	Scope of Work	Kusile Power Station
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1. Introduction

The existing Kusile Power Station perimeter fence system needs to be modified. The fence system configuration consists of mechanical and electric fencing, perimeter lighting, road infrastructure, a Closed Circuit Television (CCTV) and Public Address (PA) systems. The project scope includes the provision of engineering designs, procurement and construction services including commissioning of the *works*.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

The purpose of this document is to outline the project specifications for the intended *Works* at Kusile Power Station.

2.1.2 Applicability

This document shall to Kusile power Station

2.1.3 Effective date

This document shall be effective from the date of its authorization.

2.2 Normative/Informative References

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

2.2.1 Normative

- [1] KUS-202211157: Kusile Power Station Refurbishment of the ex-GE Store Concept Design Report

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Table 1: Employer Standards

Code	Description
Applicable Standards	
240-4332798	Engineering policy
240-5311685	Design Review Procedure
240-53114026	Engineering Change Management Procedure
240-71432150	Plant Labelling Standard
240-93576498	Coding Standard
240-76992014	Project/Plant Specific Technical Document and Records Management Work Instruction
240-65459834	Gx Projects Documentation Deliverable Requirements Specification
240-57127953	Execution of Site Preparation and Earthworks Standard
240-57127955	Geotechnical and Foundation Engineering Standard
240-107981296	Constructability Assessment Guideline Standard
240-56364545	Structural Design and Engineering Standard
203-770	Kusile Specification for Structural Concrete
240-86973501	Engineering drawing Standard
240-66920003	Documentation Management Review and Handover Procedure for Gx Coal Projects
203-103437	Technical Document Submission and Review Work Instruction
203-770	Kusile Power station specification for structural concrete
240-55714363	Coal Fired Power Stations Lighting and small power installation standard
240-93576498	KKS Coding Standard
240-56227443	Requirements for Control and Power Cables for Power Stations Standard
240-56356396	Earthing and Lightning Protection Standard

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240-55714363	Coal Fired Power Stations Lighting and small power installation standard
BS EN 62676-4	Video Surveillance Systems for use in Security Applications
240-91190304 -	Specification for CCTV Surveillance with Intruder Detection
SANS 10222-5	Electrical Security Installations Part 5: CCTV installations
240-102220945	Specification for Integrated Access Control System (IACS) for Eskom sites
240-86738968	Specification for Integrated Security Alarm System for Protection of Eskom Install and Subsidiaries
240-55410927	Cyber Security Standard for Operational Technology
240-78980848	Specification for Non-Lethal Energized Perimeter Detection System (NLEPDS) for Protection of Eskom Installations and its Subsidiaries
240-64720986	Emergency Preparedness Public Address System – For Large Area Deployment
240-131050729	Hybrid Coding Standard
240-109607732	Eskom Plant labelling Abbreviation Standard
240-106365693	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings

2.2.2 Informative

- [33] 36-681: Eskom Plant Safety Regulations
- [34] 474-58 (Rev1): Document and Records Management
- [35] 240-105658000: Supplier Quality Management Specification

3. Description of the works

3.1 Executive Overview

A robust perimeter protection solution is required for the Kusile Power Station warehouse facility to ensure continuous monitoring and alarming of the area. The facility is required to be enclosed within the National Key Point fence bounds to maintain an acceptable level of security. The facility covers an area of approximately 66000m² including peripheral infrastructure (see Figure 1).

Eskom intends to appoint an external *Contractor* to perform engineering design services, construct and commission the proposed *works*. The *Contractor* reviews existing design data prepared by others, that interface or may impact his designs, for purposes of delivering sound designs. The appointed *Contractor* reviews existing designs for completeness and constructability and proposes value-adding design changes, where required. In addition, the *Contractor* performs technical oversight/supervision during construction and commissioning activities to ensure compliance with designs. The *Contractor* assumes design liability for his designs and issues Certifications of Compliance for their portion of the *Works*.

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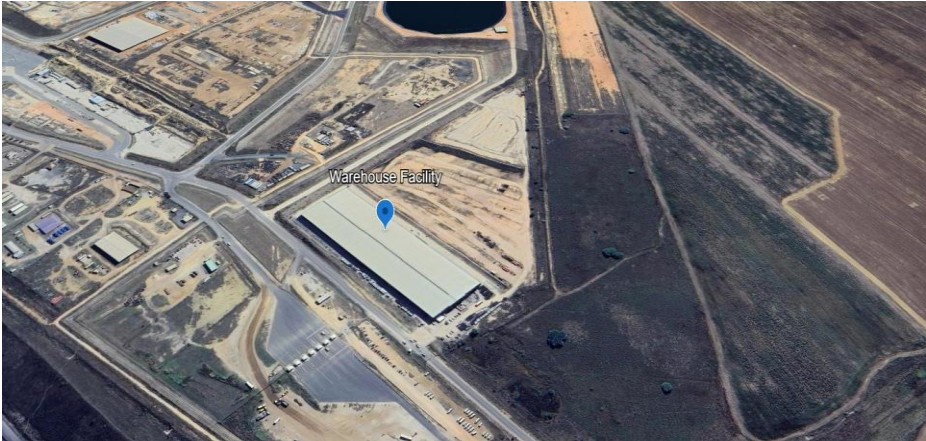


Figure 1: Warehouse Aerial View

3.2 Employer’s objectives and purpose of the works

The proposed perimeter protection works will act to safeguard the restricted area.

3.3 Interpretation and terminology

Abbreviations

Abbreviation	Description
CBMS	Consolidated Building Management System
CCTV	Closed Circuit Television
CoC	Certificate of Completion
C&I	Control and Instrumentation
ECSA	Engineering Council of South Africa
ITP	Inspection and Test Plan
NKP	National Key Point
OHS Act	Occupational Health and Safety Act
O&M	Operating and Maintenance
PEC	Professional Engineering Certificate
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
uPVC	Unplasticized Poly Vinyl Chloride
SANS	South African National Standards

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3.4 Roles and Responsibilities

3.4.1 Contractor

- a) Completes the *Works* as outlined in this works information and service agreement
- b) Ensures compliance with all requirements of the Occupational Health and Safety Act no 85 of 1993 and its regulations.
- c) Takes full professional accountability and liability for all temporary and permanent *Works*
- d) The *Contractor* is responsible to issue Professional Engineering Certificates and/or Certificates of Completion for the *Works*
- e) Ensures all employees are medically, physical and psychologically fit to perform the *Works*.
- f) Ensures all employees undergo the relevant training as per their function requirement.
- g) Ensures compliance with Eskom's SHE policy, procedures, standards, guidelines, specifications and site regulations.
- h) Ensures employees have a valid medical certificate of fitness specific to the work to be performed.
- i) Ensures employees are informed of hazards identified in the risk assessment before commencement of *Works*. The Method Statement shall also be communicated to the employees before commencement of *Works*.
- j) Ensures that all safety and health related incidents around site or working areas and threats that pose a danger to one's life or health are reported immediately.
- k) Ensures sufficient health and safety information as well as resources are made available.
- l) Ensures that all employees undergo safety induction on-site.
- m) Ensures that all power tools are inspected as and when required.
- n) Ensures that prescribed PPE for the specified works are worn at all times. The provision of PPE shall be the responsibility of the *Contractor*.
- o) Ensures that correct site drawings are obtained and communicated to the employees undertaking the *Works*.
- p) Provides adequate resources for the required *Works*
- q) Manages costs and the scheduled time frame for the *Works*
- r) Provides regular feedback on the status of the *Works* as requested

3.4.2 Employer

- a) Provides engineering support and information relevant to the scope of *works*
- b) Reviews and accepts the *Contractor's* design documentation, method statement procedure, QCP and ITP.
- c) Is present for all applicable points of the ITP and commissioning activities, where required.

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3.5 Site Description

The Kusile Power Station site is located approximately 37km northwest of eMalahleni in the Mpumalanga Province. The site is accessed from the R686 road between highways, N4 and N12. The site has approximate coordinates 25° 55' 07.34"S and 28° 54' 43.30"E.

The location of the warehouse facility is given in Figure 1. The facility serves as the main storage area for material stock at the site.



Figure 2: Warehouse Location

3.6 General Scope of the Works

- a) The scope of the entire *Works* includes the design, procurement, manufacture, fabrication, factory testing, supply, storage, delivery to site, construction, installation, erection, quality assurance, site testing and commissioning of the below listed *Works*. The construction works include the removal of ~700m of razor mesh fencing and preparation of the site along the fence line. The detailed technical project requirements are specified under section 3.6.
- Double tier mechanical fencing and gates
 - Single tier electric fencing and gates
 - Bridge or culvert crossings
 - Perimeter lighting
 - Perimeter Closed Circuit Television (CCTV)
 - Perimeter Public Address (PA) system
 - Patrol road and associated drainage
 - Stormwater design
 - Plant labelling

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3.6.1 PERIMETER PROTECTION DESIGN

3.6.1.1 Infrastructure Routing

The proposed routing for the perimeter protection infrastructure is indicated in Figure 3. The Contractor evaluates the suitability of the proposed fence routing. The Contractor identifies an alternative route for the project Works, if deemed necessary.

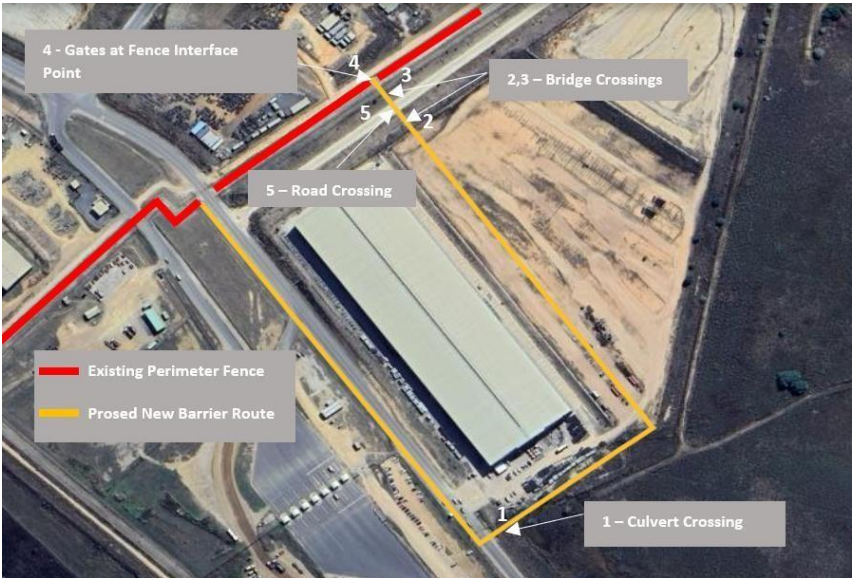


Figure 3: Proposed Routing for Perimeter Security Infrastructure

3.6.1.2 Geotechnical Investigation

The Contractor conducts a geotechnical investigation of the project site to confirm the soil conditions in the area, for his design. The extent and location of the proposed investigation is highlighted in Figure 4. All geotechnical investigations shall be conducted in compliance with the latest national and/or international standards for site investigation and ground classification techniques (this includes sample acquisition and laboratory testing).

The investigations to be carried out may include the following but not limited to:

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- Test pit excavations, sampling and profiling
- Dynamic Cone Penetrometer (DCP) tests
- Dynamic Probe Super Heavy (DPSH) test



Figure 4: Proposed Area for Geotechnical Investigation

3.6.1.3 Security Fencing

3.6.1.3.1 Mechanical Fence Design

- a) The *Contractor* reviews the existing mechanical fence designs for completeness and proposes design changes and additions where necessary to achieve complete and sound designs.
- b) The *Contractor* constructs a double tier mechanical fence system in accordance with the listed drawing details (see Figure 5 for the general fence arrangement). An estimated 955m fence coverage is required for the facility area. The fence co-ordinates are verified on site by the *Contractor* and *Employer*.
- c) The fence design complies with the listed employer drawings:
 - 0.90/707 - P146838-0UYX-S3916A Rev. 2 – Security Fence – Post Concrete Bases and Gate Details
 - 0.90/708 - P146838-0UYX-S3916B – Security Fence
 - 0.90/709 - P146838-0UYX-S3916C – Security Fence
 - 0.90/710 - P146838-0UYX-S3916D – Security Fence
 - 0.90/711 - P146838-0UYX-S3916E – Security Fence
 - 0.90/712 - P146838-0UYX-S3916F – Security Fence
 - 0.90/59093 – P146838-0UYX-S3916G – Security Fence, Single Swing Access Gate, Plan, Elevations and Details

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- 0.90/59094 - P146838-0UYX-S3916H – Security Fence
- 0.90/59093 – P146838-0UYX-S3916G – Security Fence, Single Swing Gate Keep Details

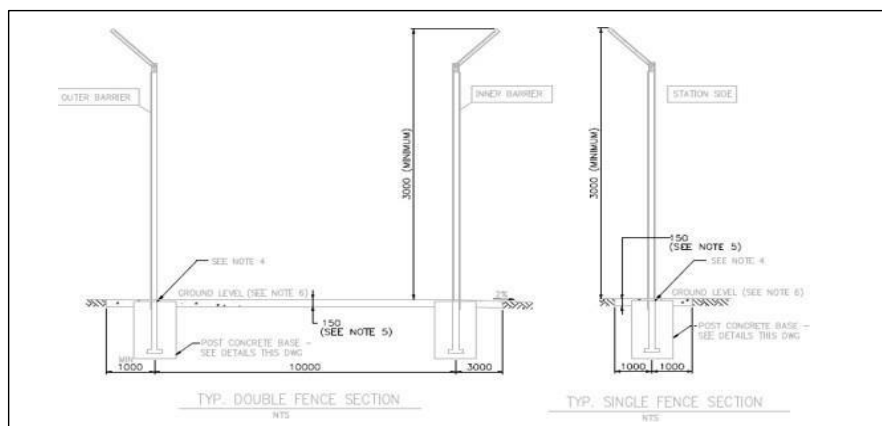


Figure 5: General Arrangement – Mechanical Fencing

Gate Specifications (Mechanical Fence)

- The *Contractor* reviews the existing mechanical gate designs for completeness and proposes design changes and additions where necessary to achieve complete and sound designs
- The *Contractor* installs 8-off single swing gates at Positions 4 and 5 per Figure 3, where the new and existing fence interface as well as at the road crossing. Table 2 indicates the proposed gate design. The gate arrangement where the existing and new fence installation interfaces is indicated in Figure 6 below.
- The gate designs comply with the listed employer drawings:
 - 0.90/59093 – 146838 – 0UYX – S3916G – Security Fence Single Swing Access Gate Plan, Elevations and Details
 - 0.90/59094 – 146838 – 0UYX – S3916H – Security Fence Gate Post Foundations
 - 0.90/59095 – 146838 – 0UYX – S3916J – Security Fence Single Swing Gate Keep Details

Table 2: Gate Details (Refer to drawing: 0.90/59093)

A (mm)	B (mm)	Foundation type (P146838-0UYX-S3916H)	T.O.C Foundation
4950	4630	1A/1B/1C/1D	100 mm above ground level (max)

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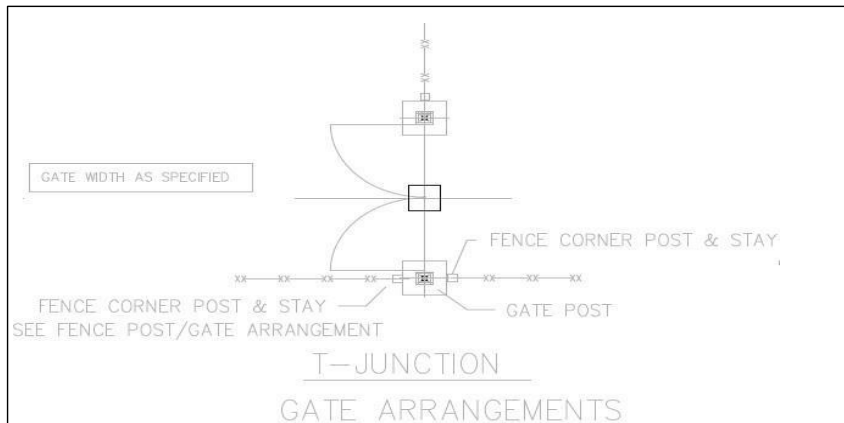


Figure 6: Gate Arrangement at Fence Junction

- a) The *Contractor* to design and construct 3-off bridge/culvert crossings at all stormwater drainage interface points i.e., Positions 1, 2 and 3 per Figure 3 layout drawing. Ditch 1 & 2 are approximately 20m (width) x 3m (depth) - refer to the listed drawings for typical details of the existing station bridge crossings. The *Contractor* secures all drain points that interface with the perimeter fence with security grids (see 0.90/25015 & Figure 5 for typical details)). All steel members shall be galvanized.
- b) The *Contractor* to construct and install guardrail systems along all stormwater crossings along the fence line to restrain and guide out-of-control vehicles. The approximate length of the rail systems to be 22m. Refer to drawing 0.90/71779 for typical details. Guardrails to comply with the requirements of SANS 1350.
- 0.90/23491 – 146838-OUZJ-S5882 – Fence Bridge – Foundations Plans, Sections & Details, Fence Bridge 1
 - 0.90/24999 - 146838-OUZJ – S55884 – Fence Bridge – Foundations Plans, Sections & Details, Fence Bridge 2
 - 0.90/25015 – 146838-OUZJ-S5885 – Fence Bridge – Foundations Plans, Sections & Details, Fence Bridge 2
 - 0.90/71779 – 146838 – OGUA – S3573 – Site Finishing – Site Guardrail Details

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Figure 7: Security Grid Arrangement (Culvert/Bridge Crossing)

3.6.1.3.2 Electric Fence Design

- a) The *Contractor* reviews the existing electric fence design for completeness and proposes design changes and additions where necessary, to achieve complete and sound designs
- b) The *Contractor* constructs a ~955m electric fence between the mechanical fence system. The fence system to be freestanding and erected at a minimum of five metres (5m) away from the mechanical fencing. The fencing design to adhere to SANS 10222-3:2003, Occupational Health and Safety Act (85 of 1993) and Standard - 240-78980848 [Specification for Non-Lethal Energized Perimeter Detection System (NLEPDS) for Protection of Eskom Installations and its Subsidiaries].

Strain Posts (In-line and Corner)

- Strain posts will be manufactured from 100mm x 100mm x 3mm square tubing, 3000mm long with 2 (two) strut brackets welded in position to accept the strut fixings.
- Strain posts will have twenty-four (24) holes in each side, 100mm apart to accept the strain insulators, and have installed non-metallic tensioner for each wire in one direction.
- Strain posts will have two (2) struts, one in each direction, manufactured from 50mm x 50mm x 2mm square tubing 3000mm long.
- Each strut will have a hole at one end to allow for fixing to the strain post.
- Strain posts and struts will be hot-dip galvanized and fitted complete with twenty four (24) strain insulators, twenty four (24) non-metallic tensioners, and two (2) x M10x25 galvanized bolts, nuts and washers.
- Strain posts will have 500mm x 500mm x 600mm deep, 20MPA concrete foundations.
- Struts will have 500mm x 500mm x 300mm deep, 20MPA concrete foundations .
- Maximum distance between (2) two consecutive strain posts will not exceed 80m.

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Intermediate posts

- The intermediate posts will be manufactured from 40mm x 40mm x 3mm hot rolled steel angles 3000mm long. Steel sections to be hot dip galvanized in accordance with SANS 121.
- The intermediate posts have twenty-four (24) holes on one flange, 100mm apart to accept the intermediate insulators.
- Intermediate posts have a 300mm x 300mm x 300mm deep 20MPA concrete foundation.
- The maximum distance between two (2) consecutive intermediate posts will not exceed 3m.
- All openings that will lead to water entrapment to be sealed appropriately.

Conductor Wires

Conductor wires to be manufactured from aluminum 1,6mm. The conductors shall provide the best current carrying capacity, resistance to corrosion, be of low resistance (<10Ω/m) and be of sufficient tensile strength (in accordance with the manufacturer's specification) for its requirements and application. Live conductors shall not contain any objects attached thereto that can form an entanglement, such as but not limited to barbed wire and razor wire. The installation and connection of electric fencing to adhere to the requirements of SANS 10222 and SANS 60335-2-76.

Commented [LT1]: @Vely, please review highlighted sections

High Tension Cables

Fence high-tension cables and conductors to be mounted in 32mm conduit piping or similar, for mechanical protection and to facilitate future repairs. All conduit fittings to be of inspection type and the inner radius of a bend in a conduit shall be at least three times the external diameter of the conduit. The protected fence high-tension cable shall:

- be buried in pickable ground with a minimum cover of 300 mm,
- be buried under roadways with a minimum cover of 500 mm and the backfill shall be properly compacted, and
- have adequate cover when buried in rock or concrete or in a building element

Insulators

Fence insulators shall comply with the requirements of SANS 10222-3. Fence insulators shall have the following general properties:

- fence insulators attached to a bracket or pole (or both) shall be manufactured out of materials capable of providing sufficient insulation between the wire conductor and any other conductive component attached to the bracket or pole (or both), that could form a short circuit;
- the fence insulator shall provide insulation under all normal weather and environmental conditions in the area where it is installed and shall be compatible with the energizer used;
- the minimum direct distance between the wire conductor on the fence insulator and the nearest conductive part capable of forming a short circuit shall be 5 mm through the fence insulators material;
- fence insulators shall provide a resistance against ultra-violet radiation and shall not deteriorate within a minimum time period of five years; and

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- the fence insulator shall be capable of withstanding all the mechanical stresses that the wire conductor it supports will be subject to, in terms of normal expected weather conditions.
- the minimum test requirements for insulators shall be as detailed in SANS 10222-3.

Ferrules

Ferrules will be used to inter-connect fence conductor wires and HT cables and will be manufactured from the same material composition as the 1,6mm aluminium conductor/trace wires.

Warning signage

Warning signage shall be displayed conspicuously along the length of the electric fence, fence posts and all access points. The minimum warning sign dimensions shall be 200mm x 100mm and the lettering and symbols shall be in accordance with SANS 60335-2-76.

Earthing

The *Contractor* adheres to the earthing requirements as stipulated in SANS 10222 and the *Employer's* Earthing and Lightning Standard: 240-56356396. The *Contractor* also adheres to the below requirements;

- Earthing of the inner perimeter fence shall be done in accordance with the relevant sheets of drawings. The earthing rod is buried 600 mm outside the perimeter fence and forms part of the station earth mat.

Concrete Anti-tunnelling Beam & Vegetation Control Concrete Slab

The *Contractor* constructs a 20Mpa concrete anti-tunnelling T beam, 100mm (wide) x 500mm (deep), underneath the full length of the electric fence, to prevent unauthorized entries by under burrowing (see Figure 8a and drawing: KUS000-09 – Kusile NLPEF Post and Concrete Slab Installation). The sill shall be constructed continuously between the gate posts under the gate lines.

A vegetation control concrete slab is required for the electric fence to prevent vegetation overgrowth and the triggering of false alarms. The control slab to be a minimum of 20Mpa concrete grade. The slab panel sizes to be 800mm (width) x 5000mm (length) x 75mm (thick) at 150mm c/c. All joints to be butted. 800mm x 150mm x 10mm wide soft board expansion joints to be provided at maximum 5m c/c (see Figure 8b and drawing: KUS000-09 – Kusile NLPEF Post and Concrete Slab Installation).

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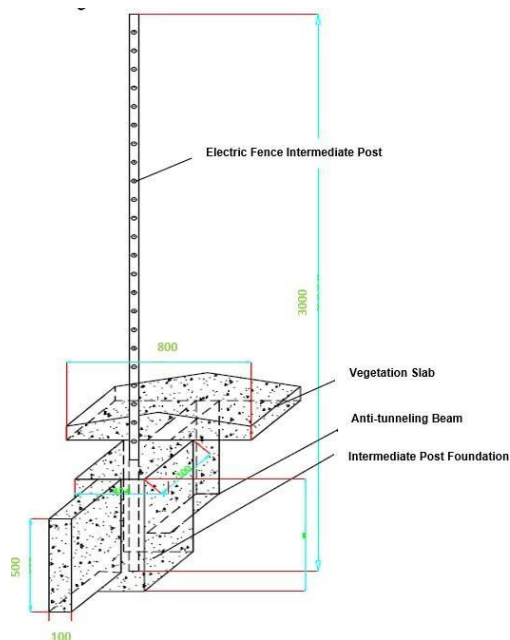


Figure 8a: Vegetation Slab and Anti-tunnelling Beam General Arrangement

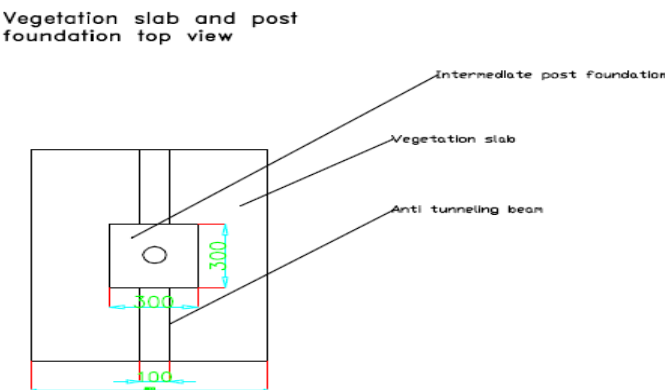


Figure 8b: Vegetation Slab and Anti-tunnelling Beam Plan Layout

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Vegetation slab and post
foundation side view

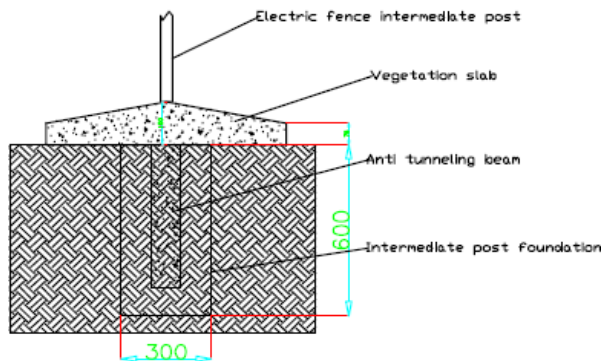


Figure 8c: Vegetation Slab and Anti-tunnelling Beam Elevation Detail

Gate Specifications (Electric Fence)

- a) The Contractor reviews the existing electric gate designs [PGE- 0000-0000-SAG1-GA-001] for completeness and proposes design changes and additions where necessary, to achieve a complete and sound design
- b) The Contractor installs 2-off double leaf gates at the new and existing fence interface and at the road crossing [Position 1 & 3]. Gate lengths are approximately 10m. Gates to be on wheel tracks. Gates shall be of comparable quality and provide a comparable degree of security to the adjacent

fencing. The overall height of the gates when fixed shall not be less than the adjacent fencing height. The top and bottom rails of the gate shall be at the same level as the fence rails.

All gate frames shall be constructed of rectangular hollow sections, and joints shall be continuously welded.

Gates to be provided with locking devices. The double gates to be fitted with a sliding horizontal locking bar that is secured to a locking plate welded to the gate frame at approximately mid-height (but not exceeding 1.5m) to ensure that the locking bar passes through both of the meeting stiles such that the gate leaves are firmly held in shut position. Locking bars to be holed to receive a padlock.

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3.6.1.4 Patrol Road

The *Contractor* reviews the existing patrol road design for completeness and proposes design changes and additions where necessary to achieve a complete and sound design.

The *Contractor* to construct a continuous patrol route along the length of the perimeter fence including associated stormwater drain designs. The road must lie on the inside boundary of the site/fence system. See figure 9 for the existing pavement layer design (section details). The road length is approximately 550m.

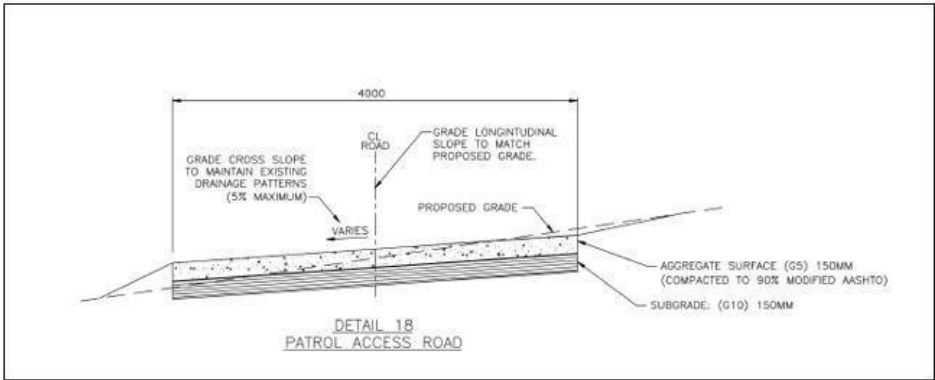


Figure 9: Typical Road Section

3.6.1.5 Perimeter CCTV Civil Infrastructure

Precast Concrete Poles (Security & Monitoring Application)

The *Contractor* to supply and install precast concrete poles that are suitable for mounting surveillance cameras - see Figure 11 for typical details. It is assumed the poles will be spaced at 70m distances. The poles shall be adequately designed to resist an Ultimate Load of at least 2.5kN. The pole design shall allow for a cable entry box and an inspection box/opening. The cable entry and inspection boxes to be galvanized steel. The dimensions of the boxes to be ~ 465mm x 145 mm. The poles to be encased in concrete mass fill. Poles shall also be earthed for protection against lightning. Poles shall be earthed via 50 x 3 mm earth tails or similar. The earth tails shall be buried and welded to the base of the fence so as not to be easily visible. Joints shall be painted the same colour as the fence to avoid theft of the copper earthing. The earthing shall conform to the latest revision of the Earthing and lightning Protection Standard. All pole openings shall be sealed with a suitable sealant. The concrete poles shall adhere to all requirements and specifications as set out in SANS 470.

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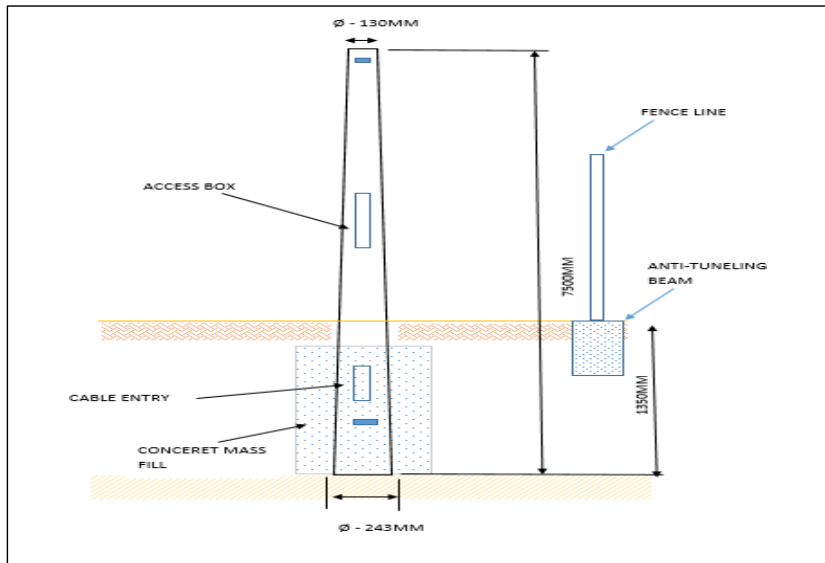


Figure 11: Schematic – CCTV Camera Pole Arrangement

Manholes

The *Contractor* to supply and install manholes that are lockable and watertight to prevent unauthorized access and ingress of water respectively. The manhole cover lids are secured within its frame by means of a locking device or similar. Locking devices shall be designed to allow for the opening of the covers by means of usual tools. Manholes shall be of Heavy-Duty type. Manhole tops shall also adhere to all requirements and specifications per SANS 50124 requirements. It is assumed the manholes will be spaced at 70m distances.

Conduit/Sleeve Pipes

The *Contractor* to supply, install and test cable conduit sleeve pipes for cable protection. The specifications of the conduit pipes are detailed below:

- Length of conduit piping – 955m (approximate)
- Conduit Material Type – HDPE
- Conduit diameter size – 110 Nominal Diameter

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The conduit sleeves will run through a section of a gravel/surface aggregate road (approximately 48m). This shall be catered for in the design (Refer to Figure 11 for typical details). Conduit pipes shall adhere to all requirements and specifications as set out in SANS 61386-24. The installation of conduit pipes shall be in accordance with the SANS 1200 series.

Conduit Mandrel Test

The Contractor to conduct a mandrel test on the conduit pipes after completion of the installation.

3.6.1.6 Perimeter Lighting Infrastructure

- a) The Contractor reviews the existing security fence light posts and plinth foundation designs for completeness and proposes design changes and additions where necessary, to achieve a complete and sound design. The Contractor constructs all lighting plinths and posts. The drawing references are detailed:
- LB – Kusile – S3810 – ELE – 1001A or 0.90/175198: Kusile Power Station Electrical Security Fence Plinth Foundation
 - LB – Kusile – S3810 – ELE – 1001B or 0.90/175199: Kusile Power Station Electrical Security Fence Plinth Foundation
 - 0.90/173170 - Pole Design

3.6.1.7 Electrical Design Scope

Perimeter Lighting

The current design of the NKP fence lighting system employs 140W HPS (High-Pressure Sodium) floodlights mounted on poles that are spaced 22 meters apart. Each pole holds two floodlights, which are angled to ensure optimal lighting coverage around the area. This setup has been effective in providing sufficient illumination along the fence, leveraging the high intensity and broad light spread characteristic of HPS lights.

In contrast, the new design proposes the use of a single 60W LED light per pole. This new approach aims to deliver an average illumination level of 10 lux or more along the fence, aligning with modern energy efficiency standards and sustainability goals. LEDs are known for their superior energy efficiency, longer lifespan, and better light quality compared to traditional HPS lights. The design adjustment involves optimizing the angle and placement of these LED lights to ensure consistent and adequate lighting.

To facilitate a thorough evaluation of the two designs, a 3D model of the new lighting system has been developed. This model illustrates the spatial arrangement and light distribution patterns of the 60W LED lights. Additionally, output light lux data has been generated to demonstrate the performance of the new lighting system. This data includes detailed measurements of lux levels at various points along the fence, providing a comprehensive view of the lighting coverage and intensity.

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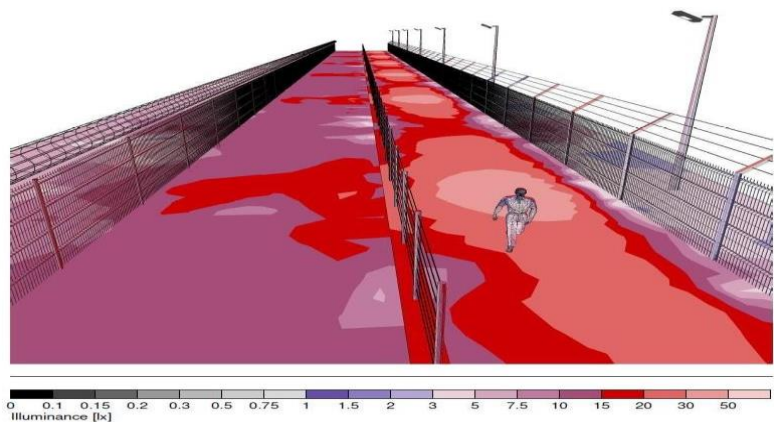


Figure 12: Lighting design for Electric Fence 3-D Model

colours shown in Figure 10 above show the average lux value produced from the lighting design also providing the average of 14lx around the area which is above the standard value of 10lx.

3.6.1.8 C&I Scope Design

The existing system is based on a digital video management (DVM) software for surveillance, real time monitoring and recording of events. The existing CCTV system consists of thermal network cameras for monitoring the perimeter fence, PTZ cameras for monitoring perimeter areas or tracking any intruders, bullet IR cameras for monitoring the perimeter areas, Honeywell enterprise building integrator (EBI) servers, DVM database and camera servers, storage devices, DVM software and license, and DVM operator workstations.

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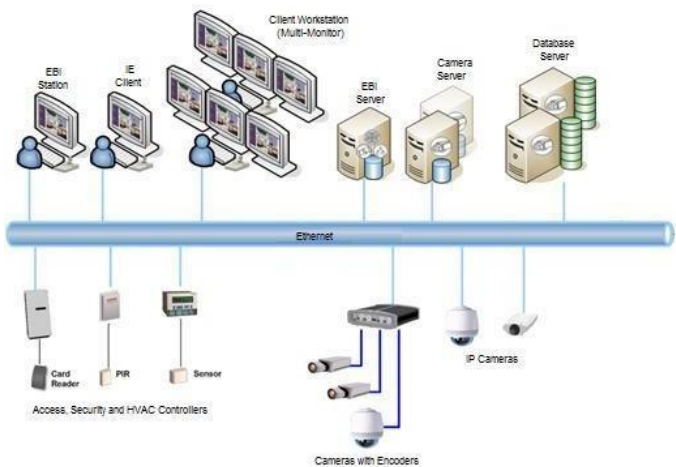


Figure 13: EBI Architecture

The proposed cameras shall be integrated into the existing site CCTV system and shall adopt the operational philosophy of the existing CCTV system. Suitable thermal CCTV technology for the low light conditions is to be utilized to enable no/low light pre-detection of attempted access into the area. The CCTV system must be linked to and monitored by the existing site security control room and must be integrated into the existing perimeter CCTV system. The design must cover the gate with a static camera where a gate exist. The Contractor shall adhere to standards and specifications supplied by Eskom. It is highly recommended to propose equipment similar to the existing equipment for spares management and maintainability purposes. In cases where the similar camera are obsolete, replacement model from Honeywell is recommended.

The existing perimeter CCTV consists of the following cameras:

- 1. Therman network camera (Honeywell Axis-Q1931/E)
- 2. Fixed network Bullet IR camera (Honeywell – HCD95534)
- 3. PTZ network camera (Honeywell – HDZ302LIW)

All equipment shall be designed and specified for a minimum realisable operational life 10 years under the prevailing environmental conditions. Visible notification shall be placed at entrances and on the outside of the perimeter fence of the premises to notify persons entering the premises, that they may be subjected to CCTV surveillance. The view of the camera shall be free of any hindering obstacles such as walls, trees or buildings. Perimeter cameras shall be arranged so that the dead spot of each camera is covered by the field of view of another camera. The use of microwave beam detection is strongly discouraged due to the prevalence of nuisance alarms. The perimeter

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detection system must generate an alarm when a human enters the monitored zone. It must be able to detect a person who is walking upright, walking hunched over, crawling or running.

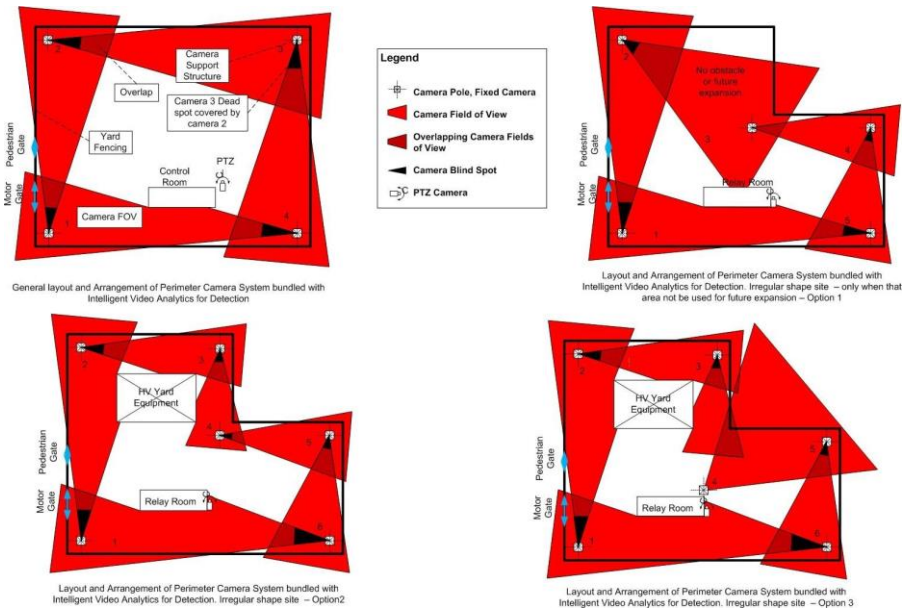


Figure 14: Examples of Camera Layouts

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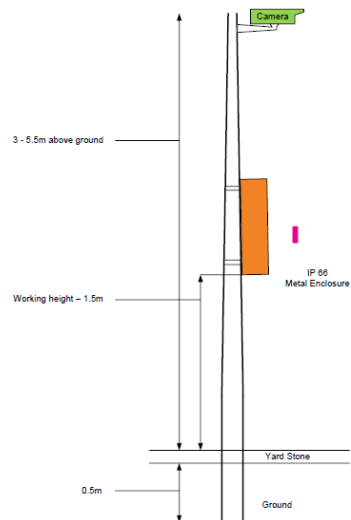


Figure 15: Camera and Metal Enclosure Mounted on Concrete Pole

The proposed CCTV solution shall integrate to the existing site security network. The following functions and specifications shall be met:

- Monitor for intrusion on the outer fence
- Monitor for intrusion on the inner fence
- Monitor general condition of the fence
- Provide reporting at CBMS level
- Detection shall not trigger for change of light, movement of trees, small vibrations of the camera pole, animals, and weather conditions.
- The camera housing shall have an IP rating of at least 65.
- The camera shall have a sun visor and be steel constructed/ harsh environment housing.
- A junction box with a minimum IP rating of 65 shall be installed on the camera mounting pole.
- Fixed Thermal perimeter cameras shall be installed
- Additionally PTZ cameras shall be installed for intruder tracking.

The perimeter cameras shall adhere to the following CCTV categories:

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Purpose	Operational Requirement
Identification	Detail should be sufficient to enable the identity of an individual to be established beyond reasonable doubt. Camera footage alone should be enough to prosecute in court.
Recognition	A high degree of certainty whether or not an individual shown is the same as someone seen before. Camera footage could aid in prosecution along with other evidence.
Observation	Be able to observe what a person is doing.
Detection	Sufficient to determine with a high degree of certainty whether or not a person is present.

The following requirements shall be met for cable routing, wiring and general electrical requirements:

- a) All power cables shall be steel wire armoured or laid in appropriately sized plastic conduit.
- b) Wireways shall be smooth and free from sharp edges, burrs, fins, or moving parts that may damage wiring.
- c) Security systems communication cables and auxiliary power cables shall not be laid in the same conduit unless using fibre communication or DC power.
- d) All trunking shall be sized for 30% future expansion.
- e) Sufficient slack shall be allowed to ensure that there is no tension in the cables.
- f) Ferules shall be used on all wiring into terminals of connectors.
- g) Cable selection and routing shall always be done in such a way that operation of equipment is not affected by electrical interference.
- h) If power and data cables must cross, it shall be at right angles.
- i) No more than two wires shall be terminated at any terminal intersection.
- j) Terminal blocks shall be in accordance with Eskom standard 240-70413291, Specification for Electrical Terminal Blocks
- k) Joined wires shall be soldered and isolated by means of heat shrink.
- l) Ethernet -CAT5 or above shall be utilised.
- m) All power cable shall be appropriately sized to ensure voltage drops along cable runs remain within the operating specifications of the equipment being powered.
- n) All equipment shall be effectively protected against overvoltage due to lightning strikes or switching surges by strategically placed surge arrestors.
- o) Equipment shall not be affected by electrostatic discharges that are applied directly to the equipment or to metal objects in the proximity of the equipment: All electronic equipment shall be a class 2 device as specified in IEEE 1613-2009.
- p) All points of cable entry shall be through glands so as to secure the cables.

All equipment shall be labelled in accordance with the design diagrams, with durable, weather resistant labels. All equipment shall be designed for application in 'special' environmental conditions as follows:

- a) Ambient air temperature: -25 °C to +70 °C.
- b) Relative humidity (24h average): 98%.
- c) All outside equipment including fasteners and supports should be corrosion resistant and appropriate for the environment on site.
- d) All nuts, bolts and washers use for the construction to be stainless steel. Screws can be cadmium plated.
- e) Equipment installed will need added dust protection.

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The proposed solution shall consist of a PA system that will be integrated into the existing perimeter PA system linked to the security control room with audibility across the whole extent of the facility. The positioning and quantity of loudspeakers are to be determined by the facility characteristics and in line with the requirements of the PA specification. The speakers shall be weatherproof, environmental, corrosion and vandalism resistant as well as UV resistant. The audio from the speakers shall be clearly audible throughout the perimeter and be able to handle an alarm siren without distortion.

When an alarm is generated by the alarm system, the CCTV system shall detect the alarm and know what zone was triggered in order to trigger the relevant cameras for that zone. The alarm system shall receive trigger signals from CCTV video analytics in addition to triggers from the site's traditional security sensors. Should the intruder detection system be triggered at night, the site's LED floodlights shall be activated for a period of 15 minutes. Should the alarm be triggered, all the floodlights shall be switched on simultaneously to act as a deterrent as well as provide light for the PTZ camera.

4. Engineering and the *Contractor's* design

4.1 *Employer's* Design

The *Employer* has conducted the concept design of the works, the extent of which is detailed in document: KUS-202211157: Kusile Power Station Refurbishment of the ex-GE Store Concept Design Report. Drawings to be issued by the *Employer* are listed in Table 2 below:

Table 3: Drawings issued by the *Employer*.

Drawing number	Title	Revision
Civil Drawings		
Mechanical Fencing		
0.90/706	Kusile Power Station Security Fence Double Swing Access Gate Plan, Elevations and Details	6
0.90/707	Kusile Power Station Security Fence Post Concrete Bases and Gate Keep Detail	2
146838-0UYX-S3916B	Kusile Power Station Security Fence Access Gate Posts Plan, Elevations and Details	0
0.90/709	Kusile Power Station Security Fence Details of Posts and Struts	1

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0.90/710	Kusile Power Station Security Fence Weldmesh Termination and Fixing Details	1
0.90/710	Kusile Power Station Security Fence Access Gate Post and Wiring Protection Details	1
Drawing number	Title	Revision
Civil Drawings		
0.90/711	Kusile Power Station Security Fence Access Gate Post and Wiring Protection Details	1
0.90/712	Kusile Power Station Security Fence With Overhang Brackets Layout and Details	1
0.90/59093	Kusile Power Station Security Fence Single Swing Access Gate Plan, Elevations and Details	4
0.90/59094	Kusile Power Station Security Fence Gate Post Foundations	2
0.90/59095	Kusile Power Station Security Fence Single Swing Gate Keep Details	0
0.90/23490	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 1	0
0.90/23491	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 1	0
0.90/23492	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 1	0
0.90/24999	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 2	0
0.90/25015	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 2	0
0.90/25016	Kusile Power Station Fence Bridge – Foundations Plans, Sections and Details Fence Bridge 2	0
Electric Fence		
0.90/49949	Kusile Power Station Concrete Slab and Post Installation	0

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4.2 Parts of the Works which the Contractor is to design

- a) The *Contractor* provides engineering design services in accordance with the Engineering Profession Act, 46 of 2000, Guideline for Professional Fees: Scope of services and Tariff of Fees for Registered Persons. The *Contractor* appoints and manages his *Subcontractors* for the project scope. The *Contractor* co-ordinates the work of his *Subcontractors* and satisfies the requirements of all relevant standards and regulations. The *Contractor* co-ordinates all interfaces to ensure design integration for all components of the project scope.

Additional Services pertaining to all stages of the project include:

- The *Contractor* reviews design data prepared by others, that interface or may impact his designs, for purposes of performing his designs and delivering sound engineering designs. The data reviews include the following but not limited to:
 - Design drawings
 - Design reports
 - Investigation/assessment reports
 - Operating and maintenance manuals etc.
 - The *Contractor* performs all required surveys, analyses, tests and investigations necessary to carry out the *Works*
 - The *Contractor* is responsible for setting out or staking out the works and indicating any boundary beacons and other reference marks pertaining to the project scope
 - The *Contractor* prepares and provides record drawings indicating all deviations from construction drawings. These includes changes to designs done by others or related to alterations to existing works
- b) The *Contractor* is mandated in terms of the Construction Regulations 2014: Duties of Designer, 6(1) g to fulfil the duties described therein. Any risks associated with the *Consultant's* design is highlighted to the *Employer* together with the mitigation measures
- c) The *Contractor's* design is required to be in accordance with all National Standards and Specifications referenced in this Works Information as well as the *Employer's* Standards referenced in Section 9.

Functional and Value-Add Design Changes

Proposed design changes are performed prior start of the *works*, by the *Contractor*. The design changes are classified as "Functional" or "Value-Add" changes. Functional changes are driven by changes to design functionality to address design flaws, omissions and/or deficiencies. Value-add changes primarily focus on cost and time reductions through design efficiency. Engineering design changes that arise during construction are catered for separately by the *Contractor*.

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The *Contractor* makes provision for a **minimum** of 150 hours of Engineering Design Support and 150 hours for Draughtsperson Support for "Functional Changes" as defined above. These hours will be used on an as-required basis based on the outcome of the design review of existing design data. The *Contractor* obtains approval from the *Employer* before making use of the allocated hours. **These hours are over and above the hours provided for by the *Contractor* for changes required during construction as a result of contractor queries etc.**

The *Contractor* makes provision for a **minimum** of 150 hours of Engineering Design Support and 200 hours for Draughtsperson Support for "Value-Add Changes" as defined above. These hours will be used on an as-required basis based on the outcome of the design reviews. The *Contractor* obtains approval from the *Employer* before making use of the allocated hours. **These hours are over and above the hours provided for by the *Contractor* for changes required during construction as a result of contractor queries etc.**

The *Contractor* provides motivations in the form of a Technical Report regarding any proposed engineering design modifications, as well as the time and cost implications of such changes. Only changes that will prohibit the *Contractor* from issuing Completion Certificates upon completion of the *works*, changes that impact execution of the *works* or changes that will have significant value-add impact for the *Employer*, will be considered for acceptance by the *Employer*.

In addition, the *Contractor* duties include the following:

- a) The *Contractor* performs design changes for purposes of completing his designs. The *Contractor* incorporates the design changes/modifications into the original designs including the finalisation of any affected drawing, schedule, report and/or specification etc.
- b) The *Contractor* assumes full design accountability and liability for his designs (temporary works included)
- c) All designs, design reports and construction drawings prepared by the *Contractor* are signed off by Professional Engineers or Technologists (registered with ECSA), who take full professional accountability for their designs.
- d) The *Contractor* submits a Level 4 schedule (schedule with defined activities) for the design scope, highlighting all design activities and milestones

4.3 Procedure for Submission and Acceptance of *Contractor's* Design

The *Contractor* shall conduct design reviews in accordance with the *Employers* Design Review Procedure, 240-53113685 and participate in all reviews as specified by the *Employer*.

The *Contractor* notes that he is the Design Authority as defined in the *Employer's* Design Review Procedure for the project scope. The design authority remains responsible and accountable for the correctness of the design documents, irrespective of whether these documents have been reviewed by the *Employer*.

The following documentation review process is followed for submission of documents:

- The *Contractor* submits the documents to the *Project Manager* for review. The *Contractor* shall allow the *Project Manager* 21 days to review and respond to the *Contractor's* document submission i.e., from time of receipt by the *Project Manager*

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- The *Employer's* project team reviews the documents and submit all comments to the *Project Manager*. On receipt of the reviewed documentation, the *Contractor* makes any modifications requested by the project team and resubmits the revised documents to the *Project Manager* within two (2) weeks of receipt. Queries regarding comments/changes made by the *Employer's* project team are addressed with the *Project Manager* prior re-submittal of documentation. Document re-submittals which have not included the comments identified, will be returned to the *Contractor* for correction. The *Contractor* shall re-issue the revised documentation incorporating all comments and details not included in the previous document issue, within 2 (two) working days of receipt.

The *Contractor* notes that no costs arising from any revisions, which are a result of the *Contractor's* omission, may be claimed from the *Employer*. This includes costs incurred by the *Contractor* in completing such designs and drawings

- The *Contractor* organises review sessions once all noted comments have been addressed and documents revised. If any further issues are found during the review process or further actions are required, the *Contractor* records all concerns and revises the documents accordingly. The *Contractor* compiles an end-of phase design review report and submits to the *Project Manager* for acceptance, upon completion of the review stage.

Change Management

Engineering design changes are performed in accordance to the latest revision of the Eskom Project Change Management Procedure [240-53114026]. The *Employer* ensures that *Contractor* is provided with latest revision of this procedure. Any uncertainty regarding this procedure should be clarified with the *Employer*.

Acceptance of the Contractor's Design

The *Contractor* implements the following for design acceptance:

- a) The *Employer* accepts the *Contractor's* design upon completion of reviews by the *Employer's* project team.
- b) The *Contractor* stamps, dates and signs his designs, to signify approval of his designs.
- c) The *Contractor* informs the *Employer* in writing of any deviation in the *Contractor's* drawings, from the scope requirements.

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4.4 Other Requirements of the *Contractor's* Design

Construction & Commissioning Monitoring

The *Contractor* provides construction and commissioning supervision in accordance with Level 4 of the ECSA Guideline Scope of Services and Tariff of Fees for Registered Persons [Engineering Profession Act, 2000, (Act No. 46 of 2000)]. The *Works* include the provision of on-site personnel during construction, as deemed necessary by the *Contractor*. These services shall be required for the duration of the *Works*. The duties of the *Contractor* are detailed below but not limited to the following:

- Perform technical oversight of the project i.e., respond to technical queries during construction and commissioning activities including but not limited to the review of construction work procedures, quality control plans, material approvals, survey approvals, requests for information, concessions, data books etc.
- Monitor construction and commissioning activities to ensure compliance with the project scope requirements
- Management of project interfaces etc.

Site Supervision

The *Contractor* provides a full-time construction supervision team on site for construction and commissioning activities. The following key responsibilities shall apply:

- Supervise and report on *Contractor's* performance;
- Submit daily diaries/daily progress reports to the *Employer*
- Should 24-hour construction monitoring be required, additional resources will be required to manage the work load
- Comply to all *Employer* and site related governance and safety, health, environment, risk requirements

4.5 Use of the *Contractor's* Design

The *Contractor* notes that all his design data, that is presented to the *Employer* in relation to the *Works*, become the property of the *Employer*. The *Employer* has total rights to use the *Contractor's* designs, as the *Employer* requires i.e., construction, refurbishment, repair, maintenance etc.

4.6 As-built Drawings, operating manuals and maintenance schedules

As-built Drawings

The *Contractor* provides "As Built" drawings/documentation for all his designs. The designs to embody all modifications made during construction. "As Built" documentation to be provided for the entire project scope i.e., Architectural, Civil & Structural, Mechanical, Electrical and C&I works etc.

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Drawings issued to the Employer will be a minimum of one hardcopy and an electronic copy. The *Contractor* is required to submit drawings electronically in both native CADD format and PDF format. Drawings issued to the Employer may not be "Right Protected" or encrypted.

Operating Manuals and Maintenance schedules

The *Contractor* shall prepare and submit operating and maintenance manuals (O&M) for equipment items under this contract. The manuals provide a detailed record of the safe operation and maintenance of the items. The *Contractor* submits the documentation to the *Employer* for review and acceptance. The *Contractor* submits the O&M manuals prior undertaking test and commissioning activities.

The manuals to provide comprehensive information on the following but not limited to:

- a) Equipment technical data
- b) Detailed drawings of equipment items
- c) Operating procedure of equipment items
- d) Prescribed maintenance schedule or routine maintenance procedures/instructions per manufacturer requirements
- e) Commissioning procedures
- f) Preservation and storage requirements

5. Construction

5.1 Temporary works, Site services & construction constraints

5.1.1 General

The *Contractor* duties include the following:

- Submits a cost proposal for the *Works*
- Submits a project specific safety file to the *Employer* for acceptance, prior to the start of *Works*
- Submit a detailed level 4 schedule for the works to the *Project Manager* for acceptance after contract award
- Manage his activities on site to ensure that no interference takes place between his work and that of others.
- Supply to the *Employer*, all consumer power requirements, potable water requirements and any other termination interface requirements that are required to complete the *Works*
- The *Contractor* confirms the available space in the site area for construction of the *Works* taking note of all existing services, pipes, structures, and any obstructions to the
- The *Contractor* to furnish all material, labour, and equipment necessary to perform and complete the *Works*.
- Provides a detailed Construction Method Statement for all work activities and details the activity durations. All method statements are reviewed and accepted by the *Employer* prior

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commencement of the *Works*. The *Contractor* in his method statements includes the following as a minimum:

- A comprehensive construction methodology of the project activities.
- A clear description of the responsibilities of the *Contractor's* personnel involved in the activity,
- Health, safety and quality control considerations for the activity.
- All plant, equipment and machinery required to complete the project activity.
- Temporary works to be used for the *Works*.
- Technical Data Sheets for all materials used including product description, composition, material and performance properties, installation, application procedures and product use limitations etc.
- Plans for confining, collecting, and disposing of waste materials as a result of removal operations, where applicable.
- *Works* required to safeguard existing infrastructure and services
- The *Contractor* shall arrange for all required test works for process control.
- The *Contractor* is responsible for quality control and management of the assigned *Works*
- The *Contractor* submits as-built drawings for all the components of the finished *Works* to the
- The *Contractor* shall compile and submit a data package for the completed *Works*. The documentation shall include but not limited to the following:
 - Construction drawings used to execute the *Works*
 - Approved construction method statement, QCP/ITPs
 - Material certificates/data sheets

5.1.2 Surveying and Setting Out of the *Works*

- a) The *Contractor* is responsible for the complete surveying and setting out of the *works* including establishment and protection of any benchmarks required to complete the *works*.
- b) The *Contractor* is required to submit as-built and/or red-line data and drawings of the completed *works* to the *Project Manager* upon handover. As-built drawings are submitted in PDF and native CAD (.DGN) formats.
- c) The *Contractor* is responsible for the verification of all survey data relating to setting out and to immediately inform the *Project Manager* of any discrepancies as soon as these are discovered.
- d) The final position of the new infrastructure i.e., ablution block, guardhouse, potable and fire water infrastructure is determined by the *Contractor* with the ideal location indicated on the issued drawings.

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5.1.3 Site Preparation & Clearance

The *Contractor* shall prepare the site for construction by clearing, removing and disposing of all unsuitable material and obstructions not forming part of the *Works*. The construction works include the removal of ~700m of razor mesh fencing and preparation of the site along the fencing line. The *Contractor* adheres to the latest revision of the *Employer's* Execution of Site Preparation and Earthworks Standard [19], SANS 1200 series and SANS 2001 BE1. The *Contractor* shall be responsible for the disposal of all waste within the construction area. All excavated excess or unsuitable materials shall be disposed of at a designated spoil site. Hazardous waste shall be disposed of at a registered waste disposal site, to be approved by the *Employer*.

5.1.4 Excavations and Associated Water Control

Excavations & Scanning of Underground Services

No excavations are permitted without an excavation permit obtained from the *Project Manager*. The *Contractor* complies with the requirements of the Construction Regulations, Execution of Site Preparation and Earthworks [19] and the Kusile Trench and Excavation Procedure [203-13626]. Scanning of underground services shall precede all excavation works. The *Contractor* performs geophysical assessments for detection of subsurface utilities, prior undertaking excavations. The geophysical scanning method employed is at the discretion of the *Contractor*. The *Contractor* therefore considers the work area prior to selection of test methodology and equipment. The *Contractor* submits the results of the scans to the *Project Manager* and indicates possible services which may interfere with the *works*. The *Contractor* shall obtain all relevant drawings, indicating the position of potential underground services around the work area. Care shall be taken by the *Contractor* to properly demarcate and protect all underground utilities. If any service or structure is damaged by the *Contractor*, that should have been located or protected by the *Contractor*, the *Contractor* shall be liable for the repair works. All excavation *works* shall be carried out in accordance with the SANS 1200 series and SANS 2001 BE1.

Water Control on the *Works*

The *Contractor* is responsible for the control of water during construction including the dewatering of excavations, to ensure the safety of the *Works*. The *Contractor* provides, operates and maintains all required equipment for this purpose i.e., pump equipment, well points etc. The *Contractor* is responsible for the design, construction and maintenance of all temporary drainage controls i.e., sumps, drains, trenches and any other temporary works that may be necessary for the dewatering and protection of the permanent *Works*.

The *Contractor* re-instates temporary drainage controls, when no longer required. The *Contractor* is responsible for the repair of damaged *Works* caused by floods, water, or failure of any part of the dewatering and flood protection controls. The *Contractor's* attention is drawn to the fact that, during rain events and seasons, high water tables may be encountered on site. The cost of the protection works, including rectification of damages, shall be borne by the *Contractor*.

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5.1.5 Temporary Works

The *Contractor* is responsible for the design of all temporary works and is mandated in terms of Construction Regulations 2014: Duties of Designer, 6(2) a – d, to fulfil the duties described therein for all temporary work designs.

5.1.6 Contractor 's Programme

- a) The *Contractor* submits to the *Employer*, a level 4 single integrated programme for the project scope.
- b) The *Contractor* submits an electronic copy of his programme in MS Project (MPP) format. The *Contractor* includes the following as a minimum in his programme:
 - Start and completion dates
 - Order and timing of project activities which the
 - Order and timing of project activities which the *Contractor* is to perform

Submission Of Revised Programmes and Progress Reporting

The *Contractor* submits his revised programme bi-weekly or as instructed by the *Employer*. The *Contractor* indicates on each revised programme:

- Actual progress achieved on each project activity and its effect on the timing of the remaining *works*.
- Management of delays encountered etc.

5.2 Completion, Testing, Commissioning and Correction of Defects

5.2.2 Testing Requirements

The *Contractor* shall be responsible for all testing of the *Works*. The *Works* shall be tested in accordance with the latest standards and procedures as outlined in the South African National Standards (SANS) as well as other applicable codes of practice. The cost of testing undertaken by the *Contractor* in terms of his obligations under the contract including the taking of samples, reinstating where samples have been taken and all testing equipment, labour, materials, etc. must be included in the rates tendered for and will not be paid for separately.

The following tests are conducted by the *Contractor* but not limited to:

- Field and laboratory testing associated with the construction works i.e., concrete and earthworks. Below is a list of tests that the *Contractor* shall perform on soil samples, as a minimum:
 - Identification tests - Atterberg Limits and Sieve analysis

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- Soil compaction tests i.e. moisture/density relationship at Modified AASHTO compaction effort and California Bearing Ratio (CBR)

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).

5.2.3 Materials facilities and samples for test and inspections

- a) The *Contractor* provides all materials, facilities and/or samples required for all tests and inspections.
- b) The *Employer* reserves the right to call for samples of equipment offered to inspect the workmanship as the work proceeds and either accepts or rejects the equipment or workmanship. The *Contractor* remains fully liable to provide complete and proper working plant.

5.2.4 Miscellaneous Materials and Services

The *Contractor* makes provision for the following but not limited to:

- Erection tools, special tools and test equipment required for erection, testing, startup, and operation of the equipment, including shipping/delivery costs to and from the jobsite.
- Construction services, storage facilities, and utilities specified herein.
- Other miscellaneous materials and services required to complete the work that is not specifically indicated herein.
- Provision of construction power and temporary lighting, including designing, furnishing, erecting, maintaining, and removal thereof, when no longer required
- Supply, install and remove all temporary support structures.
- Survey and lay out the work from the *Employer's* or Project Field Manager's designated control points.
- All welding materials, equipment and consumables required for attachment of equipment, piping, or structural steel furnished under these specifications.
- Protection of existing underground utilities, foundations, buildings, and equipment.
- Solvents and cleaning materials.
- Hazardous Material Safety Data Sheets (MSDS) for all materials supplied by *Contractor*.
- Construction consumables.

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- Supply, surface preparation and application of painting and galvanizing of all *Contractor*-furnished piping and structural steel, in accordance with Eskom Standard SSZ_45-17, Medupi Power Station Corrosion Protection Specification.
- Touch-up prime and touch-up finish paint all furnished painted piping, piping attachments and accessories, and structural steel members. *Contractor* shall furnish all materials required for surface preparation and painting. No touch-up galvanizing will be permitted except to exposed threads after assembly or per *Employer* review and approval. Materials shall be re-dipped if touch up galvanizing is required.
- Restoration of *Contractor* damage to the site.
- Furnish and install symbolic safety signs per SANS 1186 for *Contractor* installed equipment.
- Maintenance of accurate as-built drawings for all erection work and delivery of final as-built drawings to the *Employer*.
- Attendance at coordination meetings at the site at a time selected by the *Employer* to discuss matters relative to the execution of this contract.
- Initial and final fill of oils, greases, and other lubricants to equipment installed by the *Contractor*.
- Grout, pour concrete, set, align and erect all furnished pipe support foundations that are to be installed under this contract, including foundations, foundation bolts, and bolt sleeves, *Contractor* shall furnish and erect for all pipe support foundations all grouting materials and the placing thereof.

5.2.5 Pre-Commissioning Tests and Commissioning

- The *Contractor* is responsible for all commissioning activities of mechanical, electrical and C&I systems, installed by the *Contractor*, including but not limited to the planning, provision of labour, plant, material, equipment and supervision of the activities. Commissioning activities are performed in accordance with the On-Site Commissioning for Low Pressure Systems Standard [240-56356376] etc.
- The *Contractor* shall perform all tests as required by Sections or Clauses of the *Works Information* and all tests required by the *Employer's* Specifications annexed thereto, and all tests required by any applicable South African National Standard, or other Standard, and/or as directed by the *Employer's* and the *Project Manager*.
- Commissioning procedures are prepared by the *Contractor* for each plant system. The procedures are reviewed and approved by the *Employer* prior commencement of activities.
- The *Contractor* shall supply all relevant test equipment, monitoring devices etc. required to test and commission the complete *Works*.

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- Accurate records of commissioning and test activities are submitted as part of handover documentation.

5.2.5.1 Factory Acceptance Testing

The *Contractor* shall perform all routine factory tests on selected electrical and mechanical plant, as required by the *Employer*. FATs are performed at the supplier's premises before equipment is despatched to site. The *Contractor* provides test reports, certificates and any other statutory documentation, where applicable, for applicable equipment. The test reports contain the following information as a minimum:

- Technical data of component
- Test type/method
- Test evaluation results

5.2.5.2 Performance Testing

The *Contractor* carries out performance tests on selected electrical and mechanical equipment, as required by the *Employer*. Performance tests are performed at the supplier's premises before dispatchment of equipment to site. The *Contractor* prepares and submits for review and acceptance, testing procedures, Quality Control Plans and the acceptance criteria, prior commencement of tests. A representative of the *Employer* shall witness the performance tests but in doing so, the *Contractor* notes that the *Employer* assumes no responsibility or accountability for the proper functionality of plant or equipment. The *Contractor* arranges with the *Project Manager* for witnessing of test activities. The *Contractor* submits all test certificates and/or records for the test activities. The *Contractor* to supply all labour, materials, plant, and equipment for this purpose.

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5.2.5.3 Site Acceptance Tests

The *Contractor* performs site acceptance testing for selected plant and equipment, as required by the *Employer*. SATs are performed at the *Employer's* premises and witnessed by a representative of the *Employer*. Installations shall be comprehensively tested and commissioned as individual and integrated systems as may be required by the configuration, after completion of *Works*. The *Contractor* shall provide adequate and competent personnel for testing and commissioning activities, for the full duration of the commissioning process. The *Contractor* to supply all labour, materials, plant, and equipment for the required tests. The *Contractor* notes that witnessing of tests by the *Employer*, shall only be made after the *Contractor* has pre-commissioned the equipment and satisfied himself that it is in working or running order.

The *Contractor* arranges with the *Project Manager* for the witnessing of test activities. The *Contractor* submits all test certificates/records as well as any prescribed statutory documents, where applicable, certifying that the equipment is in complete working order. Where required, the *Contractor* to provide the initial fill of oil/lubrication/grease and any other consumables, for the commissioning and test activities.

5.2.5.4 Commissioning Procedures and Programme

The *Contractor* submits to the *Project Manager*, a detailed programme of the planned commissioning activities at least 14 days before commissioning commences. The commissioning programme to include the following but not limited to:

- A schedule of equipment to be commissioned, the proposed tests to be conducted and the testing methods
- Commissioning check sheets
- Commissioning programme dates and duration.

5.2.6 Access for Correction of Defects

Should the *Contractor* need to return to the site after completion of the *works* to conduct an improvement or repair, the *Contractor* arranges all resources, plant and equipment required to

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6. Plant and Materials standards and workmanship

6.1 Materials, Workmanship and Products

a) Materials and Workmanship

Only new and undamaged materials are to be used in the *Works*. Materials to be permanently installed into the *Works* are not to be used for any temporary purposes on site. Work is required to be for the acceptance of the *Employer* and is executed in accordance with the relevant manufacturer's written recommendations and instructions.

6.2 Civil engineering and structural works

The scope of Works shall be performed in accordance with the South African National Standards, prescribed Eskom standards and any other applicable codes of practice, specifications, and regulations. Reference to standards or manuals, whether such reference is specific or by implication, shall mean the latest standard, manual, or code in effect at the time of the contract award. The *Contractor* adheres to the normative references in section 2.1.4. If there is any contradiction within the codes and standards, the *Contractor* liaises with the Employer for clarification. The *Contractor* notes that the provided lists are not all-inclusive and do not relieve the *Contractor* from complying with all applicable design codes. The *Contractor* notes that the lists are not all-inclusive and do not relieve the *Contractor* from complying with all applicable codes.

Structural steelwork

The *Contractor* adheres to the latest issue of the listed standards/codes/publications. The *Contractor* notes that the list is not all-inclusive and does not relieve the *Contractor* from complying with all applicable codes.

Table 4: List of Applicable Standards for Structural Steelwork

Code	Description
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 455	Covered electrodes for manual arc welding of carbon steels
SANS 517	Light Steel Frame Building
SANS 657	Steel tubes for non-pressure purposes
SANS 679	Zinc chromate primers for steel
SANS 681	Undercoats for paints
SANS 684	Structural steel paint
SANS 1273	Fasteners for roof and wall coverings in the form of sheeting
SANS 1465	Steel castings for general engineering applications

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Code	Description
SANS 1700	Fasteners
SANS 1921-3	Construction and management requirements for works contracts, Part 3: Structural steelwork
SANS 2001-CS1	Construction works Part CS1: Structural steelwork
SANS 3834	Quality requirements for fusion welding of metallic materials
SANS 4042	Fasteners – Electroplated coatings
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10085	The design, erection, use and inspection of access scaffolding
SANS 10094	The use of high-strength friction grip bolts
SANS 10104	Hand railing and balustrading (safety aspects)
SANS 10120	Code of practice for use with standardised specifications for civil engineering construction and contract documents
SANS 10162	The structural use of steel
SANS 10177	Fire testing of materials, components and elements used in buildings
SANS 10237	Roof and side cladding
SANS 10400	The application of the National Building Regulations
SANS 10684	Fasteners – Hot dip galvanised coatings
SANS 14399	High strength structural bolting assemblies for preloading
SANS 14713	Protection against corrosion of iron and steel in structures – zinc and aluminium coatings – guidelines (ISO 14713)
SANS 15609	Specification and qualification of welding procedures for metallic materials – welding procedure specification
SANS 15614	Specification and qualification of welding procedures for metallic materials – welding procedure test
SANS 16961	Petroleum, petrochemical and natural gas industries – Internal coating and lining of steel storage tanks
SANS 23279	Non-destruction
SANS 50025	Hot rolled products of structural steels
SANS 50028	Flat products made of steels for pressure purposes
SANS 50219	Cold formed welded structural hollow sections of non-alloy and fine grain steels Part 1 – Technical delivery
EN 10210-1	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements
EN 10210-2	Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 2: Tolerances, dimensions and sectional properties
ANSI/AWS A5.1/A5.1M	Specification for carbon steel electrodes for shielded metal arc welding
ANSI/AWS A5.17/A5.17M	Specification for carbon steel electrodes and fluxes for submerged arc welding
ANSI/AWS A5.18/A5.18M	Specification for carbon steel electrodes and rods for gas shielded arc welding
ANSI/AWS A5.20	Specification for carbon steel electrodes for flux cored arc welding

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

Corrosion protection

The *Employer* uses extracts and variations from SANS 1200HC as part of the *Employer's* requirements, even though this standard has been withdrawn. All corrosion protection conforms to the requirements of 240-106365693 'Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings' as a minimum. The *Contractor* adheres to the latest issue of the listed standards/codes/publications. The Contractor notes that the list is not all-inclusive and does not relieve the Contractor from complying with all applicable codes.

Table 5: List of Applicable Standards for Structural Steelwork

Code	Description
34-1658	Distribution Standards – Part 0: Corrosion Protection Specification for New Indoor and Outdoor distribution Equipment, components, materials and structures manufactured from steel
240-106365693	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
ASTM E376	Measuring coating thickness by magnetic field or eddy current electromagnetic test methods
ASTM D4541	Standard method for pull-off strength of coatings using portable adhesion testers
ISO 12944	Paint and varnishes – Corrosion protection of steel structures by protective paint systems
ISO 4624	Paints and varnishes – Pull-off test for adhesion
ISO 4628	Paints and varnishes

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Code	Description
ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8501-4	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness – Part 4: Initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting.
ISO 8502-3	Preparation of steel substrates before application of paint and related products – Tests for the assessment of surface cleanliness-Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method).
ISO 8503-4	Preparation of steel substrates before application of paint and related products – Surface roughness characteristics of blast cleaned steel substrates – Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile – stylus instrument procedure
ISO 8504	Preparation of steel substrates before application of paint and related products – Surface preparation methods
ISO 9001	Quality Management System
SANS 110	Sealing compounds for the building industry, two-component, polysulphide base
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SABS 763	Hot-dip (galvanised) zinc coatings (other than on continuously zinc-coated sheet and wire)
SANS 1077	Sealing compounds for the building and construction industry, two-component, polyurethane-base
SANS 1091	National colour standard
SANS 1217	Internal and external organic coating protection for buried steel pipelines
SANS 1700-5-8	Fasteners Part 5: General requirements and mechanical properties Section 8: Mechanical properties of corrosion-resistant stainless-steel fasteners - Bolts, screws and studs
SANS 1700-5-9	Fasteners Part 5: General requirements and mechanical properties Section 9: Mechanical properties of corrosion-resistant stainless-steel fasteners - Nuts
SANS 1700-5-10	Fasteners Part 5: General requirements and mechanical properties Section 10: Mechanical properties of corrosion-resistant stainless-steel fasteners - Set screws and similar fasteners not under tensile stress
SANS 1700-5-18	Fasteners Part 5: General requirements and mechanical properties Section 18: Fasteners - Non-electrolytically applied zinc flake coatings
SANS 2063	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys
SANS 2808	Paints and varnishes – Determination of film thickness
SANS 5159	Adhesion of paint and varnish films (cross cut test)
SANS 5769	Cleanliness of blast cleaned surfaces for painting (assessed by freedom from dust and debris)
SANS 5772	Profile of blast cleaned surfaces for painting (determined by a micrometre profile gauge)
SANS 5870	Hardness of vulcanized rubbers of hardness 30 — 95 degrees
SANS 10064	The preparation of steel surfaces for coating
SANS 10104	Hand railing and balustrading (safety aspects)

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Code	Description
SANS 10120-2 HC	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 2: Project specification Section HC: Corrosion protection of structural steelwork
SANS 10120-4 HC	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 4: Typical schedule of quantities Section HC: Corrosion protection of structural steelwork
SANS 10120-5 HC	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 5: Contract administration Section HC: Corrosion protection of structural steelwork
SANS 10121	Cathodic protection of buried and submerged structures
SANS 10140	Identification colour marking
SANS 10214	The design, fabrication and inspection of articles for hot-dip galvanising
SANS 12944-1	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 1: General introduction
SANS 12944-2	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 2: Classification of environments
SANS 12944-3	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 3: Design considerations
SANS 12944-4	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 4: Types of surface and surface preparation
SANS 12944-5	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 5: Protective paint systems
SANS 12944-6	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 6: Laboratory performance test methods
SANS 12944-7	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 7: Execution and supervision of paint work
SANS 12944-8	Paints and varnishes - Corrosion protection of steel structures by protective paint systems Part 8: Development of specifications for new work and maintenance
SANS 14713-1	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures Part 1: General principles of design and corrosion resistance
SANS 14713-2	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures Part 2: Hot dip galvanizing
SANS 14713-3	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures Part 3: Sherardizing
SIS 055900	Swedish Code of Practice – Pictorial surface preparation standard for painted steel surfaces

Concrete works

The *Contractor* adheres to the latest issue of the listed standards/codes/publications. The *Contractor* notes that the list is not all-inclusive and does not relieve the *Contractor* from complying with all applicable codes.

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Table 6: List of applicable standards for Concrete Works

Code	Description
Admixtures	
SANS 50934-1	Admixtures of concrete, mortar and grout, Part 1, Common requirements
SANS 50934-2	Admixtures of concrete, mortar and grout, Part 2, Concrete admixtures: definitions, requirements, conformity, marking and labelling
SANS 50934-3	Admixtures for concrete, mortar and grout, Part 3, Admixtures for masonry mortar - definitions, requirements, conformity and marking and labelling
SANS 50934-4	Admixtures for concrete, mortar and grout, Part 4, Admixtures for grout for prestressing tendons - definitions, requirements, conformity, marking and labelling
SANS 50934-5	Admixtures for concrete, mortar and grout, Part 5, Admixtures for sprayed concrete - definitions, requirements, conformity, marking and labelling
SANS 50934-6	Admixtures for concrete, mortar and grout, Part 6, Sampling, conformity control and evaluation of conformity
Aggregates	
SANS 195	Sampling of aggregates
SANS 197	Preparation of Test Samples of Aggregates
SANS 201	Sieve Analysis, Fines Content and Dust Content of Aggregates
SANS 202	Chloride Content of Aggregates
SANS 794	Aggregates of low density
SANS 1083	Aggregates from natural sources – Aggregates for concrete
SANS 1090	Aggregates from natural sources - Fine aggregates for plaster and mortar
SANS 3001-AG1	Civil engineering test methods. Part AG1, Particle size analysis of aggregates by sieving
SANS 3001-AG2	Civil engineering test methods. Part AG2, Determination of the average least dimension of aggregates by direct measurement
SANS 3001-AG3	Civil engineering test methods. Part AG3, Determination of the average least dimension of aggregates by computation
SANS 3001-AG4	Civil engineering test methods. Part AG4, Determination of the flakiness index of coarse aggregate
SANS 3001-AG5	Civil engineering test methods. Part AG5, Sand equivalent value of fine aggregates
SANS 3001-G10	Civil engineering test methods. Part AG10, ACV (aggregate crushing value) and 10% FACT (fines aggregate crushing test) values of coarse aggregates
SANS 3001-G12	Civil engineering test methods. Part AG12, Soundness of aggregates (magnesium sulphate method)
SANS 3001-G13	Civil engineering test methods. Part AG13, Determination of the soundness of mudrock aggregates
SANS 3001-G14	Civil engineering test methods. Part AG14, Determination of the ethylene glycol durability index for rock
SANS 3001-G15	Civil engineering test methods. Part AG15, Determination of rock durability using 10% FACT (fines aggregate crushing test) values after soaking in ethylene glycol
SANS 3001-G16	Civil engineering test methods. Part AG16, Determination of the durability mill index values for aggregates
SANS 3001-G23	Civil engineering test methods. Part AG23, Particle and relative densities of aggregates

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Code	Description
SANS 5831	Presence of chlorides in aggregates
SANS 5832	Organic impurities in fine aggregates (limit test)
SANS 5833	Detection of sugar in fine aggregates
SANS 5834	Soluble deleterious impurities in fine aggregates (limits test)
SANS 5835	Estimation of the effect of fine aggregates on the water requirement of concrete
SANS 5836	Effect of fine and coarse aggregate on the shrinkage and expansion of cement: aggregate mixes (mortar prism method)
SANS 5837	Low density materials content of aggregates
SANS 5838	Sand equivalent value of fine aggregates
SANS 5840	Shell content of fine aggregate
SANS 5841	Aggregate crushing value of coarse aggregates
SANS 5842	FACT value (10% fines aggregate crushing value) of coarse aggregates
SANS 5844	Particle and relative densities of aggregates
SANS 5845	Bulk densities and voids content of aggregates
SANS 5846	Abrasion resistance of coarse aggregates (Los Angeles machine method)
SANS 5847	Flakiness index of coarse aggregates
SANS 5848	Polished-stone value of aggregates
SANS 5849	Total water-soluble salts content of fines in aggregates
SANS 5850-1	Sulphates content of fines in aggregates. Part 1, Water-soluble sulphates in fines in aggregates
SANS 5850-2	Sulphates content of fines in aggregates. Part 2, Acid-soluble sulphates in fines in aggregates
SANS 5851	Liquid limit of fines in aggregates for base-courses
SANS 5854	pH value of fines in aggregates for base-courses
SANS 5855	Free water content of aggregates
SANS 5856	Bulking of fine aggregates
SANS 6239	Aggregate impact value of coarse aggregate
SANS 6240	Electric conductivity of fine aggregate
SANS 6241	Particle size distribution of material of diameter smaller than 75 micron in fine aggregate (hydrometer method)
SANS 6242	Acid insolubility of aggregates
SANS 6243	Deleterious clay content of the fines in aggregate (methylene blue adsorption indicator test)
SANS 6244	Particles of diameter not exceeding 20micron and not exceeding 5micron and smaller, respectively, in fine aggregate (pipette method)
SANS 6245	Potential reactivity of aggregates with alkalis (accelerated mortar prism method)
SANS 6246	Treton impact value of aggregates
Cementitious Materials	
SANS 1745	Cementitious grouting capsules for use with tendon-based support systems
SANS 5748	Specific surface of cement
SANS 5754	Autoclave expansion of cement
SANS 6151	Free water content of Portland cementitious materials

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Code	Description
SANS 6152	Available alkali content of cement extenders (complying with SANS 50197-1)
SANS 6154	Glass content of granulated metallurgical slag (transmitted-light microscopy method)
SANS 6155	Effect of extenders, used with cement, on the reduction of expansion caused by alkali-silica reaction (accelerated mortar prism method)
SANS 50196-1	Methods of testing cement. Part 1, Determination of strength
SANS 50196-2	Methods of testing cement. Part 2, Chemical analysis of cement
SANS 50196-3	Methods of testing cement. Part 3, Determination of setting times and soundness
SANS 50196-4	Methods of testing cement. Part 4, Quantitative determination of constituents
SANS 50196-5	Methods of testing cement. Part 5, Pozzolanicity test for pozzolanic cement
SANS 50196-6	Methods of testing cement. Part 6, Determination of fineness
SANS 50196-7	Methods of testing cement. Part 7, methods of taking and preparing samples of cement
SANS 50197-1	Cement. Part 1, Composition, specifications and conformity criteria for common cements
SANS 50197-2	Cement. Part 2. Conformity evaluation
SANS 50413-1	Masonry cement. Part 1, Composition, specifications and conformity criteria
SANS 50413-2	Masonry cement. Part 2, Test methods
SANS 50450-1	Fly ash for concrete. Part 1, Definition, specifications and conformity criteria
SANS 50450-2	Fly ash for concrete. Part 2, Conformity evaluation
SANS 50451-1	Method of testing fly ash. Part 1, Determination of free calcium oxide content
SANS 50451-2	Method of testing fly ash. Part 2, Determination of fineness by wet sieving
SANS 53263-1	Silica fume for concrete. Part 1, Definitions, requirements and conformity criteria
SANS 53263-2	Silica fume for concrete. Part 2, Conformity evaluation
SANS 55167-1	Ground granulated blast furnace slag for use in concrete, mortar and grout. Part 1, Definitions, specifications and conformity criteria.
SANS 55167-2	Ground granulated blast furnace slag for use in concrete, mortar and grout. Part 2, conformity evaluation
Concrete	
SANS 878	Ready-mixed concrete
SANS 5860	Concrete tests - Dimensions, tolerances and uses of cast test specimens
SANS 5861-1	Concrete tests - Mixing fresh concrete in the laboratory
SANS 5861-2	Concrete tests - Sampling of freshly mixed concrete
SANS 5861-3	Concrete tests - Making and curing of test specimens
SANS 5862-1	Concrete tests - Consistence of freshly mixed concrete - slump test
SANS 5862-2	Concrete tests - Consistence of freshly mixed concrete - flow test
SANS 5862-3	Concrete tests - Consistence of freshly mixed concrete - vebe test
SANS 5862-4	Concrete tests - Consistence of freshly mixed concrete. Part 4, Compacting factor and compaction index
SANS 5863	Concrete tests - compressive strength of hardened concrete
SANS 5864	Concrete tests - flexural strength of hardened concrete
SANS 5865	Concrete tests - the drilling, preparation, and testing for compressive strength of cores taken from hardened concrete
SANS 6085	Concrete tests - initial drying shrinkage and wetting expansion of concrete

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Code	Description
SANS 6250	Concrete tests - density of compacted freshly mixed concrete
SANS 6251	Concrete tests - density of hardened concrete
SANS 6252	Concrete tests - air content of freshly mixed concrete - pressure method
SANS 6253	Concrete tests - tensile splitting strength of concrete
SANS 6254	Mortar tests - initial drying shrinkage and wetting expansion of mortar
SANS 6255	Mortar tests - compressive strength of mortar
SANS 50206	Concrete – Specification, performance, production and conformity
Design	
SANS 993	Modular co-ordination in building
SANS 10100-1	The structural use of concrete. Part 1, Design
SANS 10160	Basis of structural design and actions for buildings and industrial structures.
Construction	
SANS 2001 CC1	Construction works: Part CC1: Concrete works (structural)
SANS 2001 CC2	Construction works: Part CC2: Concrete works (minor works)
SANS 10100-2	The structural use of concrete. Part 2, Materials and execution of work
SANS 10109-1	Concrete floors. Part 1, Bases to concrete floors
SANS 10109-2	Concrete floors. Part 2, Finishes to concrete floors
SANS 10155	Accuracy in buildings
SANS 53670	Execution of concrete structures
SANS 55392	Sustainability in building construction: general principles
Reinforcement	
SANS 282	Bending dimensions and scheduling of steel reinforcement for concrete
SANS 920	Steel bars for concrete reinforcement
SANS 1024	Welded steel fabric for reinforcement of concrete
SANS 10144	Detailing of steel reinforcement for concrete
Water	
SANS 51008	Mixing of water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete
Concrete and Related Products	
SANS 266	Gypsum plasterboard
SANS 470	Concrete poles for telephone, power and lighting purposes
SANS 508	Concrete retaining blocks
SANS 541	Precast concrete paving slabs
SANS 676	Reinforced concrete pressure pipes
SANS 677	Concrete non-pressure pipes
SANS 685	Fibre-cement sheets (flat and profiled)
SANS 803	Fibre-cement boards

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Code	Description
SANS 819	Fibre-cement pipes, couplings and fittings for sewerage, drainage and low-pressure irrigation
SANS 927	Precast concrete kerbs, edgings and channels
SANS 975	Prestressed concrete pipes
SANS 986	Precast reinforced concrete culverts
SANS 1058	Concrete paving blocks
SANS 1215	Concrete masonry units
SANS 1223	Fibre-cement pressure pipes and couplings
SANS 1294	Precast concrete manhole sections and components
SANS 1372	Prefabricated concrete components for fences
SANS 1504	Pre-stressed concrete lintels
SANS 1879	Precast concrete suspended slabs
SANS 1882	Polymer concrete surface boxes, manhole and inspection covers, gully gratings and frames
SANS 50771-3	Specification for masonry units. Part 3, Aggregate concrete masonry unite (dense and lightweight aggregates)
SANS 50771-4	Specification for masonry units. Part 4, Autoclaved aerated concrete masonry units
SANS 10904	Fibre-cement corrugated sheets and fittings for roofing and cladding
Laboratory Practice and Equipment in General	
SANS 1649	Non-automatic self-indicating, semi-self-indicating and non-self-indicating weighing instruments with denominated verification scale intervals
SANS 2859-1	Sampling procedures for inspection by attributes. Part 1, Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
SANS 3310-1	Test sieves - technical requirements and testing. Part 1, Test sieves of metal wire cloth
SANS 3310-2	Test sieves - Technical requirements and testing. Part 2, Test sieves of perforated metal plate
SANS 6150	Verification of compression testing machines for concrete: calibration of load scale
SANS 10378	General requirements for the competence of verification laboratories
SANS 17025	General requirements for the competence of testing and calibration laboratories
Other Standards	
SANS 53584	Products and systems for the protection and repair of concrete structures – Test methods – Determination of creep in compression for repair products
SANS 1200 G	Standardized specification for civil engineering construction Section G: Concrete (structural)

Site clearance

As part of site clearance, the *Contractor* adheres to the latest revision of the *Employer's* Execution of Site Preparation and Earthworks Standard, document number 240-57127953, SANS 2001 BS1: Site Clearance and SABS 2001 C: Site Clearance (Only Clause 8 – Measurement and Payment)

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Earthworks

As part of Earthworks, the *Contractor* adheres to the latest revision of the, listed standards and references, but not limited to:

- 240-57127953 - *Employer's* Execution of Site Preparation and Earthworks Standard
- SANS 2001 BE1: Earthworks (General)
- SANS 1200 D: Earthworks (Only Clause 8 – Measurement and Payment)
- SANS 2001 DP1: Earthworks for buried pipelines & prefabricated culverts
- SANS 1921-5: Construction and management requirements for works contracts, Part 5: Earthworks activities which are to be performed by hand

Stormwater drainage

The following codes are adhered to but not limited to the following:

- SANS 2001 DP5: Stormwater Drainage
- SANS 677: Concrete non-pressure pipes
- SANS 1200 LE: Stormwater Drainage (Only Clause 8 – Measurement and Payment)

7. OTHER REQUIREMENTS FOR THE WORKS

7.1 Spares

The *Contractor* to submit a priced schedule or list of spare parts, which are recommended to be kept by the *Employer* for the long-term operation and maintenance of plant equipment and machinery. This shall detail the full particulars of the items as well as their serial numbers. The *Contractor* also submits Technical Data Sheets or Material Certificates of the mentioned spares.

7.2 Special Tools Requirements

The *Contractor* to identify and submit to the *Employer* a priced list of all special tools required for the operation and maintenance of the plant equipment and machinery. These shall include the following but not limited to:

- OEM specific tools/devices
- Tools required for on-going maintenance of the equipment

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7.3 Configuration Management Requirements

The *Contractor* supplies a comprehensive configuration management program in accordance to ISO 10007 (2nd Edition) to ensure that plant structures, components etc conform to approved design requirements. In addition, the as-built *Works* shall be accurately reflected in selected documents and databases, including those for design, procurement, construction, operation, testing and training. The configuration program shall be applicable for use throughout all phases of the project life cycle, including management of spare parts, replacement parts and product upgrades, and shall form part of deliverables for hand-over to the *Employer* for use during the operation and maintenance phases of the plant.

7.3.1 Plant Codification

Plant Coding shall be undertaken by the *Contractor*. The KKS system shall be used for classifying and designating both plant and related documentation. The *Contractor* complies with the requirements of the Technical documentation classification and designation standard [240-54179170]], Eskom Hybrid Coding Standard [240-131050729], publication KKS power plant classification (B105e) 5th Edition 2003 and the KKS Applications: Guideline and explanations A, B1-4 (B106e) etc. All maintainable plant shall be coded up to KKS breakdown level 3 (i.e., Mechanical, Electrical, C&I and Civil systems)). Omissions or deviations from the latter requirements shall not be permitted without approval from the *Employer*.

Detailed nameplates or label lists with the service legends, including the KKS Code shall be prepared by the *Contractor* and submitted to the *Employer* for review and acceptance before commencing manufacture of the labels. All maintainable plant equipment and components shall be labelled by the *Contractor*, including all pipework.

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

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

The *Contractor* shall code all plant within the scope of supply. KKS codes shall appear on all plant related documentation, drawings, lists and correspondence.

The *Contractor* shall be responsible for ensuring accuracy, completeness, and consistency of all plant and document designations.

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7.3.2 Plant Labelling

New labels shall be provided for all equipment and infrastructure provided as part of the *Works*. The *Contractor* manufactures and installs anodized aluminium nameplates per Employer's standard - 240-71432150 - KKS Plant Labelling and Equipment Descriptions Standard. The *Employer* shall assign a coding practitioner who shall interact with the *Contractor* for this purpose. Detailed nameplate descriptions shall be prepared by the *Contractor* and submitted to the *Employer* for review prior to the commencement of manufacturing. The rules for applying 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). Equipment and infrastructures to be labelled includes the following but not limited to:

- Lighting poles (~50 – off nameplates)
- Camera poles (~15 – off nameplates)
- Manholes (~15 – off nameplates)
- Surveillance cameras (??)
- PA speakes (??)
- Junction boxes (~15 - off)

7.4 Documentation Requirements

The *Contractor* ensures that the Technical Documents and Records Management Work Instruction, [240-76992014] is adhered to for all documentation requirements. The *Contractor* is responsible for the compilation and the supply of all documentation during the various project stages. The *Contractor* makes provision in their programme for the submission of design documentation. 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. Documents such as QCP's, Method Statements etc. that impact the project works to be approved by the *Employer* at least 3 working days prior to commencement of *works*.

Each revision of a document or drawing shall be accompanied with a list of comments made by the *Employer* on previous revisions, if applicable. The responses/corrective actions taken by the *Contractor* to be recorded in a revision table contained in each drawing/document.

Documents and drawings to indicate the *Employer's* unique identification number as allocated by the *Employer*. The *Contractor* may also have his own internal document or drawing number on the document or drawing.

Commented [LT2]: @Vely & @Harold, please update and review

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Document Identification

The *Contractor* shall ensure that documents have the following minimum attributes on the coverpage:

- Document title
- Document unique identification number (Eskom number)
- *Contractor* document number, if applicable
- Document status
- Revision number
- Document type
- Document revision table/history
- Page number on the footer
- Document author/authorizer
- Document originator

The following additional attributes are important for technical documents:

- Package/system name/sub-system name
- Unit number
- *Contractor* name
- Contract number
- Plant identification codes

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.

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)

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Document Headers

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

Naming of files

The *Consultant* complies with the Eskom standard for naming documentation files. The standard is as follows:

For documents that have an approval date and signature;
(YYYYMMDD_DocType_DocumentTitle_UniqueIdentifier_Revision.FileExtension)

For documents that do not necessarily require the 'Approved Date' and 'Revision & Versioning', use the date of update:
(YYYYMMDD_DocType_DocumentTitle_UniqueIdentifier_Revision.FileExtension)

Document Submissions

The *Contractor's* program to allow a minimum of 21 days for mailing, processing, and review of drawings and data by the *Employer*. All documents and records must be submitted and managed according to the Project/Plant Specific Technical Document and Records Management Procedure, 240-76992014 as well as the Generation (Gx) Projects Documentation Deliverable Requirements Specification, 240-65459834. The *Employer* shall ensure that the Contractor is provided with the latest revisions of the mentioned documents.

Information Requirements

The *Employer* requires information and data from the *Contractor* for management and execution of the Contract as well as the operation, maintenance, and support of the *works*. The *Contractor* to supply all information required in terms of the Contract including all information necessary for:

- a) Design reviews and interface management of the *works*,
- b) Quality assurance and control,
- c) Operations, maintenance, training etc.

The scope of supply of information from the *Contractor*, to include the following but not limited to:

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Table 7: Typical Document Requirement List (As-built) (where applicable)

Document Group	Description of document type (includes information data sets)
General	Equipment arrangement drawings Piping & Instrument Diagrams (P&ID's) 3D model Equipment list Isometric Drawings Valve list Pipeline list Hanger 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 etc. Databooks
Civils & Structures	Site layout Structural drawings Drainage layouts Foundation drawings Geotechnical report Survey report Design report
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 (hydrottest, concrete strength, pile integrity test, etc.) Maintenance records of all equipment while stored on site Constructability report Etc.

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Document Group	Description of document type (includes information data sets)
Commissioning	Commissioning schedule Commissioning procedures Performance test procedure Performance test reports Field test reports and certificates Etc.
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)
Operations	Operating procedure Maintenance procedures and schedules Operating and maintenance manuals Etc.
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 Etc.
Training	Training plan Training manuals and instructions Etc.
Safety & Protection	Fire hazard analysis Waste management plan Etc.

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Document Group	Description of document type (includes information data sets)
Design Analyses	Reliability model and analysis Transient / Transition Analysis Flow dynamics analysis Thermo-hydraulic analysis Pipe Stress Analysis Maintainability analysis FMECA / FMEA analysis HAZOP analysis 3D model interference checks Etc.
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 Design reports Etc.

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Document Group	Description of document type (includes information data sets)
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

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

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

Drawings

The creation, issuing and control of all Engineering Drawings shall be in accordance to the latest revision of the Engineering Drawing Standard, 240-86973501 - to be supplied as part of the enquiry documents. Drawings issued to the *Employer* will be a minimum of one hardcopy and an electronic copy. The *Contractor* is required to submit drawings electronically in both native CADD format and PDF format. Drawings issued to the *Employer* may not be "Right Protected" or encrypted.

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8. Project Deliverables

The *Contractor* shall be responsible for the handover of all *Works* associated with the contract. The handover submissions shall include but not limited to the following:

- Detailed design reports for entire *Works*. Report to be signed off by an ECSA Professionally Registered Engineer
- Approved construction drawings for the entire *Works* signed off by an ECSA Professionally Registered Engineer
- Construction quality assurance plans.
- Construction method statement and QCP/ITP
- Results and records of test works
- As-built drawings and all handover documentation is required to be submitted within 6 weeks of construction completion.
- PECs and/or CoCs for completed *Works* is required to be submitted within 6 weeks of construction completion
- Data sheets/material certificates
- Geotechnical investigation and survey reports
- All construction supervision related documentation as detailed in this scope document.

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

- Concrete 7 day and 28-day cube test results
- Slump test results
- Concrete mix designs including all required test results e.g. aggregate test results
- Pile Integrity Test Results (if required)
- Pile Load Test Results (if required)
- Foundation Certificate
- Welding procedure specifications
- Welder qualifications
- Non-destructive weld test results
- Weld test certificates
- Steel grade certificates

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Scope of Work for ex-GE Store Perimeter
Protection Scope at Kusile Power Station

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- Bolt grade certificates
- Hydrostatic tests of pipes and tanks
- 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

9. Acceptance

This document has been seen and accepted by:

Name	Designation	Signature
Vely Sondezi	Electrical Engineer	
Harold Marobane	C&I Engineer	

10. Revisions

Date	Rev.	Compiler	Remarks
June 2024	1	L. Thipa	New Document

11. Development Team

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

- Vely Sondezi
- Harold Marobane
- Chuma Xayimpi

12. Acknowledgements

Aluwani Maumela

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