Structural Design and Engineering Standard and the normative references within:

3.6.2.2.1 Reinforcement

- 1. Steel reinforcing shall comply with Steel bars for concrete reinforcement standard
- 2. Welded mesh reinforcement shall comply with Welded steel fabric for reinforcement of concrete
- 3. Bending schedule shall be in accordance with bending dimensions and scheduling of steel reinforcement for concrete.
- 4. Reinforcement chairs and spacing of spacers shall comply with detailing of reinforcement for concrete.
- 5. All concrete cover shall be in accordance with the Kusile Structural Concrete Specification, 203-770.

3.6.2.2.2 Concrete

Due to the aggressive local environment the reinforced concrete work are exposed to, the exposure condition of the concrete is classified as severe in accordance to SANS 10100-2, hence the quality of concrete works is of paramount importance. All concrete work shall be designed in accordance with the Kusile Structural Concrete Specification 203-770 and relevant design codes of practice. The *Contractor* shall ensure that the design, detailing and construction of all reinforced concrete elements/structures are done in such a way that shrinkage cracks are limited to acceptable limits to ensure long term durability of the works.

3.6.2.2.3 Brickwork

- 1. All brickwalls to be 230mm thick and shall comply with SANS 227 and Kusile Power Station Conceptual architectural specifications for building and other structures, 203-1239 requirements.
- 2. Brickwalls shall be built in two stretcher bonds.
- 3. Mortar shall be Class II as per SANS 2001-CM1

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4. All brickforce shall consist of 150 mm wide 2.8 mm diameter wires and 2.5 mm diameter cross wires, and comply with SANS 2001-CM1
5. Selected wall ties shall comply with the requirements of SANS 2001-CM1

3.6.2.2.4 Structural Steel

1. Allowable deflection for steel structures is governed by the structural use of steel Part 1: Limit-states design of hot-rolled steelwork and the Southern African Steel Construction Handbook - Red Book.
2. Structural steel work shall be designed in accordance with relevant design codes of practice.
3. Fixing of purlins to roof beams and trusses shall be by means of suitable cleats.
4. All metal grating, stair treads and fasteners shall be hot dipped galvanized to SANS 121.
5. Hand railing, floors, platforms and walkways shall be provided with kick plates 100mm x 6mm.

3.6.2.3 Construction Criteria

The *Contractor* shall construct the Works in accordance with the Works Information and the Construction works and other relevant SANS specifications referenced herein

3.6.2.3.1 Concrete Works

South African Standard Construction Works Part CC1: Concrete works (structural) and the Kusile Power Station Specification for Structural Concrete shall be used for the construction of all concrete works.

The *Contractor* shall pay special consideration to the construction of concrete classified as “massive” and hot weather concreting. The Kusile specification for structural concrete shall be considered for specialist literature regarding the construction of mass concrete, control of cracking in concrete, hot weather concreting prediction of creep, shrinkage and temperature effects. The *Contractor* shall submit to the Engineer concrete mix designs, concrete-mix test cube results and all other required test results as indicated in the Kusile Power Station Specification for Structural Concrete prior to the placement of any concrete. The *Contractor* shall also submit, to the Engineer for review, detailed construction method statements and a quality and test plan prior to the casting of concrete. Construction joints and reinforcement shall be indicated as hold points for the approval by the responsible registered Designer. The *Contractor* shall include all specified tests and interventions as a minimum in the inspection and test plans. The *Contractor* shall submit to the *Project Manager* its quality control plan (QCP) for acceptance and intervention points by the Engineer.

The *Contractor* shall familiarise himself with the local environmental conditions.

1. Material and Concrete Testing
 - The Contractor to fully comply with the testing stipulated in document number. Where any concrete and concrete material testing frequency is unclear, the Contractor and Employers Engineering team to discuss and agree on a frequency. All test results to be submitted to the Employer's Team for review.
 - Due to the importance of the concrete works the Contractor may perform durability index tests on concrete works identified as potential defects which may have an impact on the durability of the concrete works. These tests are developed to assess the transport properties of the concrete cover zone. Three durability tests are defined as:
 - Oxygen Permeability Index test
 - Chloride Conductivity test and
 - Water Sorptivity test

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The Table below provides classification for different test results for the three tests. The acceptance criteria for test results for the three different tests shall be classified as “Good” or “Excellent”. The *Contractor* to ensure the works are scheduled taking into consideration time for defects resolutions.

Table 2: Acceptance criteria for durability index test results

	Oxygen Permeability	Sorptivity	Chloride Conductivity
Excellent	> 10	< 6.0	< 0.75
Good	9.5 - 10	6 - 10	0.75 - 1.5
Poor	9.0 - 9.5	10 - 15	1.5 - 2.5
Very Poor	< 9.0	> 15	> 2.5

2. Adverse weather conditions affecting civil works

- The Contractor should note temperatures typically experienced in the region of Kusile Power Station. The Contractor to consider adverse weather conditions in the construction method statement for concrete works. For clarity of the Kusile Power Station specification for structural concrete the Contractor to note the following:
 - The latest weather statistics from the South African Weather bureau shall be used by the Contractor to assist with scheduling of works. The programme shall account for new weather patterns in the region of Kusile Power Station and in particular consider the rainy season in the region that may cause delays during construction.
 - When ambient temperature is above 36°C, the temperature of the concrete when deposited shall not be allowed to exceed 32°C and when ambient temperature is below 36°C, the temperature of the concrete when deposited shall not be allowed to exceed 35°C.
 - The Contractor should note that concrete placed during hot weather conditions, exposed to direct sun and wind is especially subject to plastic-shrinkage and the Contractor shall adapt construction processes and methods to prevent the occurrence of plastic-shrinkage cracks.

3.6.2.3.2 Structural Steelwork

1. All work shall be in accordance with the latest edition of SANS 2001-CS1.
2. The Contractor shall be responsible for the stability of the entire structure and all structural elements during all the erection stages.
3. All dimensions shall be verified on site by the Contractor before any fabrication of steelwork commences.
4. All welding shall be conducted by coded welders. Supporting documentation shall be submitted to the Engineer for acceptance. All welding shall comply with Standard for Welding Requirement on Eskom plant.
5. All welds shall be inspected using visual aids.
6. The Contractor shall supply all bolts, washers, nuts etc. for the structural steelwork.

The *Contractor* shall refer to SANS 10162-1 [99], The Structural Use of Steel- Part 1: Limit-state Design of Contractor to provide Own Concrete. Hot-rolled Steelwork, AWS D 1.1: Structural Welding Code – Steel, SANS 2001:CS1, Construction Works – Part CS1: Structural Steelwork and other standards listed in the above mentioned standards for material grades to be used, fabrication and erection tolerances, testing, corrosion protection and the design of all structural steel work.

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The *Contractor* shall submit, to the Engineer, steel grade certificates, fabrication drawings, welder's certificates and quality and test plans for review prior to fabrication. The *Contractor* shall submit a construction method statement for steel works as detailed in the VDSS, inclusive of risk assessments per area of construction, to the *Engineer* for review and approval within 28 days prior to commencement of respective activities for review and approval by the Engineer.

3.6.2.3.3 Stormwater drainage and terracing

The *Contractor* shall provide adequate drainage in case of any spill as well as floor washing for the Fuel Filling Station Infrastructure. The design shall tie into the existing dirty drain network at Kusile Power Station via an oil separator to reduce the requirements for any additional drainage infrastructure. The design shall ensure that the spill be contained within the boundaries of the Fuel Filling Station and only drain to the dirty drain network. The tie-in point (manhole Dd5 and Dd11) can be seen in drawing 0.90/23547 indicating the current drainage network within the immediate vicinity of the Fuel Filling Station. The *Contractor* shall also ensure that the area is made good after the construction activities taking care not to allow any ponding/standing water.

3.6.2.4 Design criteria

3.6.2.4.1 Design Considerations

The dirty drainage design shall interface with the existing dirty drain infrastructure via an oil separator. Levels and positioning shall be considered to ensure that no flooding occurs. The natural ground levels shall be assessed and terracing or localised reshaping may be required to ensure that no ponding occurs in any of the affected areas.

3.6.2.4.2 Design of Storm water Pipes

1. A minimum pipe diameter of 300mm shall be used for any new designs.
2. Calculations for the loads on the pipelines and selection of the appropriate pipe class shall be done in accordance with SANS 10102-1 and SANS 10102-2. A minimum of Class 100D is required for all concrete stormwater pipes.
3. All stormwater pipes shall be designed with a minimum slope of 0.5%. Changes in slope, especially a reduction in slope, shall be avoided as far is possible.
4. Design flow velocities shall be between 0.5m/s and 3.0m/s with a desirable minimum range of between 0.9 and 1.5m/s. The absolute minimum of the half-full velocity shall not be less than 0.6m/s.
5. The design flow in pipes shall not exceed a ratio of 80% of the capacity of the pipe.

3.6.2.4.3 Manholes

Manholes shall be positioned at distances not greater than 50m apart and at a minimum shall be located at the following points:

1. Where two or more storm drains converge.
2. Where pipe sizes change.
3. Where a change in horizontal alignment occurs.
4. Where a change in grade occurs.

3.6.2.4.4 Legislation

The following legislative documents shall be adhered to during the designs of all water related infrastructure:

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1. The National Water Act (Act No. 36 of 1998)
2. The Environmental Conservation Act (Act No 73 of 1989)
3. Government Notice 704, National Water Act 1998
4. National Environmental Management Act (NEMA), Act 107 of 1998

3.6.2.4.5 CONSTRUCTION SPECIFICATIONS

The latest version of the following codes shall be adhered to during construction and manufacturing of the works but not limited to

3.6.2.4.6 SANS 2001 DP5: STORMWATER DRAINAGE

The following codes are applicable: South African National Standard Construction Works Part DP5 : Stormwater Drainage Specification data pertaining to SANS 2001-DP5: 2010 is as listed in the table below. The clause listed in the table below refers to the clause number in SANS 2001-DP5 and the table below shall be read in conjunction with the code.

Clause	Specification data
4.1.10.3	Concrete Grade shall be: • Class 15 / 19 for Blinding Concrete; • Class 35 / 19 for Benching; • Class 35 / 19 for Structural Concrete.
5.3.1	Stormwater drainage, including manholes, shall be tested in accordance with the requirements of SANS 2001-DP4.
Additional Clauses	
1	Measurement and payment shall be in accordance with SANS 1200 LE Clause 8.

3.6.3 Geotechnical works

The geotechnical investigation must provide essential parameters on which the foundations of all structures may be based. Where applicable the investigation must determine the suitability of fill material which shall be prescribed by the geotechnical investigation and shall be regularly checked by field laboratory tests during construction period as part of the geotechnical verifications and designer monitoring to ensure compliance to geotechnical designs and foundation requirements.

The Contractor is required to perform a geotechnical ground investigation and gather all geotechnical information.

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The Contractor is required to gather sufficient and accurate data concerning the full geological classification inclusive of the ground-water conditions within the proposed footprint to determine characteristic values of the geotechnical engineering parameters required for the foundation design. The following specific items should be included in the investigation:

3.6.3.1 Test/Trial Pits

Test pits to be excavated using a TLB controlled by a licensed TLB operator. The required provision of plant shall be the responsibility of the contractor. Excavating pits to a specified depth (usually 1.5 to 3 meters but can vary). Maintaining safe side slopes or shoring to prevent collapse.

All test pits shall be profiled by a registered geotechnical engineer or geologist. Soil profiling shall be conducted in accordance with the SAICE code of practice (after Jennings et al.1973). All positions of test pits should be coordinated with a valid calibrated hand-held GPS and in accordance with the WGS84 coordinate system.

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3.6.3.1.1 Penetration Tests

Contractor shall perform Dynamic Cone Penetrometer (DCP) Tests or Dynamic Probe Super-Heavy (DPSH) Tests to gain both qualitative and quantitative description of the ground to enable the design of the geotechnical structures.

3.6.3.1.2 DCP

The DCP test comprises a 20mm diameter (60° apex angle) cone that is driven into the ground using a sliding hammer of 8kg mass dropping through a distance of 575mm. During the test the cone penetration is recorded after single or multiple hammer blows. The test is continued to refusal or to a depth of 1m with the option to extend the test to a depth of 2m by attaching an extension rod.

The DCP N-value or penetration rate is calculated as the average penetration of the cone in mm per blow over each increment of measurement. The penetration rate is usually plotted on a graph of rate (mm/blow) versus depth (m).

3.6.3.1.3 DPSH

DPSH equipment used in SA consists of a weight of 63,5kg dropping 750mm onto a string of rods with a 50mm diameter (20cm² projected area), 90° apex angle, disposable cone at the front. The result of the test is presented as a graph of the number of blows required for each 300mm penetration (DPSH N-Value) against depth.

The test continues to be refusal when more than 80 blows are required for 300mm penetration. Once the DPSH has met refusal, the detachable cone allows the drill string to be retracted 600mm to 1m and re-driven without the cone. This re-drive allows direct measurement of the friction on the rods at the refusal depth. The blow-counts for the entire penetration profile can then be corrected for rod friction by applying incremental adjustments that start from zero at ground surface and increases linearly with depth to equal the re-drive value at the termination depth.

3.6.3.1.4 Tests on Soil Samples

Below is a list of tests that the Contractor can perform on the soil samples:

- Identification tests - Atterberg Limits, Sieve analysis including hydrometer
- State tests - In situ Moisture content, Undisturbed Bulk density, Specific gravity
- Strength tests - Saturated Consolidated Undrained (SCU) triaxial test, Saturated Consolidated Drained (SCD) triaxial test, Unconsolidated Undrained (UU) triaxial test
- Deformability tests - Collapse potential (modified single oedometer), Double oedometer
- Compaction tests - Moisture/density relationship at Modified AASHTO compaction effort and California Bearing Ratio (CBR)
- Permeability tests-Falling head or constant head

3.6.3.1.5 Electrical Resistivity

Electrical resistivity tests conducted to obtain the specific soil resistance to establish the design parameters for the grounding system.

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3.6.3.1.6 Chemical Tests

Aggressiveness of soils towards concrete and metals including pH, electrical conductivity, organic content

3.6.3.1.7 Laboratory Testing

All laboratory testing is conducted in accordance with the latest standard methods and procedures as outlined by the appropriate authorities (B.S/ Euro Code equivalent, A.S.T.M, A.A.S.H.T.O, I.S.R.M, S.A.B.S / S.A.N.S, TMH 1).

The Contractor is responsible for the transportation of all samples to the laboratory as well as the testing thereof.

Any other field or additional testing that may be required in support of the objectives of the geotechnical investigations must be carried out with notification to the Employer's geotechnical/civil engineer.

The Project Manager reviews and accepts the proposal for additional testing prior to commencement of additional testing.

After completion of fieldworks and laboratory testing, the Contractor's professional engineering geologist or geotechnical engineer prepares and submits a consolidated geotechnical report based on the fieldworks conducted.

3.6.3.1.8 Reporting Deliverables

After completion of fieldworks and laboratory testing, the Contractor's professional geotechnical engineer prepares and submits a consolidated geotechnical report based on the fieldworks conducted. The Factual information and interpretive results are clearly distinguished.

The geotechnical report shall entail: Site Location, site, project description, geological setting and description of the field work including equipment used for excavating, probing and drilling;

Soil parameters of the in-situ/fill layer work materials which allow for the computation of soil properties shall be provided as part of the report as the following: Shear strength, Lateral or active earth pressures (where necessary), Consolidation and bearing capacity

- Surface and sub-surface conditions as determined by intrusive ground testing. This includes classification and description of all properties pertinent to the soil and rock strata,
 - discussions and calculations of both ultimate and allowed bearing capacities; maximum allowed settlements and settlements versus time.
 - any and all-natural groundwater intersection, quantification and source thereof,
 - calculations of bearing capacity and settlements, including angular distortion, if applicable of typical foundations
- Tables of Laboratory Tests
- Analysis and Recommendations to include the following:
 - Earthworks recommendations;
 - Recommendations regarding the slope stability of excavations, cuts and embankments
 - as well as support measures if applicable;
 - Recommendations of foundations types;
- Based on corrosively testing, recommendations are provided for the protection of buried steel and concrete services/structures against chemical attack from soils and groundwater (where applicable);
- The following is included in the appendices:

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- All field data and laboratory results
- All detailed calculations leading to the final recommendations such as, but not limited to, the ultimate and allowable bearing capacities, the vertical and horizontal modulus of the subgrade reaction.

The Project Manager reviews and accepts the proposal for additional testing prior to commencement of additional testing.

The Contractor submits the detailed geotechnical design report and finalised drawings for acceptance before any construction can take place.

3.6.3.1.9 Painting And Corrosion Protection

The corrosion requirements are stipulated in the Kusile Power Station Corrosion Protection Specification, SSZ_45-17. The painting requirements are stipulated in the Specification for the Identification of the Contents of Pipelines and Vessels, 240-145581571.

3.7 CONFIGURATION AND DOCUMENTATION MANAGEMENT REQUIREMENTS

The documentation and configuration management requirements are detailed in Annexure 11.6 and Annexure 11.7 respectively.

3.8 QUALITY REQUIREMENTS

- 1) Quality Control is a product-oriented set of activities for ensuring quality in products/services. These activities focus on inspection and identifying defects before these reach the *Employer*.
- 2) The *Contractor* shall ensure that Quality Control is performed at all levels and phases of work carried out for the *Employer*.
- 3) The *Contractor* shall submit the following documents within 30 days after the contract date, prior to the commencement of work, for acceptance by the *Employer*:
 - a) QCPs and ITPs for review and acceptance by Eskom prior to the commencement of any work, inclusive of subcontracted work, within 30 days after contract award.
 - b) The QCPs and ITPs show each activity/requirement of the Works Information.
- 4) In the event of poor quality, re-work or incidents where products inspected by the *Employer* fail to meet requirements, the *Contractor* shall receive a Non-conformance (NCR) if deemed so by the *Employer*.
- 5) The *Contractor* shall submit data books for all work for acceptance by the *Employer* if applicable. These are defined as follows:
 - H1 – Fabrication [Prior to Construction commencing]
 - H2 – Construction [2 weeks Prior to Commissioning commencing]
 - H3 – Commissioning including As-builts [2 weeks after commissioning has been completed]

4. VERIFICATION

4.1 DESIGN REVIEWS

Design reviews shall be conducted in accordance with Eskom Design Review Procedure. 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, 11.3.

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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 NEC contract requirements and is finalised during contract negotiations with the *Contractor*. 11.3 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* 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.

4.1.1 Change Management

All Design change management is performed in accordance to the latest revision of the Eskom Project Engineering Change Management Procedure (240-53114026) and the Kusile Engineering Change Management Work Instruction (240-132735850). The Employer ensures 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.

4.2 FACTORY AND SITE ACCEPTANCE TESTING REQUIREMENTS

All factory and site acceptance tests shall be conducted as per the requirements in the scope of work and as per the relevant standards and specifications.

4.3 COMMISSIONING AND HAND-OVER REQUIREMENTS

The Kusile Filling Station shall be commissioned in line with Kusile Commissioning Procedure [37] and handed over as fully functional system that conforms to applicable standards. The handover documentation shall be in line with Documentation Handover List - Annexure 11.5, as agreed between the *Employer* and *Contractor*.

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

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- 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

5. MAINTENANCE

The design shall include the following for the plant maintenance requirements:

- Plant maintainability characteristics sufficient to achieve the required availability
- Number and skill of maintenance personnel
- Packaging, handling, storage and transportation
- Preferred equipment for ease of maintenance
- Period between major shut-downs
- Standardisation requirements
- Spares
- Special tools & software
- Training
- Technical documentation:
 - Manuals
 - Procedures
 - Parts catalogue
- Pumping system to be designed with sufficient space for easy maintenance

6. SPARE PARTS

The supply of all spare parts and consumables required for commissioning, performance and reliability testing of the complete plant up to the issuing of the *Completion* Certificate for the *Works*, shall be the responsibility of the *Contractor*. It is the *Contractor's* responsibility to ensure that an adequate supply of spares are available on site to fulfil his contractual obligations during the commissioning, performance and reliability testing up to take-over of the plant.

The quantities of spares for two years operation based on the *Contractor's* recommended list shall be ordered at the discretion of the *Project Manager*.

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7. TRAINING REQUIREMENTS

A minimum of two training sessions shall be provided to engineering, operating and maintenance departments for the effective and efficient operation and maintenance of the filling station. Training shall include training material, tests and assessments to ensure that personnel are competent.

7.1 TRAINING

Training on the operation and maintenance of the *Works* is conducted, if required/applicable, training is targeted for the following audiences:

- Operating
- Maintenance
- Engineering

Training manuals and maintenance manuals are made available for all the above-mentioned areas

8. BASELINE APPROVAL

This document has been seen and accepted by:

Name and Surname	Designation	Signature
	Mechanical Engineer Auxiliary Engineering	
	LDE – Civil Engineering	
	LDE – Geotech	
	LDE – Electrical Engineering	
	LDE – C&I Engineering	
	Manager – Auxiliary Engineering	
	Engineering Manager	

9. REVISIONS

Date	Rev.	Compiler	Remarks
August 2026	1		Original document

10. ACKNOWLEDGEMENTS

Not applicable

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11. ANNEXURES

<u>Appendix Title</u>
Appendix 11.1 – Drawings
Appendix 11.2 – Codes, Standards and Guidelines
Appendix 11.3 – Vendor Document Submittal Schedule (VDSS)
Appendix 11.4 – Master Document Schedule (MDL)
Appendix 11.5 – Documentation Requirements for Final Handover
Appendix 11.6 – Documentation Management
Appendix 11.7 – Configuration Management

11.1 DRAWINGS

*Refer the Drawing Register and Drawings in the relevant Appendix folder of the Enquiry.

Drawing No.	Title
0.90/55181	Kusile Power Station Filling Station
0.90/24713	(Filling Station) Lighting, Small Power, and Lightning Protection Layout
0.90/71685	Site Finishing - Site Plan - Area 17D
0.90/1940	Plan, Roof Plan, Sections & Elevations
0.90/137	Station Layout
0.90/23539	Workshop & Stores Portable Water Layout
0.90/23540	Workshop & Stores Clean Sw Layout
0.90/23542	Workshop & Stores Clean Sw Long sections 2 Of 3
0.90/23545	Workshop & Stores Platform Road Parking 1 Of 2
0.90/23547	Workshop & Stores Dirty Storm Water Layout
0.90/23548	Workshop & Stores Dirty Storm Water Long Sec
0.90/24714	(Filling Station) Schematic Diagram DB-FD
0.90/24713	(Filling Station) Lighting, Small Power and Lightning Protection Layout

11.2 CODES, STANDARDS AND GUIDELINES

Reference to codes, standards and guidelines of any society, organisation, or association, whether such reference be specific or by implication, mean the latest standard, manual, or code in effect as at the time of Contract Award, unless specifically stated otherwise. Except for technical requirements, no provision

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of any such standard, manual, or code is effective to change the duties or responsibilities otherwise established in this Contract.

Civil and Structural

Code	Description
240-56364535	Architectural Design and Green Building Compliance.
366-246857	Ash Dump Layer Works Detailed Design Report
SANS 10160	Basis of structural design
240-55864504	Belt Conveyor Structural Steelwork and Welding Specification
SANS 0120-LC 1981	Cable Ducts
203-1239	Conceptual Architectural Design Specifications for Structures and Other Buildings
240-107981296	Constructability Assessment Guideline
SANS1921-5	Construction and Management of works contracts: Part 5,Earthworks activities to be done by hand
SANS 1921-3:2004	Construction and management requirements for works contracts, Part 3 Structural steelwork
SANS 1921-5	Construction and management requirements for works contracts, Part 5 Earthworks activities which are to be performed by hand
TRH 9	Construction of embankments
CR 2014	Construction Regulations 2014
SANS 2001	Construction Works (All applicable parts)
SANS 2001 BE1	Construction works Part BE1: Earthworks (general)
SANS 2001 SE1	Construction works Part BS1: Site clearance
SANS 2001-CC1	Construction works Part CC1: Concrete works (structural)
SANS 2001 CC2	Construction works Part CC2: Concrete works (minor works)
SANS 2001 CS1	Construction works Part CS1: Structural steelwork
SANS 1200 HC	Corrosion protection of structural steelwork
SANS 10161	Design of foundations for buildings
240-56364537	Design of Steel Structures

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SANS 10208-3	Design of structures for the mining industry Part 3: Conveyances
SANS 2001-DP1:2011	Earthworks for buried pipelines and prefabricated culverts
240-57127953	Execution of Site Preparation and earthworks
240-57127955	Geotechnical and Foundation engineering standard
240-92460850	Geotechnical Standard for CSY and ADF Site Investigation
240-125171334	Guideline for the Design of Ash Disposal Facilities for Coal Fired Power Stations
240-125171334	Guideline for the Design of Ash Disposal Facilities for Coal Fired Power Stations
TRH 11	Guidelines for the conveyance of abnormal loads
203-1329	Kusile Power Station Architectural Technical Specifications for Structures And Other Buildings ;
203-770	Kusile specification for structural concrete works
DIN 4024 PART 1	Machine foundations, flexible structures that support machines with rotating elements
DIN 4024 PART 2	Machine foundations, rigid foundation for machinery with periodic excitation
SANS 10400	National Building Regulations
SANS 0120-DB 1982	Pipe Trenches
240-84418186	Roads Specification Manual
Southern African Steel Construction Handbook	SAISE
36-1126	Specification for corrosion of plant and equipment with coatings
240-57127955	Geotechnical and Foundation Engineering standard
240-91244751	Specification for Geotechnical Investigations Standard
240-57127951	Standard for the execution of Site investigations
240-57127953	Execution and Site Preparation and Earthworks Standards
240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
240-83539994	Standard for Non-Destructive Testing (NDT) on Eskom Plant
240-106365693,	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
240-106628253	Standard for Welding Requirements on Eskom Plant

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0.00/2901	Standard handrail drawing
SANS 1200	Standard Specification For Civil Engineering Construction (All applicable parts)
COLTO Green Book	Standard Specification for Road and Bridge Works 1998
SANS 1200-DK	Standardized specification for civil engineering construction Section DK: Gabions and pitching
SANS 1200 HA	Steelwork (structural) sundry items
240-56364545	Structural Design and Engineering Standard
SANS 10100-1	Structural use of concrete
32-1163	The Eskom Zero Liquid Effluent Discharge (ZLED) philosophy is stated at 3.3.13 in the Water Management Policy
The National Water Act (Act No. 36 of 1998)	The National Water Act (Act No. 36 of 1998)
SAICE	Site Investigation Code of Practice, 1st Edition, South African Institution of Civil Engineering - Geotechnical Division, January 2010.
SAICE, SAIEG	Guidelines for Soil and Rock Logging in South Africa, 2nd Impression 2001, eds. A.B.A. Brink and R.M.H. Bruin, Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG, 1990.
SAICE	SAICE Code of practice for the safety of persons working in small diameter Shafts and test pits for Civil Engineering Purposes (2007
SANS 3001	Civil Engineering Test Methods
TMH 1	[TMH1:1979. Standard methods of testing road construction materials. National Institute for Transport & Road Research C.S.I.R. Pretoria.

Control and Instrumentation

Code	Description
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

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SANS 60529	Degrees of Protection Provided by Enclosures (IP Code)
SANS 10142-1	The Wiring of Premises – Low Voltage Installations
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
240-49230111	Hazard and Operability Analysis Guideline
240-52844017	System Reliability, Availability and Maintainability Analysis
240-56355729	Plant Control Modes Guideline
SPF 200-3340	KKS Coding and Labelling Procedure
N.PSZ 45-45	KKS Key Part Fossil Power Station
SPF 200-4190	The Application of KKS Plant Coding Standard
CMA MS01	CMA Guideline - Safety Around Belt Conveyors

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Electrical

Code	Description
240-49230046	Failure Mode and Effects Analysis Guideline
240-49230111	Hazard and Operability Analysis Guideline
240-52844017	System Reliability, Availability and Maintainability Analysis
240-53114248	Thyristor and Switch Mode Charger Converter Inverter Power Supply Standard
240-55714363	Coal Fired Power Station Lighting & Small Power Installation Standard
240-56176852	Essential Power Supplies for Power Stations
240-56227443	Requirements for Control and Power Cables for Power Stations
240-56355731	Environmental Conditions for process control equipment
240-56355815	Junction Boxes and Cable Termination Standard
240-56356396	Earthing and Lightning Standard
240-56356411	Fire Barrier Seals for Electrical Cable Installations
240-56360034	Stationary Vented Lead Acid Batteries
240-56360086	Stationary Vented Ni-Cad Batteries
240-137465740	Standby Battery storage and commissioning in Eskom
240-56227516	LV Switchgear Control Gear Assembly Associated Equipment for Voltage 1000V AC and 1500V Standard
240-56360387	Storage of Power Station Electric Motors Standard
240-56361435	Transport of Power Station Electric Motors Standard
240-57617975	Procurement of Power Station Low Voltage Electric Motors Specification Standard
240-56178825	Requirements for Transportation and Movement of Large Electrical Equipment Standard
240-56227778	Fault Current Calculations & Rating Switch-Gear Standard
240-56227589	List of Approved Electronic Devices to be Used on Eskom Power Stations Standard
240-56536505	Management of Hazardous Locations Standard
240-56535950	Electrical Plant Information Files Standard

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240-56536488	Control of Works Performed on Large Power Transformers Standard
240-56359053	Transformer Hand Conditioning Standard
240-56361454	Under-voltage Protection Standard
240-50237155	New MV Motor Procurement Standard
240-68973110	Specification for Power Transformer rated for 1.25MVA and above and with highest 2.2kV or above
240-56356510	Definitions of Terms Applicable to DC Emergency Supplies Standard
240-60238757	On-site Dry Out of Power Transformers Within Generation Standard
240-56358900	Sampling and Testing of Mineral Insulating Oil for Power Transformers Within Generation Division Standard
240-56357424	MV and LV Switchgear Protection Standard
240-56179027	Safety Measures Protective Equipment for Electric Arc in Switchgear 11 kV Standard
240-47859177	Generation Standard on Control of Clean Condition when Working on Generators and Large Motors
240-56227573	Air-Insulated Withdrawable AC Metal-Enclosed Switchgear Control gear for 1kV to 52kV
240-57648768	Mini-Substation National Contract Standard
240-57648795	Additional Technical Requirements for Mini-substations Guideline
240-73198286	Electrical Plant CoE Operational Plan Work Instruction
240-75005287	Electrical CoE Internal Design Review Work Instruction
240-56356491	DC Earth Fault Detection Manual
240-56062752	Medium Voltage Miniature Substations for Systems with Nominal Voltages of 3.3kV 6.6kV 11kV and 22kV Standard
200-16817	Excavation Permit Application Procedure
203-13626	Trench Excavation Procedure
240-131806419	Excavating and Trenches work instruction

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Low Pressure Services

Code	Description
240-105020315	Standard for Low Pressure Valves
240-54937454	Inspection Testing and Maintenance of Fire Protection Systems Standard
240-123801640	Specification for Low Pressure Pipelines Standard
240-145581571	Standard for Identification of the Contents of Pipelines and Vessels
SANS 14	Malleable Cast Iron Fittings Threaded to ISO 7-1
SANS 62	Steel Pipe up to 150NB
SANS 719	Electric Welded Low Carbon Steel Pipe 200NB
SANS 1109	Pipe threads where pressure tight joints are made on the treads
SANS 1123	Steel Pipe Flanges
SANS 1700	Fasteners
SANS 121:	Hot Dip galvanised coatings on fabricated iron and steel articles Specification and test method.
SANS 394	Non-destructive testing - Radiographic examination of metallic materials by X-and gamma-rays - Basic rules
SANS 4427	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply
SANS 1186:	Symbolic Safety Signs.
SANS 2001-DP2	Construction works Part DP2: Medium pressure pipelines
SANS 2001-DP6	Construction works Part DP6: Below-ground water installations
SANS 1200 Series	General, Earthworks, Bedding,
BS 2971	Class II welding
BS 3974	Pipe Supports
BS 4677	Arc welding of austenitic stainless steel pipework
EN 288	Welding Specification
JIS B 2311-82	Mild Steel Piping Fitting
ASME B 31.3	Process Piping

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ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
NFPA 291	Fire Hydrant Flow Testing and Marking
NFPA 25	Standard for the Inspection, Testing and. Maintenance of Water-Based. Fire Protection Systems
OHSA	Occupational Health And Safety Act and Regulations
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition Operations
GGR 0992	Plant Safety Regulations
PER	Pressure Equipment Regulations
SANS 347	Categorization and conformity assessment criteria for all pressure equipment
240-145581571	Specification for the Identification of the Contents of Pipelines and Vessels

System Integration

Code	Description
240-49230046	Failure Mode and Effects Analysis Guideline
240-49230111	Hazard and Operability Analysis Guideline
240-53113685	Design Review Procedure
240-76992014	Technical Documents and Records Management Work Instruction
240-53114186	Document and Record Management Procedure
IEC 61355 – 1:2008 (Edition)	Classification and designation of documents for plants, systems and equipment – Part 1: Rules and classification tables
240-86973501	Engineering Drawing Standards – Common Requirements
240-54179170	Technical Documentation Classification and Designation Standard
240-86973501	Engineering Drawing Standard Common Requirements
240-71448626	Minimum metadata requirements
240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
240-53114186	Project / Plant Specific Technical Documents and Records Management Procedure

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240-58552870	SmartPlant for Owner Operators (SPO) Documentation Metadata Standard
240-107305502	SmartPlant Data Take-On Standard
240-53114026	Project Engineering Change Management Procedure
240-132735850	Kusile Engineering Change Management Procedure
240-128515850	Documentation Handover Specification
240-109607332	Eskom Plant Labelling Abbreviation Standard

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11.3 DOCUMENTATION REQUIREMENTS FOR FINAL HANDOVER

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	2C	2.38	Functional Descriptions (Control)
	2A 2C	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 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
Operating and Maintenance Documentation			Functional Descriptions (Control)
	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
Commissioning Documentation	3.12	3.12	Licences & Approvals (Regulatory, Statutory)
		4.1	Commissioning Procedure / Manual
	4.2	4.2	Handover Certificate

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Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
	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, Isometric 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, Isometric 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
		5.2.11	KKS and Labelling Certificate

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Dossier Chapter	Dossier Sub- Chapter	Dossier Sub- Sub Chapter	Documents for Final Handover
Test and Statutory Certificates	Electric al	5.3.1	Contractor 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, Isometric 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	Contractor 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, Isometric 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
	6.1	6.1	Factory Acceptance Test (FAT)
	6.2	6.2	Site Acceptance Test (SAT)

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	6.3	6.3	Inspection Test Procedures (ITP's)
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Dossier Chapter	Dossier Sub- Chapter	Dossier	
		Sub- Sub Chapter	Documents for Final Handover
	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	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	8.1	8.1	Related Extract from SOW of Works Information Indicating Plant area / Component
			Certificate from Supplier indicating validity of the guarantee / Warrantees Period
		9	Special Tool List
		10	Insurance Cover (90 Days Notification Period)
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
	Competency Declarations		
		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
			Design Software • Software listing • Load Flows • Fault studies • Cable Routing software CAD software data fil

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When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

	15.5	15.5	Correspondences • Engineering Instructions (EI's)
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11.4 DOCUMENT MANAGEMENT

The documentation requirements cover the various engineering stages, from the design stage through fabrication, installation, testing and commissioning and most importantly for the operating, maintenance and training stage of the project. The *Contractor* ensures that the Technical Documents and Records Management Work Instruction (240-76992014) is used for any documentation requirements.

The *Contractor* is responsible for the compilation and the supply of the documentation during the various project stages and to provide the documentation programme to link with the milestone dates. Documentation and drawings are programmed for delivery to meet the milestone dates and in accordance with the agreed VDSS.

11.4.1 Document Identification

The *Contractor* ensures that a document has the following minimum attribute on the cover page:

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

11.4.1.1 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

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11.4.1.2 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
- Subheadings Font Type: Arial, Bold, Title Case
- Subheadings 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)

11.4.1.3 Document Headers

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

11.4.1.4 Naming of files

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

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_Document_Title_Unique Identifier_Revision.File Extention)

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

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11.4.1.5 Document Submission

The *Contractor* engineering program allows 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 VDSS Vendor Document Submittal Schedule . The VDSS is revisable, and changes shall be discussed and agreed upon by all parties and properly documented.

Contractor documents submittals are provided in accordance with the Vendor Document Submittal Schedule (VDSS) which is included in Appendix 12.3 Vendor Document Submittal Schedule. The VDSS to indicate the format of documents to be submitted. The *Employer* is responsible for the management of the schedule i.e. to create a document register that shall be used to track submission progress of documentation by the *Contractor* as per the committed dates on the VDSS.

Contractor documents all documentation that will be sent to the *Employer* in the Master Document List (MDL) as provided by the *Employer*. 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 will be clearly marked on the submittal by the *Contractor* and the submittal process will be repeated. If changes are made by *Contractor* after delivery to the Plant, as-built drawings indicating the changes would be prepared by *Contractor* and submitted to *Employer* for review. Any resubmittal of information to clearly identify the revisions by footnote or by a form of back-circle, with revision block update, as appropriate.

11.6.1.6 Transmittals

All document exchange to 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

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- Transmittal purpose
- Sender Name
- Sender E-Mail
- Sender Organisation
- Recipient Name
- Recipient E-Mail
- Recipient Organisation
- Disclosure Classification
- Date received
- Quantity of documentation referenced on the transmittal
- Number of copies
- Format/medium submitted (e.g. paper, External Drives, etc.)
- Sender signature
- Recipient signature, once submitted, to acknowledge receipt

If a transmittal is in response to an Eskom communication via transmittal, the Eskom Transmittal Number will be referenced in the transmittal response and will be provided in addition to the meta-data requirement above.

The *Contractor* to follow a structured and standard definition for Transmittal Descriptions, i.e. subject line convention of **YYYYMMDD – <Contract & Package Number> – <Vendor> – <Short Description> – <Sender Initials>**.

The *Contractor* to follow a structured method of communication as defined within Communication Interface Memorandum (CIM) for any correspondence

The *Contractor* to follow a structured and standard definition for email subjects i.e. a subject line convention of **YYYYMMDD – < Package File Number> – > – <Email Subject line>**.

The *Contractor* to 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

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- Issued for Installation
- Issued for Manufacturing
- Issued for Procurement
- Issued for Review
- Issued for Tender

Issuing of documents with different transmittal purposes is to be done separately and not combined into one transmittal. This would ensure fast and efficient processing of incoming and outgoing transmittals and information exchange.

Electronic technical data submittals are processed 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.

Notification to *Employer* that submittals have been posted to Zendto should 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 and notify the Employer of such submission.*

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

Submittal Description	Hard Copies Required	Soft Copy
Performance Curves	1 Original & 1 Copy	1
Design Data	1 Original & 1 Copy	1
Test and Inspection Data	1 Original & 1 Copy	1
Drawings	1 Original & 1 Copy	1

The *Contractor* submits documentation to the *Employer* 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 on external drives/USBs, 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 *Employer* will be copied on the email as well.
- Hard copies would be submitted to the *Employer* accompanied by the Transmittal Note.

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

Each submitted drawing to be project unique and 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 must be clearly identified on the drawings. If standard drawings are submitted, the applicable equipment and devices furnished for the project would be clearly marked.

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

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 to be listed on all drawings, including manufacturers' drawings. Tag numbers and equipment names to 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 would be in the English language. The units of measure to 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.

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* to comply with all minimum document metadata as specified in Technical Documentation Classification and Designation Standard (240-54179170).

The *Contractor* is to 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 Eskom System SPF (Smart Plant Foundation). Hard copy submittals will only be required for the Data books, Manuals, (H1, H2, H3) and final as-built submittals.

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Transmittal letters would be provided with each document submittal. The transmittal letter to include the *Contractor* drawing number, revision number, and title for each drawing attached. Each drawing title is to be unique and 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 to 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 to be submitted with all numerical values in metric units.

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* to, 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
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* to include drawings, documents, lists and data according to the types defined in Table below

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Typical Document Requirement List	
Document Group	Description of document type (includes information data sets)
General	Equipment arrangement drawings Piping & Instrument Diagrams (P&ID's) Material handling flow diagrams Engineering and procurement schedule Equipment list Isometric 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)
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

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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
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 Plant RAM analysis 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

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	Maintainability analysis FMECA / FMEA analysis HAZOP analysis 3D model interference checks
Electrical	Motor list Electrical load list Circuit list Raceway list Single line diagram Protection schematic diagram Electrical load flow and fault studies report Cable block diagrams Cabling routing and cable racking layout diagrams Cable termination diagrams EMC and earthing standards report Earthing layout drawings Lighting layout drawings
C&I	Alarm and set-point schedule Instrument schedule Instrument data sheets Mechanical hook-up drawings Electrical hook-up drawings Cable Schedule Termination Schedules Junction Box GA and Internal Layout Junction Box and Instrument location drawings Instrument Stand GA Maintenance Manuals and procedures Operating and Control Philosophies Functional Logic diagrams Field device calibration certificates Level measurement installation report
CBMS	Alarm and set-point schedule Instrument schedule Instrument data sheets Equipment layout drawings

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	Routing layout drawings Cable schedules Termination schedules Junction Box GA and Internal Layout Instrument Stand GA Maintenance Manuals and procedures Operating and Control Philosophies Field device calibration certificates Network architecture Fire risk assessments
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In addition to the official documentation submittals, the *Contractor* is to provide additional information for review and design coordination as requested by the *Employer* from time to time. The *Employer* reviews the *Contractor's* submitted documents. The *Contractor* ensures adherence to the contract and that a technically sound design approach is incorporated. Specific information required from the *Contractor* during tender phase and as part of the *Works* is as set out in the VDSS, in Appendix 12.3 Vendor Document Submittal Schedule. Each document submitted to the Employer requires a transmittal note (refer to Employer's template 240-71448626 for minimum metadata requirements) from the Contractor. The Contractor includes interpretation of results in every report compiled. All project documents shall be submitted to the Employer in accordance with Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). The Contractor is required to submit documents in electronic and hard copies and both copies must be delivered to the Employer with a transmittal note.

11.4.3 Documentation Recording

The *Contractor* develops, documents and maintains the Master Document List (MDL) with all the required metadata which will be submitted to the *Employer* on a monthly basis for tracking purposes irrespective of whether there are updates or not. The MDL to include a list of all drawings and documents and shall contain the following minimum information for each document:

- Date of submission
- Transmittal number
- Transmittal title
- Document description
- Document number (both *Contractor* and *Employer*)

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- Document Type
- Revision number
- Document Approval Status
- Document Authorisation Status (i.e. Accepted With Comments, Not Accepted with Comments, Accepted)
- Transmittal Reason for Issue

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

- Project / Plant Specific Technical Documents and Records Management Procedure (240-53114186)
- SmartPlant for Owner Operators (SPO) Documentation Metadata Standard (240-58552870)
- SmartPlant Data Take-On Standard (240-107305502)

11.4.3.1 Documentation Requirements

All documents supplied by the *Contractor* are subject to *Employer's* approval. For consistency, it is important that all documents used within the project follow the same layout, style and formatting as described in the Technical Documents and Records Management Work Instruction (240-76992014). Documents such as QCP's, Method Statements and other documents impacting the work are approved by the *Employer* at least 3 working days prior to commencement of the *Works*.

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

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

The *Contractor* compiles a complete data book for all work done during manufacturing, construction and commission containing the following as a minimum if applicable:

1. Scope of work
2. Approved "As built" drawings
3. Design calculations
4. Approved QCP / ITP
5. Inspection reports
6. Pipe ovality reports if applicable
7. As built drawings (isometric drawings and P&IDs)
8. Material summary that gives full traceability between components used, drawings and material certificates
9. All material certificates for pipes, fittings and all components used
10. Pressure test certificate and the calibration certificates of the gauges used.
11. Pressure test procedures

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12. The manufacturer's/repairer's certificate as defined in PER.
13. All CAR's and corrective actions
14. Operating Philosophy including all alarm and trip values
15. Parts catalogue
16. Maintenance manual
17. Storage, packing and transportation instructions

11.5 CONFIGURATION MANAGEMENT

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

11.5.1 Plant Coding

Plant Coding is undertaken by the *Contractor*, and as such the *Contractor* makes available the following documentation to code:

- Mechanical
 - Piping and Instrumentation Diagrams (P&IDs)
 - interface list
 - process flow diagrams (PFDs)
- Electrical
 - single line diagrams
 - electrical board general arrangements (GA)
 - cable schedule
- C&I
 - C&I architecture drawings
 - C&I Cubicle GA
 - cable block diagrams
 - remote control station lists
 - cable schedules
- Civil
 - Site layouts
 - building layouts
 - building sectional layouts
 - building floor plans per level
 - underground services layouts
 - cable rack & support
 - building lists (including room equipment lists)

The *Contractor* only codes the KKS code defining Documentation listed above. The *Contractor* assigns a coding practitioner who interacts with the *Employer* in coding the plant as listed above. It may be required that the person be based at the Employer's offices full

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time. The *Contractor* is required to include allocated codes to all other designs and related documentation. It is also the responsibility of the *Contractor* to consistently apply the KKS codes throughout the rest of the technical documentation which includes, but not limited to:

- load schedules
- board parts lists
- cable block diagram
- termination diagram
- drive & actuator schedules
- instrument schedules
- alarm lists, loop diagrams
- signal lists
- schematic diagrams
- termination diagrams
- Logic diagrams, etc.

The *Contractor* ensures that all documentation is coded (as per the codes assigned by the Practitioner) prior to Employer for review

11.5.2 Plant Codification

The KKS system is 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” contains a KKS code as part of the documentation identification relevant to the plant equipment. All plant (Process, electrical, C&I and Civil) is coded to KKS breakdown level 3. The KKS code contains break down level 1, break down level 2 and breakdown level 3. Omission of any break down level is not permitted. The system is applied from the concept stage until project closeout. The rules specified in the VGB guidelines are used but all rules specified in Eskom documents takes precedence

Detailed nameplate or label list with the service legends and including the KKS Code are 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 are 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* uses Eskom –specific interpretations of the KKS standards, which are reviewed and agreed on after Contact Award. The following variations relating to 240-93576498 are noted.

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- Breakdown level 3 component code -> not used in P&ID's and PFUP's, only used by control hardware supplier
- Breakdown level 0: is 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* codes all plant within scope of supply according to the KKS Classification System to Breakdown Level 3 where possible. The relevant KKS codes thus allocated appear on all plant related documentation, drawings, lists and correspondence.

The *Contractor* is 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* submit these for the *Project Manager's* approval.

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

The *Contractor*, as soon as possible after the contract is placed, provides the *Project Manager* 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* provides the name of
- The actual manufacturer and his coded drawing or reference
- Numbers and relevant technical data for identification purposes

11.5.3 Plant Labelling

1. New labels are provided for all plant, material and equipment provided as part of the Works. It is the responsibility of the *Contractor* to manufacture and install labels according to station based labelling standard. Eskom to provide the labelling standard.
2. Coding and labelling of components inside electrical and C&I panels are done by the *Contractor*.

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3. The Coding practitioner facilitates base-lining of all equipment lists from the *Contractor*, and only baseline equipment lists are used as a basis for the production of labels.
4. The abbreviations are in accordance with the Kusile's abbreviation standard, 240-109607332 Eskom Plant Labelling Abbreviation

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