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1 Description of the Works

1.1 Executive overview

Kusile Power Station is a new-build coal fired power station located in the Nkangala district of Mpumalanga, South Africa. A 30m x 35m storage building is required for the temporary storage of hazardous crystalliser solids (Type 1 Waste) produced by the Wastewater Treatment Plant (WWTP) during emergencies before being transported to an off-site registered waste disposal facility.

The Works include:

- The detail design review, procurement, installation, construction and commissioning of the building including associated civil and structural infrastructure such as earthworks, access roads, storm water drainage and landscaping in accordance with the *Employer's* design;
- The detail design and construction of pile and pile caps foundations for the building;
- Issuing of professional engineering certificates for building including associated civil and structural infrastructure such as earthworks, access roads, storm-water drainage and landscaping upon completion.
- Issuing of professional engineering certificates for pile and pile caps foundations upon completion.
- The detail design review, procurement, installation, construction and commissioning of mechanical infrastructure in accordance with the *Employer's* detailed design;
- The design, procurement, construction, installation, commissioning, and testing including providing documentation for the entire electrical reticulation to ensure fully functional systems.
- The design, procurement, construction, installation, commissioning, and testing including providing documentation for the earthing and lightning protection.
- The design, procurement, construction, installation, commissioning, and testing including providing documentation for the lighting (interior and exterior lighting for the Solid Waste Emergency Holding Facility Building).

1.2 Employer's objectives and purpose of the Works

Kusile Power Station does not have a registered waste disposal facility to dispose of the hazardous crystalliser salts (type 1 waste) produced by the WWTP. The operational plan states that waste produced will continuously be transported to a registered off-site facility. The *Employer* requires a facility that caters for the safe storage of this waste during emergencies when the option to take the waste off-site is not available.

1.3 Interpretation and terminology

1.3.1 List of Definitions

Table 1 - List of Definitions

Definition	Description
Crystalliser Salts	Salts produced from the centrifuge, alternatively, referred as centrifuge salts, centrifuge sludge or crystalliser solids. By-product of WWTP.
Employer	The person named as the Employer in the Appendix to Tender and the legal successors in title to this person.
Others	Others, as defined in this document includes the other discipline specific Contractors (i.e. Electrical, Civil and Structural, etc.)

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Project Manager	The person appointed by the Employer to act as the Project Manager for the purposes of the Contract and named in the Appendix to Tender, or other person appointed from time to time by the Employer and notified to the Contractor as per NEC procedures.
Subcontractor	Party employed by the Contractor for specialised work (i.e. Electrical, Mechanical and Civil and Structural installations)
Technical Specification	The document/s forming part of the contract in which are described the methods of executing the various items of work to be done, as well as the nature and quality of the materials to be supplied and includes technical schedules and drawings attached thereto as well as all samples and patterns.

1.3.2 List of Abbreviations

The following abbreviations are used in this Works Information:

Table 2 - List of Abbreviations

Abbreviation	Description
AFC	Approved for construction
e.g.	Example
ISO	International Standards Organisation
kPa	Kilopascal
LOSS	Limits of Supply and Scope
LPS	Low Pressure Services
OEM	Original Equipment Manufacturer
OHSA	Occupational Health and Safety Act
Rev	Revision
SANS	South African National Standards
SHEQ	Safety Health Environmental and Quality
WWTP	Wastewater Treatment Plant
FGD	Flue Gas Desulphurisation
SGA	Fire and Floor wash system
GME	FGD Crystalliser Salts Recovery system
LOSS	Limits of Supply and Scope
VDSS	Vendor Document Submittal Schedule

1.3.3 Normative References

[1] 366-369361 Kusile FGD WWTP Solid Waste Holding Facility Detail Design Report

1.3.4 Informative References

[2] 240-53114026 Engineering Change Procedure

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2 Employer's Design

- The extent of the *Employer's* design is as described in the *Employer's* Works Information and the *Employer's* drawings.
- The *Employer* has no design responsibility for the *Contractor's* portion of the *works*.
- The *Contractor* brings to the *Project Managers* attention, any changes that are required to the *Employer's* design. All changes proposed by the *Contractor* are motivated and submitted as a mark-up of the *Employer's* design documents for acceptance by the *Project Manager*.
- The design remains the property of the *Employer*.
- The *Employer* has conducted the detailed design of part of the *works*, the extent of which is indicated in the drawings/documents referenced in Table 6 of Section 6 below.
- The Contractor will be required to issue all statutory certificates associated with the scope [Civil Professional engineering certificates, CoC's, etc.]
- The Employer will make available all the required native files to the Contractor to enable completion of the design reviews and updating of the Employer's drawings.

2.1 Architectural Design

The *Employer* has conducted the architectural design of the building as detailed in drawing listed in Table 6 in Section 6.

2.2 Structural Design

The *Employer* has conducted the structural design of the building including associated infrastructure such as entrance ramps and a collection sump as detailed in drawing listed in Table 6 in Section 6.

The structural design of the building consists of a structural steel portal frame building with IBR sheeting covering. The steel columns are supported by pile foundations designed by the *Contractor*. The building has a reinforced concrete ground slab supported by engineered fill.

2.3 Roads and Parking Design

The extent of the *Employer's* design is as shown and described in the *Employer's* drawings and *Works Information* which indicates what is to be supplied and built/installed. The access road is designed to cater for skip trucks delivering and collecting skips. Refer to drawing listed in Table 6 in Section 6.

Construction of a dual carriageway asphalt surfaced road, with approximately 750mm layer works. Road width to tie into existing road widths (Interconnecting Road). Works will include, but not limited to the following:

- Construction of a concrete lined trapezoidal-drain
- Erection of road furniture and road markings
- Protection of road embankments
- Elevations indicated with an * are to be confirmed on site with the contractor and respective engineer
- Terrace levels to be extended as indicated on the drawing

The following construction works are required, but not limited to:

- Accommodation of Traffic
- Clearing & grubbing, where necessary,
- Layering and compaction of base layers from approved borrow area,
- Layering and compaction Sub-grade
- Ancillary concrete works

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- Verification of all underground services (LPS, EC&I, Civil etc.) prior to commencement of any Works

The *Contractor* undertakes all works for the construction and erection of the Roads and Drainage channels.

2.4 Stormwater Design

The *Employer's* stormwater drainage design consists of surface drainage at road edge into a channel at the southern face of the building. The drainage channel drains into environment with erosion protection as indicated on the *Employer's* drawings. The area is shaped to facilitate surface drainage into the surrounding environment. Refer to drawing listed in Table 6 in Section 6.

All *works* to be constructed according to information provided on drawings listed in Table 6, Section 6.

2.5 Electrical Design

Existing plant data is provided by the Employer. Where additional information is required, the *Contractor* collects all data for the design, to enable completion of the *works*. The *Contractor* is to clarify and co-ordinate all relevant interfaces that may exist.

The *Employers* Electrical concept design is indicated in Figure 1, Figure 2 and Figure 3 which are in section 2.5.1 Power Supply.

Electrical Appendices are divided into sections A to E (Refer to Section 11.9).

2.5.1 Power Supply

Appendix A indicates the concept layout of Electrical Equipment required for this project. Bulk power will be supplied as per Figure 1 from the 400V H2/N2 GNR PLANT BOARD 1 (01BFH04 DA001A) to the 400V EMERGENCY HOLDING FACILITY DB (located inside the Solid Waste Emergency Holding Facility Building). The *Contractor* to route the bulk power cable and earth wire in the cable tunnel from the 400V H2/N2 GNR PLANT BOARD 1 (01BFH04 DA001A) to the 400V EMERGENCY HOLDING FACILITY DB as indicated by the blue line that becomes a red line in Appendix A. The *Contractor* shall dig a cable trench (the red line continuing from the blue line in Appendix A) that complies with the requirements of Appendix C (Direct Buried Cable Typical Details and Section Cuts) to route the bulk power cable and earth wire to the 400V EMERGENCY HOLDING FACILITY DB (which is located inside the Solid Waste Emergency Holding Facility Building) along the path indicated by Appendix A.

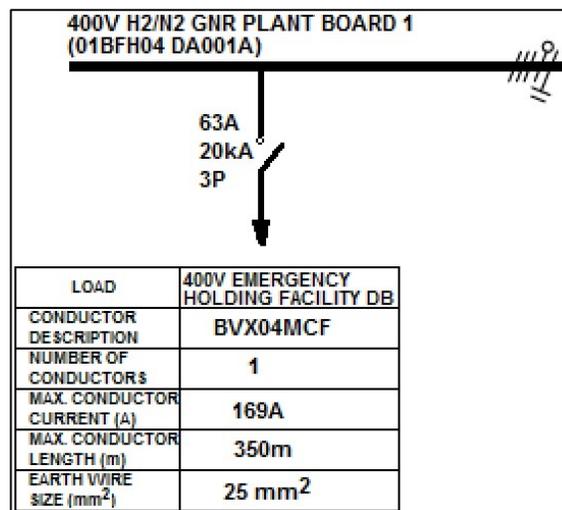


Figure 1 – Concept Bulk Power Supply to 400V EMERGENCY HOLDING FACILITY DB

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The concept electrical reticulation from the 400V EMERGENCY HOLDING FACILITY DB is as per Figure 2. The Contractor is required to design, supply, install, test and commission the 400V EMERGENCY HOLDING FACILITY DB including the entire electrical reticulation as indicated in Figure 2 to ensure fully functional systems. The Contractor is required to design, supply, install, terminate, test and commission all cabling and earth wire indicated in Figure 1, Figure 2 and Figure 3.

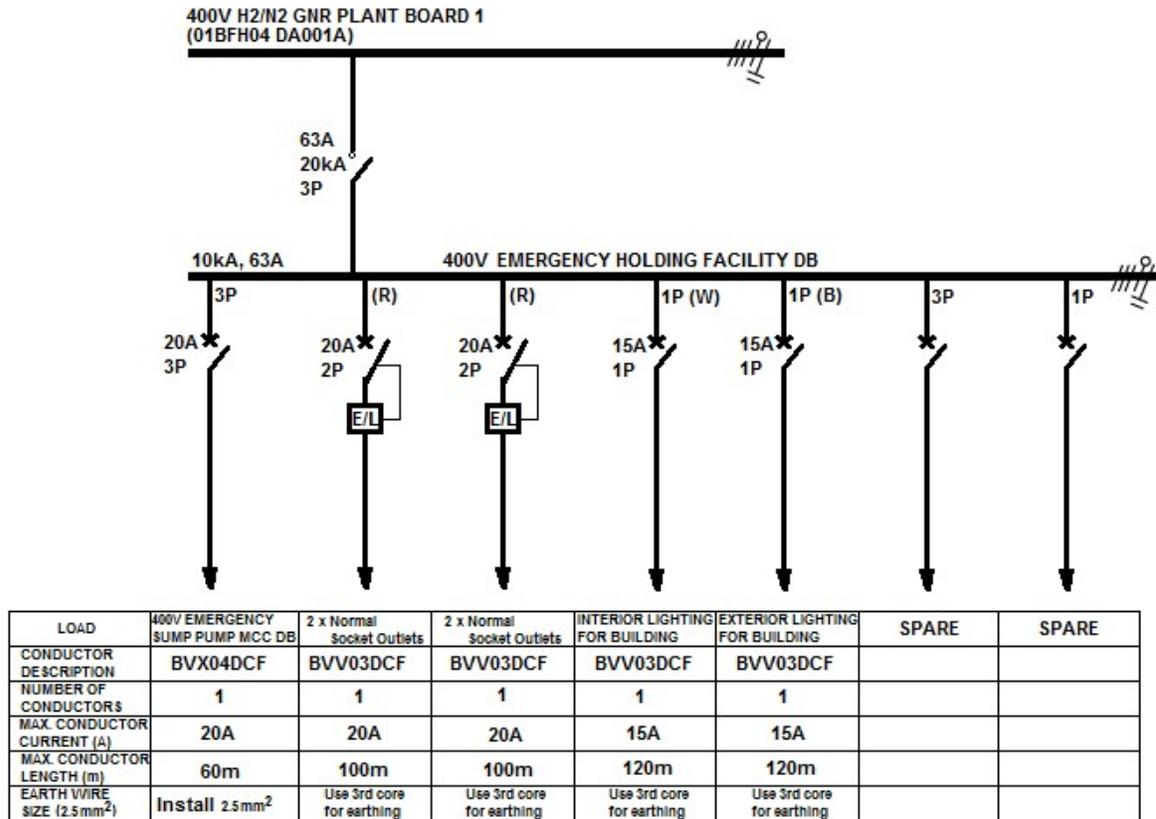


Figure 2 – Concept Power distribution from 400V EMERGENCY HOLDING FACILITY DB

The description of how the 400V EMERGENCY SUMP PUMP MCC DB is supplied from the 400V EMERGENCY HOLDING FACILITY DB is described. The concept cable route is indicated by Appendix A. The Contractor to dig the cable trench to comply to the Direct Buried Cable Typical Details and Section Cuts (0.90/95563) in Appendix C. The Contractor to design, supply, install, test, and commission the 400V EMERGENCY SUMP PUMP MCC DB in accordance with the combination of the schematics in Appendix D described below. The Schematic Diagram required for the 400V Emergency Sump Pump for this project requires taking the Sump Pump Direct Online Schematic Diagram, 0.90/2532, sheet 15 (Appendix D) as the base and adding the circuits SC48 (thermal overload in Appendix D) and SC18 (Emergency trip in Appendix D) to it to give the Contractor the schematic that is required for the 400V Emergency Sump Pump for this project.

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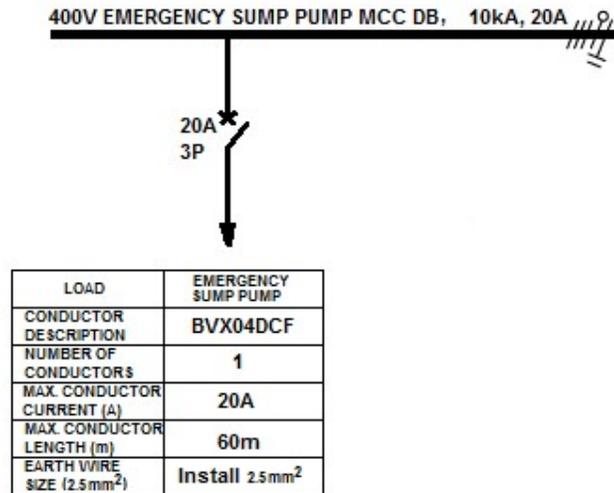


Figure 3 – Concept Power supply from 400V EMERGENCY SUMP PUMP MCC DB to EMERGENCY SUMP PUMP

2.6 Mechanical Design

The *Employer's* designs are described in detail below and drawings are listed in the Table 6 in Section 6.

The *Employer* has completed the detail design for the mechanical scope below:

- Fire protection system for the holding facility. The water supply to the temporary facility will be an extension of the existing Fire and Floor wash (SGA) system. The system will provide wash water to two locations inside the holding facility at the required flow and pressure.
- FGD Crystalliser Salts Recovery (GME) system to pump water from the holding facility sump to the WWTP. The system will consist of one submersible pump; piping and accessories.

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2.7 Limits of Supply and Scope (LOSS)

The table below provides a summary of the interfaces between existing infrastructure and the *Contractor's* design or the *Employer's* detailed design and the *Contractor's* design.

Table 3: Terminal Point Summary

#	Discipline	System	Terminal Point / Interface Location	Terminal Point Requirements Summary
1.	Mechanical	Fire & Floor Washing	See Employer drawing 0.90/20093	Potable water supply Tap off from below grade pipe to interface with all fixtures/equipment requiring potable water supply indicated in designs done by <i>Employer</i> .
2.	Mechanical	Salt Recovery System	See Employer drawing 0.90/20093	Pipe routed below grade from the hold pad sump to supply effluent at WWTP trench located above grade
3.	Electrical	Electrical Supply	circuit 01BFH04 DA001A in the 400V H2/N2 GNR PLANT BOARD 1	The <i>Contractor</i> to procure and install a 63A, 20kA, 3P circuit breaker (including any other installation required) at circuit 01BFH04 DA001A in the 400V H2/N2 GNR PLANT BOARD 1 and design, supply and install all electrical reticulation as indicated in this specification to ensure that the <i>Employers</i> requirements are complied with to ensure a fully functional system.
4.	All	Support of Equipment/Infrastructure from Ceiling	Steel Roof Truss	Support structures for infrastructure to interface with building structure including connection details of hangars to existing structure.
5.	Civil	Roads	Existing road/new road interface	New road to tie into existing roads as indicated in designs done by <i>Employer</i> , reviewed, and issued by <i>Contractor</i> .
6.	Civil	Structural	Piles for building	Piles including pile caps designed by <i>Contractor</i> based on loading provided for the building designed by <i>Employer</i> , reviewed, and issued by <i>the Contractor</i>

3 Parts of the Works which the Contractor is to design

3.1 Responsibility for Design

- The *Contractor* takes full professional accountability and liability for all designs and design reviews done by the *Contractor*.
- The *Contractor* is responsible for the design of all temporary works required for the execution of the *Works*.

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- The Contractor is responsible for the design reviews of all detail designs completed and supplied by the Employer, on behalf of the Employer.
- The Contractor is responsible for issuing of approved for construction drawings upon completion and final acceptance of Contractor's design reviews by the Employer.
- All designs, design reviews, design reports and construction drawings prepared by the *Contractor* are signed off by an ECSA Professionally registered Engineer who takes full professional accountability for the designs including all design reviews completed by the Contractor.
- The *Contractor* submits a Structural Professional Engineering Certificate signed by an ECSA professionally registered engineer confirming that all designs and design reviews done by the *Contractor* have been designed and design reviewed in accordance with the relevant codes and standards. Certification is done in accordance with SANS 10400.
- The *Contractor* is mandated in terms of Construction Regulations 2014: Duties of Designer, 6(1) g to fulfil the duties described therein or the detailed designs done by the *Contractor*. Any risk associated with the *Contractor's* design is highlighted to the *Employer* together with mitigation measures.
- Where the *Contractor* requires additional information to review, design, or install certain components of the Plant or the *Employer's* design, the *Contractor* notifies the *Project Manager* of the *Contractor's* requirements a week before continuing with the *works*.
- The *Project Manager* may review, but will not accept, the *Contractor's* work to check compliance with the Works Information, the responsibility to ensure compliance remains with the *Contractor*. The *Contractor* supplies as-built information and drawings of all components he designed to the *Employer* for acceptance prior to handover. All changes required for construction or manufacturing, that impact or change the *Employer's* design is redlined on drawings by the *Contractor*. The redline drawings include notes for clarification purposes. The engineering change process will be used in case of any design changes. The *Contractor* submits the redlined drawings to the *Project Manager* for his acceptance and includes the final redlined drawings in the data books.
- The *Contractor's* design engineer carries out inspections at appropriate stages throughout the construction of the *works* to verify that the construction is carried out in accordance to the *Contractor's* design.
- It is the *Contractor's* responsibility to provide design and construction which is fit for purpose, in accordance with sound engineering principles and prudent industry practice. The *Contractor* and his sub-*Contractors* perform the *works* in compliance with legislation, rules and regulations, applicable national and international engineering codes, environmental standards, other applicable standards, statutory requirements, and this Works Information.
- The *Contractor's* design is required to be in accordance with the *Employer's* Standards referenced in Annexure 9.1.
- The *Contractor* is responsible to ensure compliance with the *Employer's* Works Information.

3.2 Contractor's Civil & Structural Design

- The *Contractor* is responsible for the detailed design review of all the *Works* which have been designed by the *Employer* on behalf of the Employer:

3.2.1 Geotechnical Investigation

The *Employer* has conducted a geotechnical investigation of the site (refer to Table 7). The *Employer* issues the Geotechnical Investigation Report to the *Contractor* for Information.

- The *Contractor* is required to conduct any additional geotechnical investigations required for his design should the existing geotechnical information be inadequate for his design. The verification of existing information is to be conducted if the existing information is deemed unreliable or un-usable or in the case where supplementary information is required. The *Contractor* provides proposals for

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further investigations to the *Project Manager* for his acceptance before any investigations are conducted.

3.2.2 Piling

The foundations for the portal frame columns building consist of plinths supported by pile caps and piles. Pile loads are provided by the *Employer* in drawings listed in Table 6 in Section 6.

- The *Contractor* is required to conduct a detailed design of the all piles and pile caps in accordance with the information provided by the *Employer*. The *Contractor* submits the detailed pile design to the *Employer* and makes allowance in the schedule for the *Employer* to review and accept the designs. All drawings issued during the tender phase are therefore not to be used for construction. The *Contractor* is requested to revise all drawings to a Construction status before construction can take place.

3.2.3 Roller Shutter Doors

- The *Contractor* is required to provide all roller shutter doors in accordance with the information provided by the *Employer*. The *Contractor* is requested to detail design, procure, install, commission and sign-off the roller shutter doors design before final submission to the *Employer*, for final acceptance. All drawings issued during the tender stage are therefore not to be used for construction. The *Contractor* will revise all drawings to a Construction status before construction can take place.

3.2.4 Equipment foundations and support structures

Foundations and support structures are required to accommodate the pipeline as detailed in the *Employer's* detailed design

- The *Contractor* is required to conduct the detailed design for these foundations and support structures considering any designs done by the *Employer* or existing infrastructure which may interface with or be affected by these structures. Where the *Contractor's* design interfaces with the *Employer's* design or existing infrastructure and requires any changes to accommodate these interfaces such as cast in bolts, penetrations, changes to avoid clashes etc. the *Contractor* submits his proposals to the *Employer* for his acceptance. The details of all loads from the *Contractor's* design exerted on the *Employer's* design or existing infrastructure are to be submitted to the *Employer* for review and final acceptance.

3.2.5 Supports for electrical services

- Electrical light fittings will require to be supported by the building's steel roof trusses designed by the *Employer*.
- The *Contractor* submits the details of all supports and connections to the existing structure including all loads to the *Project Manager* as indicated in Section 3.3 below.

3.2.6 Roads

- The *Contractor* accounts for any temporary construction access roads, service roads, final access roads and future maintenance access roads requirements.
- Layerworks for the proposed permanent roads are submitted to the *Project Manager* for acceptance before the commencement of works. The required roads are designed using the specified road pavement layers. However, the *Contractor* may deviate from existing pavement layers if he deems it necessary due to load, site conditions, final surface layers or any other motivation that has been submitted and accepted by the *Project Manager*.
- The new roads required should interface with the existing drainage system, terrace design and existing as-built roads, services, structures where necessary, and be constructed in accordance with drawing provided.

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- The *Contractor* complies with all legislation, regulations and standards regarding road design and construction.

3.3 Contractor's Electrical Design

3.3.1 Electrical System Overview

- 1) The *Contractor* is responsible for the design, procurement, construction, installation, commissioning and testing including providing documentation for the entire electrical reticulation from and including the 63A, 20kA, 3P circuit breaker at circuit 01BFH04 DA001A in the 400V H2/N2 GNR PLANT BOARD 1 up to and including providing power to the following loads to ensure fully functional systems:
 - Emergency Sump Pump
 - Interior lighting for the Solid Waste Emergency Holding Facility Building
 - Exterior lighting for the Solid Waste Emergency Holding Facility Building
 - 4 plug points for the Solid Waste Emergency Holding Facility Building
- 2) The *Contractor* is responsible for the design, procurement, construction, installation, commissioning, and testing including providing documentation for the earthing and lightning protection for the scope of this project to comply with 240-56356396 Earthing and Lightning Protection Standard and the requirements of this specification. The *Contractor* is responsible to ensure interfacing of the earthing and lightning protection designed for this project to the Power Station earth.
- 3) The *Contractor* is responsible for the design, procurement, construction, installation, commissioning and testing including providing documentation for the lighting to ensure that the interior and exterior lighting for the Solid Waste Emergency Holding Facility Building complies with 240-55714363 Eskom Generation Power Station Lighting and Small Power Installation Standard and the requirements of this specification.
- 4) Figure 1, Figure 2, and Figure 3 indicates the Employers concept design.

3.3.2 Electrical Requirements

3.3.2.1 Motors

The *Contractor* is responsible for the procurement, construction, installation, commissioning and testing including providing documentation for the 400V Emergency Sump Pump Motor that is required for this project. The motor shall be designed and fabricated in accordance with 240-57617975 (New Low Voltage Motors Procurement Standard).

The *Contractor* to ensure that the motor has an IP rating that will allow it to operate safely and reliable ensuring that it performs its intended function. The motor will be located outside exposed to weather. The *Contractor* to comply with the requirements of the following standards for this motor –

- Transport of Power Station Electric Motors Standard (240-56361435).
- Storage and Preservation of Power Station Electric Motors Standard (240-56360387).
- New Low Voltage Motors Procurement Standard (240-57617975).

3.3.2.2 LV Switchgear

- 1) The *Contractor* is responsible for the design, procurement, construction, installation, commissioning and testing including providing documentation for all LV Switchgear required for this project. The *Contractor* to comply with the requirements of the following standards for all LV switchgear the *Contractor* provides for this project:
 - LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and including 1000V AC and 1500V DC Standard (240-56227516).

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- The Wiring of Premises (SANS10142-1)
- 2) Switchgear required for this project that the *Contractor* needs to design, procure, construct, install, commission and test including providing documentation is:
 - a 63A, 20kA, 3P circuit breaker (including any installation required to ensure circuit is fully functional) needs to be installed at 400V H2/N2 GNR PLANT BOARD 1 (Circuit 01BFH04 DA001A).
 - the 400V EMERGENCY HOLDING FACILITY DB to feed the loads indicated in Figure 2.
 - the 400V EMERGENCY SUMP PUMP MCC DB to feed the load as indicated in Figure 3.
 - 3) The 400V EMERGENCY HOLDING FACILITY distribution board to be installed in the Solid Waste Emergency Holding Facility Building and the 400V EMERGENCY SUMP PUMP MCC DB shall be in the space provided according to the Drawings. The *Contractor* to design the distribution board such that it fits in the space allocated.
 - 4) The distribution board drawings, showing front view with sections, equipment arrangement, equipment type, rating, labels and gland plates shall be submitted by the *Contractor* to the *Employer* for acceptance before commencement of manufacture.
 - 5) The distribution board with its equipment shall be labelled by the *Contractor* as specified on the schematic diagram drawings, and in accordance with standard drawing 0.00/5007.
 - 6) The cables used for connections in the distribution board shall have PVC insulation. The colour of the insulation of the red phase shall be red, the white phase shall be white, the blue phase shall be blue and the neutral conductor shall be coloured black.
 - 7) All busbars and connections shall be shrouded using a suitable insulation material. They shall be capable of withstanding the full test voltage as required by 240-56227516.
 - 8) The local switches shall have provision for locking in the open position, using 8mm diameter padlock. Standard handle lock device suitable for switch-disconnectors shall be used.
 - 9) The distribution board sections shall have provision for cables and trunking entries.
 - 10) Distribution board shall be constructed in accordance with SANS1973-3 and SANS 10142-1.
 - 11) The small power distribution boards shall be painted in accordance with the requirements of 240-56227516.
 - 12) The cable gland plates shall be provided by the *Contractor* for all armoured and unarmoured cables. They shall have the necessary support to prevent the movement of the cables.
 - 13) The *Contractor* shall provide 20% equipped spares for all distribution boards or LV Switchgear provided for this project.

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14) The Contractor to design the 400V EMERGENCY HOLDING FACILITY DB to have an IP rating of IP3X. The Contractor to design the 400V EMERGENCY SUMP PUMP MCC DB to have a minimum IP53 rating. The Contractor to design the switchgear such that they operate safely and reliable in the environments and areas where they will be installed at Kusile Power Station. The 400V EMERGENCY HOLDING FACILITY DB will be installed indoor and the 400V EMERGENCY SUMP PUMP MCC DB will be installed outdoor.

3.3.2.3 LV Switchgear Protection Philosophy

The Contractor to comply with the requirements of MV and LV Switchgear Protection Standard (240-56357424) for all protection that forms part of the scope of this project.

3.3.2.4 Trunking and Cable Tray

- Trunking shall be installed on top of trusses in the ceiling.
- For corrosion protection, hot dip galvanised zinc coating shall be used in accordance with SANS 121.
- Vertical trunkings and covers shall be painted with epoxy coating. The colour of the coating shall be in accordance with SANS1091. Trunkings in laid roof void may not be painted.

3.3.2.5 Equipment

All plugs, cables, sockets, miniature circuit breakers (MCB's), earth leakage and associated material shall be SABS approved.

3.3.2.6 Conduits and Accessories

- 1) All conduits and accessories shall be SABS approved.
- 2) All conduit work shall be carried out using high impact PVC conduits and accessories.
- 3) Conduits for light switches, socket outlets and push-buttons shall be installed flush in the walls.

3.3.2.7 Conductors and Wiring

All conductors and wiring shall comply with SANS 10142-1:

- All wiring shall be carried out using standard PVC insulated copper conductors and bare copper earth wires.
- The wiring shall run in trunkings and conduits.
- The rated voltage of the wiring shall be 600/1000V.

3.3.2.8 Switch – Disconnectors, Light Switches, Socket Outlets and Push-Buttons

- The *Contractor* shall install SABS approved switch-disconnectors, light switches, and socket outlets.
- The colour of flush-type light switches and socket outlets shall be white.
- Socket outlets shall have a protection rating of IP54.

3.3.2.9 Connections

Tee-off connections of all earth and neutral wires in trunkings shall be made with crimped ferrules.

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3.3.2.10 Labelling

- All labelling shall be specified in accordance with standard drawing 0.00/5007.
- The position of labels shall be as indicated on the Drawings.
- All cover plates shall be labelled with circuit numbers using 7mm high characters.
- All electrical circuits and equipment are to be labelled by the Contractor according to the KKS Coding Standard 240-93576498.

3.3.2.11 Electrical Wiring / Conduits / Junction Boxes

Shall meet all requirements of SANS 10142-1.

3.3.2.12 Cabling and Racking

The *Contractor* to comply to the Requirements for Control and Power Cables for Power Stations Standard (240-56227443) for all cabling that forms part of this project. The *Contractor* to design, procure, construct, install, terminate, commission and test including providing documentation for all the cabling for this project to ensure fully functional systems. Below is a list of cables –

- cable from 400V H2/N2 GNR PLANT BOARD 1 (01BFH04 DA001A) to 400V EMERGENCY HOLDING FACILITY DB.
- cable from 400V EMERGENCY HOLDING FACILITY DB to 400V EMERGENCY SUMP PUMP MCC DB.
- cable from 400V EMERGENCY HOLDING FACILITY DB to 2 x Normal Socket Outlets.
- cable from 400V EMERGENCY HOLDING FACILITY DB to 2 x Normal Socket Outlets.
- cable from 400V EMERGENCY HOLDING FACILITY DB to Interior Lighting for Building.
- cable from 400V EMERGENCY HOLDING FACILITY DB to Exterior Lighting for Building.
- cable from 400V EMERGENCY SUMP PUMP MCC DB to Emergency Sump Pump.

The Electrical Layout Drawing (Appendix A) indicates how the Contractor can route the cables e.g. via cable trench, cable racking etc. The *Contractor* to dig trenches for this project to lay cables to comply to Direct Buried Cable Typical Details and Section Cuts (0.90/95563) in Appendix C.

The *Contractor* ensures that all cables and cable racks are installed as per SANS 10198, this Technical Specification and 240-56227443 (Requirements for Control and Power Cables for Power Stations).

The *Contractor* verifies the electrical continuity of the existing cable racks that will be affected by this project. The *Contractor* ensures that all cable racks installed by the *Contractor* are connected to the earth mat of Kusile Power Station.

3.3.2.13 Fire Barrier Requirements

1. Fire barriers are installed wherever electrical cables pass through walls, floors and ceilings, inside low and medium voltage switchboards, transformers, battery chargers, UPSs' which are boundary elements of a specified fire zone. Fire barriers have a fire rating of 2 hours minimum in compliance with the fire resistance criteria for insulation, stability and integrity as specified by recognised testing institutions and their standards.
 2. The *Contractor* ensures that wherever cables pass through holes or slots in floors and walls or enter or leave sleeve pipes in floors or walls; the openings should be sealed with the approved material. This material is domed or slightly raised towards the centre to prevent the accumulation of water or oil in the seal. The sealing material should be water resistant and provides a barrier for smoke and toxic fumes.
1. Test certificates are provided with fire barriers in accordance with:

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- a) SANS 10177-2, Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements.
- b) BS 479, Part 8: 1972, Test methods and Criteria for the Fire Resistance of Building Construction Elements.
- c) IEEE 634: 1978, Testing for Fire Rated Penetration Seals
- d) ASTM E814: Fire Test of through Penetration Fire Stops

3.3.2.14 Earthing and Lightning Protection

The *Contractor* is responsible for the design, procurement, construction, installation, commissioning and testing including providing documentation for the earthing and lightning protection system for the building and all equipment part of this project such that the system satisfies the requirements below:

- To limit the touch potentials on structures and equipment and to provide low impedance return path to limit the damage to equipment by fault currents, during normal or abnormal system conditions.
- The installation is protected from lightning by conducting the strike through a preferred path to earth.
- All non-current carrying metal parts of the installation is earthed.
- Protect plant and people against the effects of lightning;
- Protect electrical components against incoming surges;
- Provide a path for the dissipation of electrostatic discharge; and
- To provide a reference point for electrical signals.

The *Contractor* shall comply to the requirements of the following standards for all earthing and lightning protection designed, procured, constructed, installed, commissioned and tested including providing documentation for this project:

- Earthing and Lightning Protection Standard (240-56356396)
- Protection against lightning - Physical damage to structures and life hazard (SANS 10313)
- The wiring of Premises (SANS 10142-1).
- The installation shall be earthed in accordance with the requirements 0.54/393.

The *Contractor* is responsible to design, procure, construct, install, terminate, commission and test including providing documentation for all earth wire required for this project.

The *Contractor* to submit all designs and documentation to the Project Manager for acceptance before any procurement or manufacturing of any equipment occurs.

3.3.2.15 Lighting

The *Contractor* is responsible for the design, procurement, construction, installation, commissioning and testing including providing documentation for the following lighting required for this project –

- 1) Lighting is required for the Interior of the Solid Waste Emergency Holding Facility Building such that the waste can be safely offloaded, stored and reloaded onto vehicles that will transport waste into and out of the building. The interior lighting to be designed in accordance with SANS10114-1 with high bay light fittings to produce:
 - minimum maintained illuminance (Em) on the reference surface of the interior, area, task or activity of 150 lux.
 - maximum unified glare rating (UGR) applicable to the interior, area, task or activity of 25.
 - minimum colour-rendering indices (Ra) for the interior, area, task or activity of 60.
- 2) Lighting is required for the Exterior of the Solid Waste Emergency Holding Facility Building such that the vehicles can safely enter and exit the building.

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The *Contractor* is responsible to design, procure, construct, install, commission and test including providing documentation for all lighting for this project so as to comply with 240-55714363 Eskom Generation Power Station Lighting and Small Power Installation Standard. The SANS average lumen method shall be used for the design of the lighting installation. This yields both the quantities required and the spacing of the luminaires. All lighting designs to be submitted to the Project Manager for acceptance prior to any procurement or manufacturing of equipment. Once installed, the Contractor to demonstrate via testing that the Employers requirements have been met.

3.3.2.16 Small Power

The *Contractor* to comply to Eskom Generation Power Station Lighting and Small Power Installation Standard (240-55714363) for all lighting and small power that forms part of the scope of this project. The *Contractor* is responsible for the procurement, construction, installation, commissioning and testing including providing documentation for the 4 single socket outlets. The location of the socket outlets is indicated in Appendix A.

3.3.2.17 Material

All material supplied shall be in accordance with SANS10198 and SANS 62262.

3.3.2.18 Certificate of Compliance

Contractor to issue COC's for all electrical work completed as required by:

- SANS 10142-1.
- Occupational Health and Safety Act, (OHS Act 85 of 1993).

3.3.3 Documentation

3.3.3.1 Drawings

- 1) 0.00/5005 – Wiring Terminations
- 2) 0.00/1310 – Power cable code
- 3) 0.00/1290 – Cable number tag
- 4) 0.52/1037 – Pad lockable lever lock
- 5) 0.52/1038 – Panel fasteners
- 6) 0.54/393 – Earthing standards
- 7) 0.00/1800 – Standard Drawing Sheets
- 8) 0.00/5007 – Engraving and labelling requirements

3.3.3.2 Contract Documents

- 1) Contractor to produce documentation for the entire electrical reticulation (e.g. protection drawings, cable schedule, drawings showing all the power layouts, cable routes, cable racks, trenching, plugs, switches, earthing, wire ways, trunking layouts and routing) and issues to the Project Manager for acceptance before procurement of any equipment. The Electrical Cable schedule template (240-56176097) to be populated by the Contractor and submitted to the Project Manager for acceptance before any cabling can be procured.
- 2) Contractor to produce distribution board design drawings (e.g. general arrangement drawings, schematic diagrams, summary sheets) for the scope of this project.
- 3) *Contractor* to produce protection, earthing and lightning protection designs and drawings.
- 4) Contractor to produce motor technical documentation for the scope of this project.

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- 5) Where necessary, manufacturers shall outline drawings showing required clearance for maintenance. Operating and Maintenance Manuals to be provided for the lighting, switchgear and motors.
- 6) Contractor to produce datasheets, catalog sheets, equipment drawings, equipment schedules and certificate of conformity for all electrical equipment part of the scope of this project.
- 7) The Contractor to provide the As Built Design Package a maximum of 3 weeks after hot commissioning. All drawings and documentation developed by the Contractor for the electrical scope of this project must be provided "As Built" after circuit installation and are signed by the Contractor's ECSA registered Professional Electrical Engineer.
- 8) Contractor to do tests and produce documentation to demonstrate that the equipment they provided meet the Employers performance requirements. E.g motors, lighting. The Employer to witness the testing.
- 9) All drawings to be submitted by the Contractor to the Project Manager for acceptance before procurement, manufacture, installation, testing and commissioning.
- 10) *The Contractor* to produce two hard copies and one electronic copy of "As built" drawings for the complete installation.
- 11) The Contractor to produce lighting designs and drawings for the scope of this project. The *Contractor* to submit a detailed schedule illustrating all luminaires, lamps and fittings and where they will be installed to the Project Manager for acceptance before procurement. The *Contractor* shall submit catalogue sheets for all types of luminaires, lamps sockets, switch disconnectors, cabling, wires, conduits, and trays supplied for evaluation purposes.
- 12) The *Contractor* shall submit an electronic copy of the contract drawings in accordance with drawing 0.00/1800, for acceptance at least two weeks before manufacture is due to commence.
- 13) Acceptance will be by letter listing the drawings and the allocated numbers. If a drawing is not accepted, a marked-up print showing the required revisions may be returned to the *Contractor*.

No drawing which has been submitted may be cancelled by the *Contractor* without prior agreement and, once issued, no alterations, additions or omission may be made to or from any drawing without reissuing it under a new revision number.

3.3.4 General

The *Contractor* to submit all design documents for acceptance to the Project Manager prior to procurement or manufacturing of any equipment.

3.4 Contractor's Design Integration

The *Contractor's* detailed Design interfaces with the *Employer's* detailed design in several instances.

- The *Contractor* is required to conduct his detailed designs ensuring design integration with the *Employer's* detailed design.
- The *Contractor's* detailed design considers all existing services identified ensuring no clashes with existing infrastructure.

3.5 Use of the Contractor's design

All documentation, as specified in this Works Information, forms part of the *works*, and is supplied to the *Project Manager* by the *Contractor*. The *Employer* reserves the right to issue the *Contractor's* design or drawings to other contractors for purposes of maintenance, spares, verifications, modifications in future or any other purposes required by the *Employer*. The *Employer* has total rights to use the design as the *Employer* requires. The *Contractor* notes that all drawings and other documentation supplied to the *Employer* become the property of the *Employer* upon completion of the *works*.

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3.6 As-built drawings, operating manuals and maintenance schedules

3.6.1 As-built Drawings

- The *Contractor* provides “As Built” drawings for all his designs and that of the *Employer* based on the shop drawings embodying all modifications made during construction.
- The “As-Built” drawings are to include general arrangement and sections of all plant and equipment including isometrics and P&ID’s. Safety, instrumentation, control and operation drawings are to also be included “As Built” drawings indicating the intended functioning, capacity data and control functioning of all systems.
- The As-Built drawing will indicate all relevant plant coding and labelling. The determination of these codes and labels will be done in accordance the documents listed in Works Information.
- The Contractor to provide all “As Built” documentation for the entire Electrical scope of this project.
- All changes required for construction or manufacturing, that impact or change the Employer’s design is required to be redlined on drawings by the Contractor. The redline drawings include notes for clarification purposes. The engineering change process will be used in the case of any design changes. The Contractor submits the redlined drawings to the Project Manager for his acceptance and includes the final redlined and blacklined drawings in the data books submission.

3.6.2 Operating Manuals and Maintenance schedules

- The operation and maintenance manuals are to consist of the following:
 - List of Contents (Index)
 - Introduction
 - General description of the functions of each of the systems including detailed description of each element of each system, how it functions, how it operates and how to maintain it and what attic stock or tools to carry.
 - Full as-built drawings and detailed drawings, brochures and catalogues for each system and each element of each system.
 - The format of the O & M documentation is to be A4 and are to be a specially bound document with hard cover and with metal ring binding. (All drawings and details are to be reduced to A3 format and folded into A4 format.)
 - The names, addresses and telephone/fax numbers/email addresses of all responsible persons and manufacturers/suppliers are to be listed in the O& M document.
 - A full list with reference numbers are to be included to enable the O&M staff to order materials and equipment.
 - Colour diagrams are to be provided to illustrate the operation and function of each system with reference to the relevant as-built drawings or brochures of equipment. These diagrammatic drawings are to also indicate the locations of valves with their numbers.
 - Instruction Manuals are to be submitted in accordance with Eskom Standard GGSS 1423 Standard for O&M Manuals

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3.7 Mechanical engineering works

3.7.1 Technical Scope and System Performance Requirements

3.7.1.1 Technical Scope of Work

The work under these specifications shall include furnishing all materials and equipment; providing all labour, supervision, administration and management; and supplying all construction equipment, materials and services necessary to perform the Mechanical Construction complete in accordance with the specifications, drawings and other contract documents. The Works shall include document submittals, inspecting, testing, transportation to site, receiving, unloading, storing, and tagging for all items that are specified to be furnished and installed by *Contractor*.

The Works under these specifications shall include, but not be limited to the following:

1. Furnish all construction materials and services for the execution of the Works under this contract unless otherwise specified.
2. Furnish and install a submersible pump, motor and associated supports
3. Receive, inspect, unload, store, protect, transport, provide preventive maintenance and install *Employer*-furnished and *Contractor*-furnished equipment and materials.
4. Provision of climate controlled storage facilities to store and protect any *Contractor*-furnished equipment and materials.
5. Onsite transportation and temporary laydown of equipment and materials.
6. Design, furnish, and erect all temporary and permanent structural steel and lifting lugs required for piping and equipment erection when required. All temporary works shall be removed from site upon work completion.
7. Furnish, fabricate, clean, coat, erect, and test all *Contractor*-furnished piping as quantified in the Bill of Quantities. Design drawings including design lists will be provided by the *Employer*. Fabrication drawings for pipe supports, pipe racks, etc. shall be provided by the *Contractor*. *Contractor's* scope includes the following components:
 - All piping
 - Pipe supports and hangers
 - Flanges and fittings
 - Piping accessories
 - Valves
 - Supplemental support steel
 - Supplemental sleeper support steel
 - Nuts, bolts, and gaskets
 - Coating, pipe wrapping, and galvanizing
8. Furnish and install piping accessories including, but not limited to:
 - Hose connections
 - Quick disconnects and dry break couplings
 - Flexible hoses
 - Floor washing connections
9. Pressure test all piping installed under this Contract in accordance with referenced standards
10. Furnish, install and remove all pressure testing materials, equipment, valve kits, caps, blanking plates and blind flanges.
11. Furnish testing and checkout of equipment furnished and/or erected under this specification.
12. Flushing fluids and hydro testing water may be disposed of on-site as directed by the *Employer*.

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13. Grout, pour concrete, set, align and erect all *Contractor*-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.
14. *Contractor* is fully responsible for all commissioning and start-up activities for the mechanical systems installed by the *Contractor*, including, but not limited to, all craft labour and supervision.
15. *Contractor* shall field performance test pumping system. *Contractor* shall furnish all labour, materials and test equipment inclusive of temporary piping, valves, instruments, etc. Testing shall be performed in accordance with ISO 9906 and any allowances made for inaccuracies due to site testing shall be approved by the *Employer*.

The above explanations and listings are intended to give a general definition of scope of the work under these specifications. The *Contractor* shall be responsible for construction of complete facilities, conforming in all respects to the details and requirements of the specifications, drawings, and other contract documents.

3.7.1.2 Drawings and Technical Attachments

The attachments listed in section 6.1, Drawings issued by the *Employer* shall be part of the Contract.

3.7.1.3 Codes and Standards

Work performed under these specifications shall be done in accordance with the codes and standards listed on Annexure 11.1, or equivalent International codes and standards approved by the *Employer*. SANS standards where applicable, shall take precedence over other standards in the table below and all technical sections.

3.7.2 Miscellaneous Metals

3.7.2.1 General

3.7.2.1.1 Scope of Work

Work under these specifications shall include furnishing and erecting miscellaneous metals and services complete as specified herein:

Table 4 – Scope of Supply

Scope of Supply (Procurement)
Detailing and production of fabrication and erection drawings.
Material procurement, fabrication, surface preparation, coating application and shipping in accordance with these specifications and the drawings.
Scope of Supply (Erection)
Receipt, inspection, unloading, storage and erection of materials furnished under these specifications or furnished by others, in accordance with the specifications and the drawings.
Supply and install touchup coatings.

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1. **Miscellaneous Materials and Services for Procurement.** Miscellaneous materials and services not otherwise specifically called for shall be furnished by the *Contractor* in accordance with the following:

Tests and inspections required by the specifications.

2. **Miscellaneous Materials and Services for Erection.** Miscellaneous materials and services not otherwise specifically called for shall be furnished by the *Contractor* in accordance with the following:
 - Supply all fit-up bolts, welding electrodes, welding, and other fasteners not supplied by the *Employer* that are necessary for the completion of the work.
 - Survey and lay out the work from the designated control points.
 - Tests and inspections required by the specifications.

3.7.2.2 Products

3.7.2.2.1 Materials

Materials shall be new and unused and shall conform to the following.

1. **Steel Certification.** Signed mill certifications shall be obtained for all steel purchased under this specification. A copy of the mill certifications shall be provided to the *Employer*.
2. **Bolt Inspection - Manufacturer.** High strength bolts shall be tested by the manufacturer prior to shipment in accordance with the Production Lot Method. A copy of the inspection test reports shall be forwarded to the *Employer*.

The *Employer* reserves the right to independently test the bolt materials. Should the bolt materials be found to be defective, they shall be replaced at the *Contractor's* expense.

3.7.2.2.2 Welding

All fillet welds shall be a minimum of 6 mm unless noted otherwise.

All welds shall receive 100 percent visual inspection. Butt joint splices, complete penetration T-joints, plate girder welds, and built-up column welds shall be tested.

3.7.2.2.3 Coatings

When galvanizing is specified for structural steel members, all connection components shall be galvanized, but shall not be applied within 75 mm of any field welded connection. No field or touch-up galvanizing will be permitted. All steel members shall be re-dipped.

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3.7.2.3 Execution

3.7.2.3.1 General

The *Contractor* shall store the miscellaneous metals in a manner that will prevent the materials from being damaged or subject to deterioration prior to erection. Materials shall not be stored in direct contact with the earth. Care shall be exercised to prevent damage of the steel coatings, and to prevent ponding of water that could damage the surfaces of galvanized materials.

Fasteners shall be furnished in suitable containers, which shall remain closed until the fasteners are required for erection.

3.7.2.3.2 Touch-up Painting

The *Contractor* shall inspect fabricator applied paint films and inform the Site QA Manager of inadequate coatings prior to the erection of the materials. Damaged or inadequate paint films of shop primed structural steel materials, all accessible surfaces of field welds and ungalvanized field connection bolts shall be cleaned and touchup painted per Eskom Corrosion Protection Specification. Damaged or inadequate galvanized surfaces shall be removed off site and re-galvanized. Exposed pipe threads on galvanized piping are allowed to be cold galvanized after assembly and installation on site.

3.7.3 General Service Pipe

3.7.3.1 General

3.7.3.1.1 Scope of Supply

Scope of supply shall include furnishing materials for piping systems as indicated in the *Employer's* attachments listed in section 6.1. Materials shall include straight lengths of pipe, fittings, flanges, and unions. Gaskets and flange bolting materials shall be furnished as indicated in the attachments.

1. **Piping Isometric Drawings.** Piping isometric drawings, if included, indicate the routing of the piping systems for which materials are to be furnished under this Contract. The Supplier shall use the isometric drawings to determine the quantities of straight lengths of piping, fittings, flanges, gaskets, bolting, etc., required for each system.
2. **Plan and Section Drawings.** Plan and section drawings, if included, indicate the routing of piping for which materials are to be furnished under this Contract. The *Contractor* shall use the plan and section drawings to determine the quantities of straight lengths of piping, fittings, flanges, gaskets, bolting, etc., to be furnished for each section of pipeline.
3. **Piping and Instrument Diagrams/Flow Diagrams.** Piping and instrument diagrams or flow diagrams, if included, indicate the materials and line sizes of piping systems for which materials are to be furnished under this Contract.

3.7.3.1.2 Technical Attachments

Technical attachments relevant to the work under this section are listed in Section 3.7.1.2.

3.7.3.2 Products

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3.7.3.2.1 Piping Material Requirements

All pipes shall be in accordance with the applicable codes and standards designated in annexure 11.1 and the attachments thereto per section 6.1. Except as otherwise specified, schedule numbers, sizes, and dimensions of piping shall conform to the applicable standards specified in annexure 11.1

Material substitutions, except as specified on the attachments listed in section 6.1, shall not be made without written approval from the *Employer*.

1. **Steel Pipe.** Carbon steel shall be galvanized seamless type unless otherwise specified. Alloy steel pipe shall be ungalvanized seamless type unless otherwise specified. Steel plate piping, where allowed by these specifications, shall be of the straight seam welded type unless otherwise specified.
2. **High Density Polyethylene Pipe.** HDPE pipe shall be as specified in the attachment(s) by standard dimension ratio (SDR) for all other services or as required by *Contractor's* overall design.

3.7.3.2.2 Fittings

Fittings shall be constructed of materials equivalent to the pipe with which they are used. Unless otherwise specified herein or indicated on the drawings, steel fittings 65 mm and larger shall be butt weld type, except flanges which shall be threaded 150 mm and smaller and slip-on weld type 200 mm and greater. Steel fittings 50 mm and smaller shall be threaded type unless otherwise indicated on the drawings.

1. **Steel Fittings.** Unless otherwise indicated on the attachment(s), steel fittings 65 mm and larger shall be butt welding type and steel fittings 50 mm and smaller shall be threaded.
2. **Butt Welding Fittings.** Butt welding fitting wall thicknesses shall be equal to the pipe wall thickness with which they are used. Fittings shall be manufactured in accordance with the applicable standards listed in annexure 11.1. Unless otherwise indicated on the drawings, elbows shall be of the long radius type and conform to the applicable standards listed in annexure 11.1.
3. **Forged Steel Fittings - Threaded.** Forged steel fittings shall be used for threaded connections. Threaded fittings shall conform to the applicable standards. Metal thicknesses of fittings shall be adequate to provide actual bursting strengths equal to or greater than those of the pipe with which they are to be used. Minimum pressure class rating of threaded fittings shall be in accordance with the applicable standard
4. **High Density Polyethylene Fittings.** Fittings for HDPE piping systems shall have pressure ratings equivalent to the straight pipe sections with which they will be used. Fittings shall be of the moulded or mitered type as indicated on the drawings. If not indicated on drawings, fittings shall be moulded type unless otherwise approved by the *Employer*. Fittings shall be of the butt fusion weld, socket fusion weld, or saddle type as recommended by the pipe manufacturer for the point of application within the system.

3.7.3.2.3 Flanges

Flanges shall conform to applicable standards indicated in annexure 11.1.

1. **Steel Flanges.** Flanges shall conform to applicable SANS 1123. Unless otherwise specified herein or indicated otherwise on the drawings, flanges shall be as follows:

Flanges mating with flanges on piping, valves, and equipment shall be of sizes, drillings, and facings that match connecting flanges.

Flange class ratings shall be adequate to meet the design pressure and temperature specified in Employer drawings for the piping with which they are used.

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Flange materials shall be equivalent to the pipe with which they are used.

Except as indicated on the drawings, flanges 150 mm and smaller shall be of the threaded type, and flanges 200 mm and larger shall be of the slip-on weld type. Flanges shall have raised face flange preparation except as specified otherwise herein or indicated on the drawings.

3.7.3.2.4 Gaskets

Gaskets shall be furnished as indicated on the Employer's detail design drawings in section 6.1

Unless otherwise specified, compressed fibre gaskets shall be used with flat face flanges and slip-on raised face flanges. Spiral wound gaskets shall be used with all raised face flanges other than slip-on flanges. Gaskets are not required for lined pipe-to-lined pipe connections unless otherwise recommended by the manufacturer. Gaskets containing asbestos are not acceptable.

2. **Compressed Fibre Gaskets.** Compressed fibre gasket materials shall be suitable for a maximum working pressure of 4.1 MPa and a maximum working temperature of 400° C. Gaskets shall be dimensioned to suit the contact facing. They shall be full faced for flat face flanges and shall extend to the inside edge of the bolt holes on raised face flanges. Gaskets for plain finished surfaces shall be not less than 1.6 mm thick and for serrated surfaces shall be not less than 2.4 mm thick.
3. **Spiral Wound Gaskets.** Spiral wound gaskets shall be constructed of a continuous stainless steel ribbon wound into a spiral with non-asbestos filler between adjacent coils. The gasket shall be inserted into a steel gauge ring whose outside diameter shall fit inside the flange bolts properly positioning the gasket. The gauge ring shall serve to limit the compression of the gasket to the proper value. Compressed gasket thickness shall be 3.302 mm ±0.127 mm.
4. **Rubber Gaskets.** Rubber gasket materials shall be cloth inserted sheet rubber. They shall be full face and 1.6 mm thick unless otherwise specified.

3.7.3.2.5 Bolting

Flange bolting shall be furnished if so indicated on the attachments listed in section 6.1.

Alloy steel bolting shall be used for joining all steel flanges having a design pressure rating of Class 150 or greater, except steel slip-on flanges.

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

Bolting for bolt diameters 45 mm and larger shall consist of threaded studs and two nuts. Bolting for bolt diameters less than 45 mm may be threaded studs and nuts or bolts and nuts. Bolts and nuts shall be heavy hexagonal heads conforming to the standards.

3.7.3.2.6 Unions

All piping unions shall be of the ground joint type constructed of materials equivalent in alloy composition and strength to other fittings in the piping systems in which they are installed. Union pressure classes and end connections shall be the same as the fittings in the piping systems in which they are installed.

Steel unions shall have hardened stainless steel seating surfaces on both faces.

3.7.3.2.7 Cleaning

Interior and exterior surfaces of all piping shall be thoroughly cleaned of sand, mill scale, greases, oils, dirt, and other foreign materials.

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3.7.3.2.8 **Coatings**

All non-galvanized carbon and alloy steel piping shall be coated as specified herein and in the Eskom Corrosion Protection Specification listed in annexure 11.1.

3.7.3.3 **Execution**

Piping erection shall be in accordance with the requirements of Section 3.7.5

3.7.4 **Miscellaneous Valves**

3.7.4.1 **General**

3.7.4.1.1 **Scope of Supply**

Scope of supply shall include furnishing the miscellaneous valves indicated on the *Employer's* attachments listed in section 6.1.

3.7.4.1.2 **Test Requirements**

The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the *Contractor* unless specifically identified as a Tender Option or *Employer*-conducted. Tests identified as an option are to be priced separately. If identified as *Employer*-conducted, costs for the initial test will be the responsibility of the *Employer*. However, the *Contractor* is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
Hydrostatic shell and seat leakage tests required by the referenced standard	ANSI B16.34	<i>Contractor</i>

3.7.4.1.3 **Technical Attachments**

Technical attachments relevant to the work under this section are listed in Section 6.1.

3.7.4.2 **Products**

3.7.4.2.1 **General**

Valves included with these specifications designates valve identification number, nominal valve size, description, design conditions, valve class rating, material, end preparation requirements, and special features.

All check valves shall be designed for installation in either horizontal or vertical piping with upward flow.

3.7.4.2.2 **Angle and Check Valves**

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

3.7.4.2.3 **Ball Valves**

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

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3.7.4.2.4 Plastic Valves

PVC valves shall be constructed entirely from polyvinyl chloride and teflon. CPVC valves shall be constructed entirely from chlorinated polyvinyl chloride and teflon.

3.7.4.2.5 Installation Instructions

Contractor shall follow manufacturer’s installation instructions for installing the valves. The instructions shall state valve plug or disk position during joining operations, disassembly requirements, and all other precautions, recommendations, or special instructions for proper installation.

3.7.4.2.6 Identification

Each valve assigned a valve number by the *Employer* shall be provided with a permanent stamped stainless steel tag bearing the valve number securely attached to the valve with 20 gauge stainless steel wire. Lettering on the tag shall be 5 mm minimum. Each accessory item furnished with the valve, but not securely attached to the valve, shall be provided with an identical identification tag. Shop drawings and all correspondence shall be identified by the valve number.

3.7.5 Piping Erection

3.7.5.1 General

3.7.5.1.1 Scope of Work

The work shall include erection of all piping, fittings, valves, supports, and piping specialties, as called for on the drawings and specifications, and by the codes and standards. Erection of piping systems designated by the system codes and indicated on the drawings listed in section 6.1 are included, except as otherwise specified herein. The *Contractor* shall furnish all required materials and perform all related work for completion of the work included under these specifications.

The *Contractor* shall provide as-built drawings of all installed piping.

Additional Scope	The additional Scope of Work for this package includes the following items:
Piping location relative to grade:	
Above grade piping	Yes
In trenches	Yes
Below grade piping	Yes
In addition to erection of the piping systems defined above, the Scope of Work includes the following services and materials:	
Routing of miscellaneous 50 mm and smaller pipe, fittings, and valves	Yes
Hydrostatic testing of piping erected under these specifications	Yes
Furnish water for hydrotest	No

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Furnish chemicals for treatment of hydrotest water	Yes
Provide penetrations of structures for pipe installation	Yes
All required penetrations	Yes
Partial scope (penetrations by others shown on drawings)	No
Furnish and install pipeline identification	Yes

3.7.5.1.2 Codes and Standards

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

Work	In Accordance With
Installation of mechanical joint piping	ANSI/AWWA C111/A21.11
Dimensions and installation of restrained push-on type joints	AWWA C606
Sterilization of piping and equipment	AWWA C651, AWWA C652
Piping Erection	Pressure Equipment Regulations ASME B31.1

3.7.5.1.3 Test Requirements

Testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the *Contractor* unless specifically identified as a Tender Option or *Employer*-conducted. Tests identified as an option are to be priced separately. If identified as *Employer*-conducted, costs for the initial test will be the responsibility of the *Employer*. However, the *Contractor* is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
Pressure testing of nonmetallic piping	ASME B31.1, Paragraph 137	<i>Contractor</i>

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3.7.5.1.4 Technical Attachments

Technical attachments relevant to the work under this section are listed in Section 6.1

3.7.5.2 Execution

All piping, valves, fittings, and piping specialties shall be erected in accordance with the requirements of this section. Any piping installation not specified herein shall be done in accordance with good engineering practice and shall be approved by the *Employer*.

The drawings indicate the dimensions of the major lines. These dimensions are subject to change to accommodate the equipment, valves, and fittings actually furnished and the variations in equipment as actually installed. If the equipment, valves, fittings, and other components of the piping systems actually furnished differ in dimensions from those indicated, the piping systems shall be altered as required to accommodate these changes. If, due to some unforeseen circumstance, the installation of the piping as indicated would result in interference, the modifications or corrections required to install the piping free from interferences shall be made.

A field check of all connections to equipment and existing pipe, valves, or fittings for location, size, butt weld end preparation or flange drilling and facing shall be made prior to erecting interconnecting piping.

Allowances in fit-up and modifications to piping spools shall be made as required prior to completion of field welds and hoisting pipe spools into place as applicable.

Pipe, fittings, valves, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe and fittings are not damaged. Care should be taken to protect the piping from UV exposure as required by the piping manufacturer's instructions.

Particular care shall be taken to prevent damage to protective coatings and concrete pipe joint rings. Slings shall be nonabrasive and located between the ends of each pipe section when lifting. Bare wire rope slings or the use of hooks to lift pipe will not be permitted.

3.7.5.2.1 Welding

Field welding shall be in accordance with the requirements of 240-106628253, Standard for Welding Requirements on Eskom Plant

3.7.5.2.2 Miscellaneous Piping

Miscellaneous piping is defined as piping 50 mm and smaller which is not shown on the detailed piping drawings. All miscellaneous piping shall be routed and installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance. All piping shall be installed perpendicular or parallel to the major equipment, building structure, and floor levels except in special cases approved by the *Employer*.

If routing of miscellaneous piping is included under these specifications, all piping, including tubing, not located on the drawings shall be routed and installed in accordance with the following requirements:

1. Pipe routing shall allow unobstructed maintenance of plant equipment.
2. Piping shall not be installed above, or within a horizontal distance of 1 m from, electrical equipment such as switchgear, switchboards, control panels, motor controls, contactors, communication equipment, batteries, battery chargers, and motor generators unless written consent of the *Employer* is obtained. Improperly located piping shall be removed and relocated.
3. All branch piping shall be provided with shutoff valves at the main headers.
4. Valves shall be installed in such a manner that they can be operated from the main operating floors or platforms without the use of ladders or special operating devices.

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5. Piping shall be installed with a minimum of 2.3 m headroom over passageways and walkways.
6. Pipe runs that require drainage shall be installed so that they pitch toward the point of drainage.
7. Flange/spill guards shall be installed on all lubrication oil and diesel fuel oil piping.
8. Where building expansion walls are indicated on the drawings, piping shall not be supported from or located on columns or beams on these walls.
9. Piping indicated on P&IDs or other drawings as having a connection for the future extension of the piping to another unit shall be routed to a convenient point along the column row adjacent to the unit or the location for a future unit.
10. Routings shall be selected to avoid interference with planned and dimensioned locations for lighting fixtures, electrical trays, raceways, or conduit. The *Contractor* shall review the *Employer's* drawings for electrical construction to avoid such interferences before routing the piping.

Sketches of the proposed routing of all piping not located on the drawings shall be submitted to the *Employer*. The *Employer's* approval of all routings shall be obtained before the piping is erected.

3.7.5.2.3 Piping in Existing Areas

Before installation of piping in existing areas, the routings of new piping to be installed shall be walked down to verify that the piping and supports can be installed as designed without interference. If the piping as designed would interfere with existing facilities, the pipe routing shall be reviewed with the *Employer* and shall then be altered or existing piping shall be relocated. All pipe routings shall be subject to approval by the *Employer*.

3.7.5.2.4 Alterations and Cut-ins

All alterations and cut-ins to existing piping and equipment indicated on the drawings shall be made as specified herein and as required for proper installation of the new piping and equipment.

All cut-ins shall be done by sawing, machining, or careful flame cutting as directed by the *Employer*. Flame cut holes shall be ground smooth. The interior of the piping shall be thoroughly cleaned after cutting.

Whether indicated on the drawings or not, existing miscellaneous piping shall be revised as required to permit installation, without interference, of new piping and equipment. Existing miscellaneous piping that interferes with walkways or presents an unsightly appearance after modification of existing buildings, structures, equipment, or piping shall be relocated as directed by the *Employer*. The alterations to existing piping shall include any required revisions, additions, or replacements of insulation and pipe supports.

Any piping materials and valves removed and not reused shall be disposed of as directed by the *Employer*.

All alterations and cut-ins to existing systems shall be made on a time schedule acceptable to the *Employer*.

After alterations and cut-ins to existing coated equipment or coated piping have been made, the damaged coating shall be repaired. All welds and sharp edges shall be finished smooth and all weld spatter shall be removed. The metal shall be prepared and the coating system applied in strict accordance with the instructions and recommendations of the coating manufacturer. Damaged, inadequate, or altered galvanized surfaces shall be removed off site and re-galvanized. Exposed pipe threads on galvanized piping is permitted to be cold galvanized after assembly and installation on site.

3.7.5.2.5 Pipe Supports

The support assemblies shall not be used for the attachment of rigging to hoist the pipe into place. The piping shall be securely held in place by other means until the pipe support is completely assembled and attached to the pipe and building structures and the spring support set to take care of pipe sway. All rigging shall be removed in such a manner as not to impose a sudden load on the pipe support.

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After the piping has been completely installed, insulated, and filled with its normal operating medium, the springs shall be adjusted to the "C" or cold position.

Welding of pipe supports to structural steel forming a part of the building supporting structure shall be in accordance with the requirements of 240-106628253. Generally, welds shall run parallel with the length of the beam and all welding of lugs or attachments shall be staggered on the sides, with cooling allowed between subsequent weld bead deposits. Loaded beams shall be unloaded or properly shored prior to field welding if 10 percent or more of the flange width or web depth should be heated to over 260° C at any one time.

3.7.5.2.6 Valve Installation

Excessive piping strains and bending moments on valves, especially large steel gate valves and butterfly valves, shall be avoided. Excessive strains and moments will result in distorted valve seats.

All steel globe valves shall be installed, wherever possible, in such a manner that closing of the valve will relieve the pressure from the packing and permit repacking of the valve with the plant in normal operation. This shall be accomplished by installing the valves on all branch lines from a pressure source, with the pressure under the seat of the valve. In the case of a bypass line, or a line containing two or more globe valves connecting two pressure sources that cannot be taken out of service after the plant is in normal operation, the valve at each end of the line shall be installed in such a manner that the connecting line between the valves may be taken out of service for repacking of both valves when they are closed. Exceptions to the above requirements are those valves for which the manufacturer indicates the required direction of flow through the valve and those valves for which the direction of flow is indicated on the drawings.

Valve disks and plugs shall be off the valve seats when welding valves into the lines.

Check valves shall not be installed in vertical runs of piping unless they are specifically designed for vertical operation.

3.7.5.2.7 Relief Valve Piping

Relief valve discharge piping shall be installed in a manner to safeguard operating personnel. Unless otherwise indicated on the drawings, piping from relief valve drip pan wells, discharge elbows, bellows, and above seat drains shall be routed to a safe location.

3.7.5.2.8 Making Flanged Connections

The faces of all flanges and gaskets shall be wiped clean when making up flanged joints. The contact faces of all flanges shall meet squarely, and particular care shall be exercised in pulling up flanged joints to prevent overstressing of flanges or flange bolting.

The threads of all bolting shall be painted with a suitable thread lubricant before the joint is made. The lubricant shall be suitable for the operating temperatures involved.

3.7.5.2.9 Miscellaneous Small Connections

All openings for vents, drains, instruments, and other similar connections made after erection of the piping systems shall be drilled. No burning of such openings will be permitted. Connections shall be made in accordance with the details indicated on the drawings, if details are provided. Any burrs remaining on the inside wall of the pipe after drilling shall be removed.

The low points of all water piping systems and other systems specified to be hydrostatically tested shall be provided with 19 mm minimum screwed plugged openings as indicated on the drawings and as required to permit drainage of the systems.

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Indoor equipment drains and baseplate drains shall be piped to the drain funnels or floor drains provided in the floors. Drains shall be caulked into the drains where required by the *Employer*.

The lubricating oil drains on all machinery shall be provided with a brass plug cock of the same size as the equipment connection and a screwed pipe plug before the installation of the oil.

3.7.5.2.10 Damage to Machined Surfaces

Special measures shall be taken to avoid damage to machined surfaces such as flange facings or pipe ends that have been prepared for welding. Any damage to welding ends shall be repaired prior to butting up for welding. If a flange facing is marred, scratched, or damaged to such an extent that, in the opinion of the *Employer*, the flange will be a cause for leakage, such flange shall be repaired or replaced.

When welding to equipment that is in the assembled condition, separate ground leads shall be attached to the equipment, pipes, or components to prevent stray welding currents from arcing the internals of the equipment. Wherever possible, the ground lead shall be 2/0 cable or larger directly and mechanically connected adjacent to the welding area and returned directly to the welding power source.

3.7.5.2.11 Piping Isolation

All necessary flange isolating materials and insulated bushings, unions, and couplings shall be installed as indicated on the applicable drawings and as required to properly isolate the piping. Bolting at insulated flanges shall consist of studs and nuts with sufficient stud length to allow at least one full stud thread protruding through each nut. Sleeves shall extend into the insulating washers. After installation, insulated flanges, bushings, unions, and couplings shall be tested to determine that the piping is properly electrically isolated to the satisfaction of the *Employer*.

The *Contractor* shall electrically isolate the designated piping from connecting piping and equipment, reinforcing steel, structural steel, the station grounding system, and other buried piping.

3.7.5.2.12 Penetration Seals

Penetration seals shall be furnished and installed on piping that passes through walls and floors where indicated on the drawings.

Seals shall be designed for any expected axial and lateral movements.

Seals at penetrations in fire rated walls or enclosures shall be fire rated and shall be approved by the *Employer*.

Seals in non-fire rated applications shall be *Contractor's* standard.

Seals will be installed and sealed in accordance with the manufacturer's installation instructions. Insulation work shall be complete before installing seals on insulated piping. The *Contractor* shall measure the outside diameter of the insulated and lagged pipe and the outside diameter of the penetration sleeve at each point where a penetration seal is to be installed and shall purchase penetration seals of the proper size.

3.7.5.2.13 Protective Coatings

Protective coatings will be in accordance with 240-101712128 and 240-106365693

3.1.6.6.3.19.1 Electrical Inspection. After the field coating work is complete, and just prior to backfilling, 100 percent of all shop and field coated areas shall be inspected by the *Contractor* using an electrical holiday detector. Holiday detector voltages shall be as follows:

Coating System	Holiday Detector Voltage Range
----------------	--------------------------------

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Shop applied coal tar, fibrous glass, felt	In accordance with the standard specified for coating
Field applied tape	In accordance with manufacturer's recommendation
Field applied shrink sleeves	In accordance with manufacturer's recommendation

Any flaws or holidays found in the coated areas shall be repaired. The pipe coating shall be retested after repair. Testing and repair shall continue until no holidays are detected.

3.7.5.2.14 Underground Piping

The Underground Utilities work under these specifications shall be performed in accordance with the South African Bureau of Standards Standardized Specifications for Civil Engineering Construction listed in Section 11.1 (SANS 1200). Additional South African Bureau of Standards Standardized Specifications are referenced within the specifications above and shall also apply to the work.

3.7.5.2.15 Non-metallic Pipe Installation

The installation of nonmetallic piping, including high density polyethylene pipe (see 3.7.5.2.14) or other nonmetallic pipe, shall be as specified herein.

Nonmetallic piping shall be installed in strict accordance with the piping manufacturer's installation recommendations. Special attention shall be given to the manufacturer's recommended ambient installation temperatures, recommended embedment materials, pipe jointing system requirements including preparation and curing times and techniques, support requirements during installation, and recommended backfilling sequence and technique.

The *Contractor* shall submit evidence to the *Employer* that the piping manufacturer has reviewed the piping system layout and has provided proper guidance for the installation work to be completed successfully. The *Contractor* shall advise the *Employer* of any piping system layout modifications recommended by the manufacturer or otherwise required to properly install the piping. After receipt of approval from the *Employer*, the *Contractor* shall proceed with such changes at no cost to the *Employer*.

3.7.5.2.16 Testing

Where required by Article 3.7.5.1.1, materials and equipment tests shall be made by the *Contractor* as specified herein, and as required by code requirements and local and state regulations. Nonmetallic pipe shall be pressure tested per Article 3.7.5.2.16.

Water used to test lines shall be clean potable water and shall be chemically treated to inhibit biological organisms. Treatment levels shall not exceed 2 mg/L of residual chlorine.

Testing water shall not be left to stagnate in the lines.

All materials, equipment, tools, instruments, blocking, bracing, bulkheads, blanking plates, and all labour required to complete the tests shall be furnished by the *Contractor*. Test water and chemicals shall be furnished by the *Contractor* or the *Employer* as specified in Article 3.7.5.1.1.

If any tests reveal unsatisfactory materials of workmanship, such materials or installation shall be repaired or replaced to the satisfaction of the *Employer*.

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3.7.5.2.17 Identification

All piping shall be identified in accordance with 240-145581571 Specification for the Identification of the Contents of Pipelines and Vessels listed in section 11.1.

3.7.6 Submersible Sump Pumps**3.7.6.1 General****3.7.6.1.1 Scope of Supply**

Contractor shall furnish and install the pump and support structure in accordance with the performance and design requirements specified herein and drawings technical attachment listed in section 6.1

3.7.6.1.2 Performance and Design Requirements

Performance and design requirements for the equipment to be furnished under this section of these specifications are indicated herein. The sump pump shall be capable of pumping chloride salts slurry and/or fly ash slurry (up to 1.2 SG).

Sump Pump (1 total) shall be sized for the following conditions:

Pump Name	FGD Crystalliser Salts Emergency Holding Pad Slurry Sump Pump
Pump identification number	0 0GME10 AP017
Rated capacity	12 m3/hr
Rated total head	38 m
Maximum solids diameter	40 mm
Maximum Power rating	2.0 Kw
Electrical service	Procurement of Power Station Low Voltage Electric Motors Specification Standard per Appendix 11.1
Enclosure Minimum Protection Rating	IEC 60529 IP68
Pump controller enclosure protection rating	IEC 60529 IP68

3.7.6.1.3 Materials

The following materials shall be used:

Component	Material
Pump/Motor assembly enclosure	28% Chrome; Epoxy coated with Zinc Anode
Impeller	28% Chrome Epoxy coated with Zinc
Shaft	416 Stainless steel

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3.7.6.1.4 Technical Attachments

Technical attachments relevant to the work under this section are listed in Section 6.1

3.7.6.2 Products

3.7.6.2.1 Drawings and Data

Catalog cuts and manufacturer's specifications covering the sump pumps and accessories shall be submitted in accordance with the Schedule of Submittals.

3.7.6.2.2 Controls

The sump pump shall be manually controlled on a Local Controller panel furnished with the pump.

3.7.6.2.3 Motor

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

Refer to section 3.3.2.1 for additional motor requirements.

3.7.6.2.4 Other Accessories

The pump shall be furnished with slide rails and guide brackets to allow their easy removal from the sumps. The pumps shall be shipped with the necessary accessories installed for rail travel. Connections shall be provided at the top of the pumps for lifting by Supplier provided means (chains, wire ropes, etc.).

3.7.7 Mechanical Start-up

3.7.7.1 General

3.7.7.1.1 Scope of Work

Scope of Work shall include performing all work required to place all component systems and equipment installed by the *Contractor* into operation.

In addition, Scope of Work for mechanical startup includes the following preoperational checks:

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1. Before starting equipment, all bearings, shafts, and other moving parts shall be checked for proper alignment.
2. All fire protection systems and equipment shall be installed and operative.
3. All spring type pipe hangers shall be checked for proper cold settings.
4. All temporary shipping braces, blocks, or tie rods shall be removed from expansion joints.
5. All pump suction pits shall be free of trash, mud, silt, and debris.
6. Each lubricating oil system shall be flushed and the filters inspected. Note that flushing of systems is not to be considered as a startup activity. All oil tanks, reservoirs, gear cases, and constant level type oilers shall be checked for proper oil levels. All points requiring manual lubrication shall be greased or oiled as required.
7. All cooling and sealing water supplies shall be flushed and checked for proper operation.
8. Visual and mechanical inspection of equipment.
9. Mechanical adjustment and testing of all equipment as required to assure proper mechanical functioning and operation.
10. All testing and reconnection necessary to obtain correct operation of the equipment.
11. All mechanical adjustment necessary or recommended by the manufacturer of the equipment being connected or installed.

3.7.7.1.2 Test Requirements

The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the *Contractor* unless specifically identified as a Tender Option or *Employer*-conducted. Tests identified as an option are to be priced separately. If identified as *Employer*-conducted, costs for the initial test will be the responsibility of the *Employer*. However, the *Contractor* is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
Hydrotesting or Pneumatic testing	The most current edition of the ASME Code for Pressure Piping, B31.1, Power Piping and the ASME Boiler & Pressure Code, including all addenda thereto	<i>Contractor</i>

3.7.7.1.3 Technical Attachments

Technical attachments relevant to the work under this section are listed in Section 6.1

3.7.7.2 Execution

The *Contractor* shall render all services and do all work required to place each item of equipment installed by him, including all auxiliaries and piping, in operating condition to the satisfaction of the *Employer*. All equipment shall be prepared for operation as recommended by the equipment manufacturer, and shall be operated in accordance with the recommendations of the equipment manufacturer.

Individual systems and items of equipment shall be completed in a sequence that will permit systematic checkout and trial operation of each such component before it is incorporated into the initial operation.

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The *Employer* will furnish operating personnel during the startup. The *Contractor* shall provide all other workmen required to make adjustments and correct deficiencies during the equipment and plant checkout and operation. It is anticipated that the checkout and operation will be in progress continuously over extended periods of time. The workmen required of the *Contractor* shall be on the site as required by the *Employer*. All regular and overtime payrolls and all other contingencies in connection with the plant startup shall be included as a part of the contract price.

The *Employer* will furnish, and the *Contractor* shall apply, all oils, greases, and other lubricants required to place permanent plant equipment in a condition ready for operation. The *Contractor* shall provide all temporary instrumentation and gauging devices required during checkout and trial operation of the equipment and systems.

3.7.7.2.1 Equipment Checks

Preoperational checks and inspections shall be performed on all equipment as specified herein and in accordance with the equipment manufacturer's recommendations. A representative of the *Employer* shall be present during the equipment checks.

Pre-operational checks shall include, but not necessarily be limited to, the tasks indicated in section 3.7.7.1.1.

The *Contractor* shall verify in writing that all work and checkouts have been completed. When the services of equipment manufacturer's field service representatives are specified, the *Contractor* shall include verification by such representatives that the equipment is ready for trial operation.

3.7.7.2.2 Trial Operation of Equipment

After all preoperational checks and inspections have been completed, each piece of equipment will be given a trial operation. Trial operation of equipment will be conducted by the *Employer*. A representative of the *Contractor* shall be present during the trial operations.

Trial operation of all equipment and subloop systems shall extend over a period of time as required to reveal any equipment weaknesses in bearings, cooling systems, heat exchangers, and other such components, or any performance deficiencies that may later handicap the operation of main systems and the complete plant.

All rotating equipment will be checked by the *Employer* for overheating, noise, vibration, and any other conditions that would tend to shorten the life of the machinery. All equipment shall operate so that the level of vibration displacement is not more than that indicated in Article 3.7.7.1.1.

Cooling water systems shall be adjusted by the *Contractor* to provide the proper flow of coolant to each item of equipment.

Each trial operation shall be summarized by the *Contractor* in a written report describing the observations and results of the operation and the specific deficiencies discovered that require additional work. The report shall indicate whether a retest is required. Decisions for retests will be made by the *Employer*. Deficiencies that are the result of the installation shall be corrected by the *Contractor* at the *Contractor's* expense.

3.7.7.2.3 Main Systems Checkout

Main systems will be checked, operated, and tested by the *Employer* after each individual piece of equipment and its accessories have been operated and declared ready for on-line operation. Representatives of the *Contractor* shall be present during the main systems checkout.

All functional and operational testing of protective interlocking, automatic controls, instrumentation, alarm systems, and all other field testing of the main systems will be completed before the systems are started.

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3.7.7.2.4 On-Line Operational Checks

During on-line operation of the integrated systems, all equipment will be checked by the *Employer* for overheating, noise, vibration, and any other checks recommended or required by the manufacturer of the specific piece of equipment. Representatives of the *Contractor* shall be present during the on-line operational checks.

The *Contractor* shall be responsible for the following:

- All piping systems shall be visually checked for leaks, plugged pressure gauges, interferences, excessive vibration, and other abnormal conditions.
- Pump suction strainers shall be checked periodically for clogging. These strainers shall be kept in service during initial operation and shall be cleaned as required to minimize pressure drop due to clogging. Whenever equipment is shut down due to strainer clogging, the strainer shall be cleaned immediately, regardless of the time of day, to ensure availability of the equipment. New gaskets, furnished by the *Contractor*, shall be installed after each cleaning operation. After initial operation, when strainer loading no longer occurs, temporary strainers shall be removed from the piping. Spacers shall be furnished and installed where temporary cone type strainers are removed.

3.8 Electrical engineering works

Refer to Section 2.5 and Section 3.3.

3.9 Quality Requirements

Refer to Annexure 11.8 for Quality Requirements.

4 Document Management

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

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

4.1 Document Identification

4.1.1 Identification of the Documentation

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

- Title of the document
- Document Unique Identification number (Eskom number)
- *Contractor* Document number, if applicable
- Document status
- Revision number
- Document Type
- Document security level
- Document revision table/history
- Page number on the footer
- Document Author/Authoriser/

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- Document Originator *Contractor*

The following additional attributes are important for technical documents:

- Package/System name, sub-system if applicable
- Unit/s number
- *Contractor* name
- *Contractor* number
- Plant Identification Codes

4.1.2 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.

4.1.3 Layout and Typography

Every document should comply with the following font specifications:

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

4.1.4 Document Headers

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

4.1.5 Naming of files

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

For documents that have approval date and signature

- (YYYYMMDD_DocType_DocumentTitle_UniqueIdentifier_Revision.FileExtention)

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

- (YYYYMMDD_DocType_DocumentTitle_UniqueIdentifier_Revision.FileExtention)

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

4.2 Document Submission

The *Contractor's* engineering program to allow a minimum of 21 days for mailing, processing, and review of drawings and data by *Employer*. The *Contractor* is responsible for the compilation and the supply of all the documentation required during the various project stages and to provide the documentation programmed to

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link with the milestone dates. Documentation and drawings are programmed for delivery to meet the milestone dates and in accordance with the agreed VDSS. The VDSS is revisable and changes shall be discussed and agreed upon by all parties and properly documented.

Contractor documents submittals are provided in accordance with the Vendor Document Submittal Schedule (VDSS) which is included in Annexure 1.9. The VDSS to indicate the format of documents to be submitted. The *Employer* is responsible for the management of the schedule i.e. to create a document register that shall be used to track submission progress of documentation by the *Contractor* as per the committed dates on the VDSS.

Contractor documents all documentation that will be sent to the *Employer* in the Master Document List (MDL) as provided by the *Employer* in Annexure 11.7. All documentation, including reports, manuals, etc. is in the English language.

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

4.2.1 Transmittals

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

- Title of the document
- Reason for issuing/submission
- Transmittal Number
- Transmittal Name
- Transmittal Description
- Contract Number:
- Package Number
- Transmittal purpose
- Sender Name
- Sender E-Mail
- Sender Organisation
- Recipient Name
- Recipient E-Mail
- Recipient Organisation
- Disclosure Classification
- Date received
- Quantity of documentation referenced on the transmittal
- Number of copies
- Format/medium submitted (e.g. paper, External Hard Drives, etc.)
- Sender signature
- Recipient signature, once submitted, to acknowledge receipt

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

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

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

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

The *Contractor* to select the purpose for transmittal in line with the standard Eskom Selection Criteria:

- Issued for Approval
- Issued for Award
- Issued for Basic Design
- Issued for Commissioning
- Issued for Concept Design
- Issued for Consideration
- Issued for Construction
- Issued for Detail Design
- Issued for Document Review
- Issued for Handover
- Issued for Information
- Issued for Installation
- Issued for Manufacturing
- Issued for Procurement
- Issued for Review
- Issued for Tender

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

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

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

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

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

Submittal Description	Copies Required
Performance Curves	2
Design Data	2

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Submittal Description	Copies Required
Test and Inspection Data	2
Drawings	2

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

- Electronic copies can be submitted to Eskom Documentation Centre through generic email address agreed to by the project. Electronic copies large for email will be delivered on external drives/USBs, large file transfer protocol and/or hard drives to the Project Documentation Centre. A notification email, with the transmittal note attached, shall be sent to the project generic email address. The *Employer* will be copied on the email as well.
- Hard copies to be submitted to the *Employer* are to be accompanied by the Transmittal Note.

4.2.2 Drawings

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

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

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

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

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

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

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

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

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

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4.2.2.1 Drawing Submittal

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

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

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

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

4.2.2.2 Information Requirements

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

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

1. Design reviews and the interface management of the *works* with the Project *works*;
2. Quality assurance and control; and
3. The operation, maintenance, support, inspection, integrity management, training and technical optimization of the *works*, over the lifecycle thereof.

The scope of supply of Information from the *Contractor* to include drawings, documents, lists and data according to the types defined in Table 5 below:

Table 5: Typical Document Requirement List	
Document Group	Description of document type (includes information data sets)

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Table 5: Typical Document Requirement List	
Document Group	Description of document type (includes information data sets)
General	Equipment arrangement drawings Piping & Instrument Diagrams (P&ID's) Material handling flow diagrams Engineering and procurement schedule Equipment list Isometric Drawings Valve list Pipeline list Hanger list 3D model Interface list Equipment specifications & data sheets Drawings and data for all equipment and material Installation, Operation, and Maintenance (IOM) Manuals Spare parts list Factory Acceptance Test (FAT) report
Quality Assurance	Quality assurance manual Quality control plans Quality control reports Weld summary index Material traceability certificates Manufacturing test reports Manufacturing Non-Conformance Reports (NCR's)
Civils & Structures	Site Layout Geotechnical Investigation Report Building arrangement and floor layouts Structural drawings Architectural drawings Structural analysis and design report Foundation drawings Structural support drawings Access Platform/Walkway Drawings Professional Engineering Certificates from Professionally Registered Engineers

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Table 5: Typical Document Requirement List	
Document Group	Description of document type (includes information data sets)
Construction	<ul style="list-style-type: none"> Transportability study/report (including heavy haul study) Site management plan (QA, Safety, Environmental etc.) Construction schedule Site storage requirements for major equipment Construction test records (hydrotest, concrete strength, pile integrity test, etc.) Maintenance records for all equipment while stored on site Constructability report
Commissioning	<ul style="list-style-type: none"> Commissioning schedule Test & Evaluation Master Plan (TEMP) Commissioning procedures Commissioning database Performance test procedure Performance test reports Field test reports and certificates
Operations	<ul style="list-style-type: none"> Operating procedures Plant operational documentation Plant tech specs Incident & upset mitigation procedures Operating scenarios (for C&I control purposes)
Logistic Support	<ul style="list-style-type: none"> Maintenance concept Plant maintenance documentation ISI plan/program Spare parts assessment Plant RAM analysis Equipment access and removal paths assessment Fault finding diagrams
Training	<ul style="list-style-type: none"> Training plan Training manuals and instructions
Safety & Protection	<ul style="list-style-type: none"> Fire hazard analysis Waste management plan

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Table 5: Typical Document Requirement List	
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
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 Cable schedule Cabling routing and cable racking layout diagrams Cable termination diagrams EMC and earthing standards report Earthing layout drawings Lighting layout drawings

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Table 5: Typical Document Requirement List	
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
CBMS	Alarm and set-point schedule Instrument schedule Instrument data sheets Equipment layout drawings Routing layout drawings Cable schedules Termination schedules Junction Box GA and Internal Layout Instrument Stand GA Maintenance Manuals and procedures Operating and Control Philosophies Field device calibration certificates Network architecture Fire risk assessments

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

The *Contractor* to use the *Employer's* SmartPlant Environment and all design tools as the delivery mechanism for all project data and document deliverables. The EDMS and design tools will be provided to the *Contractor* pre-configured based on *Employer's* data handover requirements. Any project data and

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document deliverables not generated from design tools provided by the *Employer* shall be supplied in a format specified by the *Employer*.

The *Employer* reviews the *Contractor's* submitted documents. The *Contractor* ensures adherence to the contract and that a technically sound design approach is incorporated. Specific information required from the *Contractor* during tender phase and as part of the *works* is as set-out in the VDSS, in Appendix 9.2. Each document submitted to the *Employer* requires a transmittal note (refer to *Employer's* template 240-71448626 for minimum metadata requirements) from the *Contractor*. The *Contractor* includes interpretation of results in every report compiled. All project documents shall be submitted to the *Employer* in accordance with Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). The *Contractor* is required to submit documents in electronic and hard copies and both copies must be delivered to the *Employer* with a transmittal note.

4.3 Documentation Recording

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

- Date of submission
 - Transmittal number
 - Transmittal title
 - Document description
- I. Document number (both *Contractor* and *Employer*)
- Document Type
 - Revision number
 - Document Approval Status
 - Document Authorisation Status (i.e. Accepted With Comments, Not Accepted with Comments, Accepted)
 - Transmittal Reason for Issue

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

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

4.4 Documentation Requirements

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

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

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

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

- 1 Scope of work
- 2 Approved "As built" drawings
- 3 Design calculations
- 4 Approved QCP / ITP
- 5 Inspection reports
- 6 Pipe ovality reports if applicable
- 7 As built drawings (isometric drawings and P&IDs)
- 8 Material summary that gives full traceability between components used, drawings and material certificates
- 9 All material certificates for pipes, fittings and all components used.
- 10 Pressure test certificate and the calibration certificates of the gauges used.
- 11 Pressure test procedures
- 12 Test reports
- 13 Calibration certificates
- 14 Certificates of Completion (CoCs) or Professional Engineering Certificates (PECs)
- 15 The manufacturer's/repairer's certificate as defined in PER.
- 16 All CAR's and corrective actions
- 17 Operating Philosophy including all alarm and trip values
- 18 Parts catalogue
- 19 Maintenance manual
- 20 Storage, packing and transportation instructions

4.5 General Requirements

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

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

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

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

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5 Configuration Management

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

5.1 Plant Identification

5.1.1 Plant Coding

Plant Coding is undertaken by the *Contractor*, the *Employer* will review all the codes and as such the *Contractor* make available of the following documentation to code:

1) Mechanical

- General arrangements (GA)
- Piping and Instrumentation Diagrams (P&IDs)
- Interface list
- Process Flow Diagrams (PFDs)

2) Electrical

- single line diagrams
- electrical board general arrangements (GA)
- cable schedule

The *Employer* may only code the KKS code defining Documentation listed above. The *Employer* assign a coding practitioner who shall interact with the *Contractor* in coding the plant as listed above. It may be required that the person be based at the *Contractor's* offices full time. The *Contractor* is then required to include allocated codes to all other designs and related documentation. It is also the responsibility of the *Contractor* to consistently apply the KKS codes throughout the rest of the technical documentation which includes, but not limited to:

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

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

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5.1.2 Plant Codification

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

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

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

The *Contractor* shall use Eskom –specific interpretations of the KKS standards, which will be reviewed and agreed on after Contract 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* codes all plant within scope of supply according to the KKS Classification System to Breakdown Level 3 where possible. The relevant KKS codes thus allocated shall appear on all plant related documentation, drawings, lists and correspondence.

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

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

As soon as the contract is place, the *Contractor* provides the *Employer* with the following: -

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

5.1.3 Plant Labelling

1. New labels are provided for all plant, material and equipment provided as part of the *works*. It is the responsibility of the *Contractor* to manufacture and install labels according to station based labelling standard. The *Employer* provides the labelling standard.
2. All labels are made from anodised aluminium and are pop riveted in place.
3. Coding and labelling of components inside electrical and C&I panels shall be done by the *Contractor*.
4. The Coding practitioner facilitate the base-lining of all equipment lists from the *Contractor*, and only baseline equipment lists shall be used as a basis for the production of labels.

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5. The abbreviations are in accordance with the Kusile's abbreviation standard, 240-109607332 – Kusile Power Station Project – Standard Abbreviations provided Design Reviews and Change Management

5.1.4 Design Reviews: Procedure for submission and acceptance of *Contractor's* design

Specific information required from the *Contractor* during the tender phase and as part of the *works* are as set out in the Vendor Document Submittal Schedule (VDSS).

Each document submitted to the *Project Manager* requires a transmittal note (refer to *Employer's* template 240-71448626 for minimum metadata requirements) from the *Contractor*.

The *Contractor* includes interpretation of results in every report compiled and submitted.

5.1.4.1 Review of design documentation

The *Contractor* submits all documentation to the *Project Manager* for acceptance. The *Project Manager* reviews the *Contractor's* submitted documents in accordance to the *Employer's* Design Review Procedure (240-53113685).

The *Contractor* conducts design reviews of the *Contractor's* design and that completed on behalf of the Employer as per the *Contractor's* official design review procedure. The *Contractor* ensures adherence to the Works Information and that a technically sound design approach is followed in carrying out the designs.

The designs submitted are complete packages with all elements (all related drawings and detailed design report) included in order for the *Employer* to review as a whole.

The *Contractor* takes note of the *Employer's* Design Review Procedure (240-53113685) and participates in all design reviews as specified by the *Employer*. The *Employer* may "Accept"; "Accepted with Comments" or "Not Accepted". If required, the *Contractor* makes the necessary revisions on the documentation and ensures acceptance is obtained from the *Project Manager*. The *Contractor* includes these design reviews as part of the schedule. All designs must be reviewed, accepted and frozen before manufacturing and construction of the relevant plant item starts.

In terms of the Construction Regulations, the *Employer's* review of the *Contractor's* design does not influence the design as only the *Contractor* can amend, update and revise the design. The *Contractor* remains the "Designer" as per the Construction Regulations, the *Employer* is not the "Designer".

The *Employer*, as per the design review procedure (240-53113685), conducts the following design reviews below:

- Contract Award Review,
- Design Freeze Review(s) (Detail Design),
- System Integrated Design Review (Detail Design),
- Pre-Commissioning Review (per unit),
- Hand-over Review,
- Further reviews as specified in this Works Information.

Design Freeze reviews can be conducted as End-of-Phase Design Reviews or as a series of Interim Design Reviews with the aim to design freeze a system or subsystem/asset in order to enable subsequent designs to progress. The number of design freeze reviews is proposed by the *Contractor* and accepted by the *Employer*.

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

The *Project Manager* conducts Design Reviews as per the *Employer's* design review procedure; Participation of the *Contractor* in the *Employer's* Design Reviews consists of:

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

The *Project Manager* accepts the *Contractor's* design once the report is accepted and signed by the *Employer's* project team.

5.1.5 Change Management

All Design change management are performed in accordance to the latest revision of the Eskom Project Change Management Procedure (240-53114026) and the Kusile Engineering Change Management Work Instruction (240-132735850). The *Employer* ensures that *Contractor* is provided with latest revisions of this procedure. Any uncertainty regarding this procedure should be clarified with the *Employer* and clarification updates should be reflected in updated versions of this procedure.

5.2 Handover

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

- All documentation or requirements as per the VDSS.

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

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

5.3 System Interface

The *Contractor* is responsible for all system interfaces which forms part of the *works*. The *Employer* shall provide the relevant information defining the system interfaces. The *Contractor* caters for all the identified interfaces, taking into consideration all Packages required.

6 List of drawings

6.1 Drawings issued by the *Employer*

The following drawings are issued to the *Contractor* to be used for tender. The *Employer* provides the *Contractor* with drawings issued for construction after contract award. Drawings for Tender are not used for procurement, fabrication or construction.

The *Employer* provides additional concrete reinforcement drawings and bending schedules, for the Civil & Structural drawings indicated below, issued for construction to the *Contractor* after contract award.

Some drawings may contain both Works Information and Site Information.

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Table 6: Employer's Detailed Design Drawings

Drawing number	Revision	Title	Status
Architectural Drawings			
366-428151	A	Elevations	For Tender
366-428153	A	Plan Layout	For Tender
366-428152	A	Section and Details	For Tender
Structural Drawings			
366-427904	00	Sht 1 of 4 FDG Holding Pad - Concrete Layout	For Tender
366-427905	00	Sht 2 of 4 FDG Holding Pad - Concrete Sections and Details	For Tender
366-427906	00	Sht 3 of 4 FDG Holding Pad - Concrete Joints Layout and Details	For Tender
366-427907	00	Sht 4 of 4 FDG Holding Pad - Pile Cap and Plinth Concrete Layout, Sections & Details	For Tender
366-427908	00	Sht 1 of 3 FDG Holding Pad - Reinforcement Layout	For Tender
366-427909	00	Sht 2 of 3 FDG Holding Pad - Reinforcement Section and Details	For Tender
366-427910	00	Sht 3 of 3 FDG Holding Pad - Pile Cap and Plinth Reinforcement Layout, Sections & Details	For Tender
366-427911	00	Sht 1 of 5 FDG Holding Pad - Structural Steel Layout and Details	For Tender
366-427912	00	Sht 2 of 5 FDG Holding Pad – Purlin Layout	For Tender
366-427913	00	Sht 3 of 5 FDG Holding Pad – Girt Layout	For Tender
366-427914	00	Sht 4 of 5 FDG Holding Pad – Bracing Layout and Details 1	For Tender
366-427915	00	Sht 5 of 5 FDG Holding Pad – Bracing Layout and Details 2	For Tender
Road Drawings			
366-428266	00	Kusile FGD Salts Holding Pad – Road Markings	For Tender
366-428260	00	Kusile FGD Salts Holding Pad – Setting Out	For Tender
366-428263	00	Kusile FGD Salts Holding Pad – Access Road Long Section	For Tender

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Drawing number	Revision	Title	Status
366-428264	00	Kusile FGD Salts Holding Pad – Exit Road 6 Long Section	For Tender
Mechanical Drawings			
0.90/1243 Sheet 21 (OGME-M2646V)	00	Piping and Instrumentation Diagram – FGD Crystalliser Salts Recovery	For Tender
0.90/942 Sheet 02 (OSGA-M2665B)	11	Piping and Instrumentation Diagram – Fire Fighting and Floor Washing Water	For Tender
0.90/62310 (0UXC-S3963B)	08	Terrace Underground Facilities – Site Valve Pit Details	For Tender
0.90/20090 (0UXC-S3963)	34	Terrace Underground Facilities – Site Valve Pits	For Tender
0.90/20068 (0UXC-S3962)	27	Terrace Underground Facilities – Site Fire Hydrant and Valve Details	For Tender
0.90/20093 (0UXC-S3314C)	09	Terrace Underground Facilities – Site Plan – Area 14	For Tender
0.90/81197 (0UXC-S3314A)	00	Terrace Underground Facilities – Site Plan – Area 14	For Tender
0.90/81187 (0UXC-S3305C)	00	Terrace Underground Facilities – Site Plan – Area 05	For Tender
0.90/157599 (OGME-M1646I)	00	FGD Salts Emergency Holding Pad Sump Pump Piping Details	For Tender
OSGA-M4665WXN	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
OSGA-M4665WXO	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
OSGA-M4665WXP	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
OSGA-M4665WXQ	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
OSGA-M4665WXR	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender

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Drawing number	Revision	Title	Status
0SGA-M4665WXS	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXT	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXU	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXV	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXW	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXI	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXM	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXJ	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665WXK	00	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
0SGA-M4665-8W	00	System Isometric - Drawing Reference	For Tender
0SGA-M4665-8X	00	System Isometric - Pipe Supports	For Tender
0SGA-M4665WXL	01	Detailed Piping Isometric WWTP Solid Waste Holding Facility	For Tender
Electrical Drawings			
N/A (Sketch)	N/A	Electrical Equipment Layout for this project	For Tender
EXTRACTED FROM ESKOM DRAWING 0.00/1310	N/A	Eskom Standard Code For Power and Control Cables	For Tender
0.90/95563	00	Direct Buried Cable Typical Details and Section Cuts (0.90/95563)	For Tender

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Drawing number	Revision	Title	Status
0.90/2532	00	LV Switchgear, Typical Circuit Types: SC1, SC8, SC10, SC14, SC16, SC18, SC20, SC48, Schematic Diagrams	For Tender
0.90/2532	00	LV Switchgear Sump Pump Direct On Line Schematic Diagram	For Tender
0.00/1290	05	Cable Number Tag Details	For Tender
0.00/1310	13	Standard Power and Control Cable Codes	For Tender
0.00/1800	04	Standard Drawing Sheets	For Tender
0.00/5005	02	Control and Relay Panel Wiring Terminations	For Tender
0.00/5007	04	Control and Relay Panel Engraving and Labelling Requirements	For Tender
0.52/1037	00	MV and LV Switchgear Front Panels Padlockable Lever Lock	For Tender
0.52/1038	00	MV and LV Switchgear Real Panels Fastener	For Tender

The following drawings and documents are issued to the *Contractor* to be used for information. Drawings and documents for Information are not used for procurement, fabrication or construction.

Table 7: Employer's Drawings and Documents for Information

Document number	Revision	Title	Status
17-0718R04	00	Geotechnical Report for Holding Pad	For Information

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7 Authorisation

This document has been seen and accepted by:

Name & Surname	Designation
Tumiso Railo	Project Engineering Manager
Yuvir Gokul	Engineering Design Work Lead
Thabani Mdlalose	Civil Site Engineer
Ayo Jimoh	Lead Civil Discipline Engineer
Shamita Lalla	Lead Integration Engineer
Goldstone Khumalo	Lead Electrical Discipline Engineer
Tiyani Malwandla	LPS Site Engineer
Simon Peter	Configuration
Dhires Ram	LPS Fire Engineer
Navash Brigman	Electrical Site Engineer

8 Revisions

Date	Rev.	Compiler	Remarks
April 2020	0	Wikus van Rensburg	Draft document for review
July 2022	01	Thabani Mdlalose	Additional Information

9 Development Team

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

- Wikus van Rensburg – Civil Site Engineer
- Thabani Mdlalose – Civil Site Engineer
- Ayo Jimoh – Civil Lead Design Engineer

10 Acknowledgements

- N/A

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11 Annexures

11.1 Employer's Standards

Number	Title
240-105020315	Standard for Low Pressure Valves
240-109607332	Eskom plant Labelling Abbreviation Standard
240-123801640	Standard for Low Pressure Pipelines
240-40643427	Coding and Labelling Standard
240-53113685	Design Review Procedure
240-54937439	Fire Protection & Detection Assessment Standard
240-54937450	Fire Protection and Life Safety Design Standard.
240-55714363	Eskom Generation Power Station Lighting and Small Power Installation Standard
240-56176097	Electrical Cable Schedule Template
240-56227443	Requirements for Control and Power Cables for Power Stations Standard
240-56357424	MV and LV Switchgear Protection Standard
240-56227516	LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and Including 1000V AC and 1500V DC Standard
240-56227927	Electrical Load List Template
240-563555	Junction box and cable termination
240-56355754	Field Instrumentation Installation Standard
240-56355815	Field Instrument Installation Standard - Junction Boxes and Cable Termination
240-56355888	Temperature Measurement Systems Installation Standard
240-56356376	On-Site Commissioning for Low Pressure Systems Standards
240-56356396	Earthing and Lightning Protection Standard
240-56364535	Architectural Design and Green Building Compliance Manual
240-56364545	Structural Design and Engineering Standard
240-66920003	Documentation Management Review and Handover Procedure for Gx Coal Projects
240-71432150	Plant Labelling Standard
240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
240-77302094	Cable Termination Schedules
240-85065548	Project Controls Specification for <i>Contractor</i> Integration
240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
240-86973501	Engineering drawing Standard

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240-93576498	KKS Coding Standard
VGB B 105e	KKS Identification System for Power Stations
VGB B 106e	KKS Application Explanations
Alpha KKS 01	KKS Plant Labelling and Equipment Descriptions Standard
Alpha KKS 02	Medupi Power Station Project – Standard Abbreviations
SPF 200-3340	KKS Coding and Labelling Procedure
N.PSZ 45-45	KKS Key Part Fossil Power Station
SPF 200-4190	The Application of KKS Plant Coding Standard
4011	Plant Labelling & Coding Procedure
IEC 62381	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)
240-106628253	Standard for Welding Requirements on Eskom Plant
240-145581571	Specification for the Identification of the Contents of Pipelines and Vessels
240-108079430	Power Plant Water Systems Design Guideline
240-101712128	Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings
240-106365693	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
240-106628253	Standard for Welding Requirements on Eskom Plant
240-49230046	Failure Mode and Effects Analysis Guideline
240-49230111	Hazard and Operability Analysis Guideline
240-49230030	Reliability Engineering Analysis Guideline
240-52844017	RAM Analysis Guideline
240-53113685	Design Review Procedure
240-76992014	Technical Documents and Records Management Work Instruction
240-53114186	Document and Record Management Procedure
IEC 61355 – 1:2008 (Edition)	Classification and designation of documents for plants, systems and equipment – Part 1: Rules and classification tables
240-54179170	Technical Documentation Classification and Designation Standard
240-86973501	Engineering Drawing Standard Common Requirements
240-71448626	minimum metadata requirements
240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
240-53114186	Project / Plant Specific Technical Documents and Records Management Procedure

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240-58552870	SmartPlant for Owner Operators (SPO) Documentation Metadata Standard
240-107305502	SmartPlant Data Take-On Standard
240-53114026	Eskom Project Change Management Procedure
240-133557442	Mechanical Terminal Point Datasheet Template
240-132735850	Kusile Engineering Change Management Procedure
240-128515850	Documentation Handover Specification
ISO 9906	Hydraulic performance acceptance tests
240-56361435	Transport of Power Station Electric Motors Standard
240-56360387	Storage and Preservation of Power Station Electric Motors Standard
240-57617975	New Low Voltage Motors Procurement Standard
0.54/393	Earthing Standards
SANS 1123	Steel Pipe Flanges
SANS 1700	Fasteners
SANS 1551	Check Valves
SANS 62	Steel Pipe up to 150 NB
SANS 1056	Ball Valves
SANS 4427	High density polyethylene (HDPE) pipe
SANS 719	Wall thickness tolerances for carbon steel pipe
ANSI B16.21	Compressed fibre gaskets and rubber gaskets
ASME B31.1	Power Piping Code for piping Erection, Pressure testing of nonmetallic piping
SANS 1200 A-1986	General
SANS 1200 0-1988 (As amended 1990)	Earthworks
SANS 1200 DB-1989	Earthworks (Pipe Trenches)
SANS 1200 G-1982	Concrete (Structural)
SANS 1200 LB-1983	Bedding (Pipes)
SANS 1200 LD-1982	Sewers
SAN S 1200 LE- 1982	Storm water Drainage

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11.2 Construction

11.2.1 List of applicable standards

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

Table 8: List of applicable standards for construction

Code	Description
SANS 1200 series	Standardised specification for civil engineering construction (except parts superseded by SANS 2001)
SANS 1393	Construction management systems – Requirements
SANS 1921	Construction and management requirements for works contracts
SANS 2001	Construction works
SANS 3001	Civil engineering test methods
SANS 10120	Code of practice for use with standardised specifications for civil engineering construction and contract documents
SANS 10400	The application of the National Building Regulations
SANS 10403	Formatting and compilation of construction procurement documents
SANS 10845	Construction procurement
SANS 18173	Non-destructive testing – general items and definitions
OHS Act 85 of 1993	Construction Regulations, 2014
NKP Act 102 of 1980	National Key Point Act, 102 of 1980
EPA	South African Environment Protection Act
AWS D1.1	Structural welding code – steel
SANS 50025	Hot rolled products of structural steels
32-245	Eskom Waste Management Standard
32-727	Eskom Safety, Health, Environment and Quality (SHEQ) Policy
240-72273656	Power Generation Asset Critical Classification Standard
240-83539994	Standard for Non-Destructive Testing (NDT) on Eskom Plant
240-105658000	Supplier Quality Management Specification
240-106365693	Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
240-106628253	Standard for Welding Requirements on Eskom Plant
240-107981296	Constructability Assessment Guideline
240-144332407	Guideline for Eskom Power Stations Concrete Remedial Work

1.1.2 Standard clauses

The *Contractor* carries out the civil, structural and building portion of the *works* in accordance with the Occupational Health and Safety Act (85/1993): Construction Regulations, 2014 and the National Building Regulations.

The *Contractor* provides all labour, installation tackle, gear and tools, vehicles, rigging tackle, temporary works/ scaffolding including any geotechnical works required, craneage and foundations for such, consumables, bulk mixing plant, site workshops, site offices, stores, facilities, Equipment and cleaning materials required to Provide the Works. The *Contractor* is responsible for the supply/ procurement of Plant

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and Material, fabrication/manufacturing, shop detailing, painting/ galvanising, handling, shipping, storage, testing, delivery, off-loading, erection/construction, disposal of debris, final painting and finishing complete in every detail of structural steelwork, concrete structures, miscellaneous support steel and concrete, access platforms, staircases, foundations, Equipment and spares required to supply the *works*. The *Contractor* is responsible to construct any works that can reasonably be inferred from this Works Information and the *Employer's* drawings.

The *Contractor* provides all the test equipment for testing, the sub-assemblies and the functional groups for site testing, commissioning and performance testing.

The *Contractor* provides all necessary temporary works required to complete the *works*. This includes scaffolding, suspended platforms, rope access work, material hoists, cranes, services etc.

The *Contractor* carries out manufacturing and proves standards of quality by means of inspections at every stage of the project.

During the erection period, the *Contractor* as a builder and/or user of machinery performs 'building work' in terms of OHS Act. The *Contractor*, before taking occupation on a Site, obtains a permit to work from the *Project Manager*. Before a part of the Site is released for access to Others, the said part conforms to the safety requirements of OHS Act. The party taking access then becomes the 'User' in terms of the OHS Act. The releasing of a part of the Site in the above described manner does not relieve the '*Contractor* Giving Access' of any of his obligations in terms of his contract with the *Employer*. No unauthorised person(s) enters into any prohibited/restricted area. Daily dairies/logs/data books are kept and signed by the *Contractor* and are also signed off daily by the *Supervisor*.

The following is to be recorded (as a minimum) in the daily diaries:

- Manpower and Equipment used,
- Weather conditions,
- Description of any unique occurrences, incidents or accidents,
- Delays and reasons for the delays,
- Industrial relations abnormalities,
- Interface and access problems,
- Description of activities to be performed,
- Recording of on-site tests, for example a concrete slump test.

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

- The *Contractor* is restricted to the Site;
- The *Contractor* is not to enter any other areas and ensures that his employees abide by the regulations;
- The *Contractor* performs all hoisting and lifting by qualified riggers;
- The *Contractor's* Equipment does not impair the operation or access to the plant;
- The *Contractor* provides any temporary or expendable materials required for the storage of material;
- The *Contractor* safeguards and secures all items whilst in the *Contractor's* custody and control, until completion of the *works*;
- The adjacent plant and equipment are not modified without written permission from the *Project Manager*. Modification in this sense includes, but is not limited to the following:
 - Welding onto existing plant,
 - Drilling into structural steel or concrete,
 - Cutting or removing
 - Loading adjacent structures.

The *Contractor* ensures that a complete QCP, risk assessment, method statement, ITP and temporary works calculations accompanied by a rigging study, where applicable are submitted to the *Project Manager* for review and acceptance before the *works* can commence. During reviews of the ITPs, the *Employer* provides the necessary intervention points.

All items that are assembled and constructed off site are listed and provided to the *Project Manager*. From this an ITP is developed between the *Project Manager* and the *Contractor* to determine the intervention points.

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1.1.3 Work Method Statement

The *Contractor* provides a detailed work Method Statement for each activity of his work, together with activity durations. In addition to a description of the method of constructing the *works*, the *Contractor*, in his work Method Statement, includes the following as a minimum:

- The scope of the particular Method Statement;
- A comprehensive description of the activity;
- Construction methodology and sequence of construction taking into consideration access restrictions and safety requirements;
- How the *Contractor* has taken into account the constraints for constructing the *works*;
- A clear description of the responsibilities of the *Contractor's* personnel involved in the activity, including (where applicable) his Project Manager, Site Quality Manager, Site Engineer, Health and Safety Manager, Technical Office Manager, Production Manager, Supervisor, Environmental Officer and other personnel required for the activity work;
- Reference to applicable statutory requirements and how the requirements have been taken into account;
- Health, safety and quality control for the activity;
- All plant, equipment and machinery required to complete activity;
- Quality control points as accepted by the *Project Manager*;
- Temporary works to be used including *Project Manager's* acceptance where such is supported off existing structures.
- Rigging studies and design calculations where applicable;
- Manufacturer's literature/ Technical Data Sheets for all materials used including product description, composition, material and performance properties, installation and application procedures, use limitations and recommendations;
- Plan for confining, collecting and disposing of broken concrete and other waste materials as a result of removal operations, where applicable;
- Works required to safeguard existing infrastructure and services; and
- Risk assessments associated with shutdown of plant/ equipment where deemed necessary, in order to execute the works.

All Method Statements are reviewed and accepted by *Project Manager* prior to starting any work.

1.1.4 Temporary works

The *Contractor* is responsible for all temporary works that is used by the *Contractor* to complete the *works*. The *Contractor* submits all designs or proposals for temporary works to the *Project Manager*. The *Project Manager* reviews but does not accept the temporary works. The *Project Manager* comments on the effectiveness, necessity or risk of the temporary works or Equipment, to allow the *Contractor* to Provide the Works efficiently and without delay.

The *Contractor* designs, procures, manufactures and constructs all temporary works required for the execution of the *works*. The *Contractor* dismantles/demolishes temporary works when such works are no longer required.

The *Contractor* designs all temporary *works* necessary to execute the *works* in accordance with the applicable codes and standards stated in *Table 8*.

The *Contractor's* appointed ECSA professionally registered structural engineer:

- Reviews and approves (by signature) the designs and drawings of all temporary works and additional supports and method statements produced by the *Contractor*; and
- Supervises, inspects and approves the works as per such.

All temporary works designs where supported from the existing structure are submitted to the *Project Manager* for review and acceptance, to prove that the members of the existing structure can withstand the induced load. The *Contractor* submits all design calculations, in a design report which includes, but is not

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limited to, all inspection reports, survey data, structural analysis models, assumptions, drawings/sketches, rigging studies etc.

The *Contractor* takes note that review and acceptance of any document/ drawing/ design calculations by the *Employer* in no way relieves the *Contractor* of his liability for the *works*. The *Contractor* remains liable for all *works* conducted as per this Scope of *works*.

1.1.5 Correction of defects

The *Project Manager* cannot certify Completion until all the work is free of Defects which would have prevented the *Employer* from using the *works* and Others from doing their work.

1.1.6 Excavations

No excavations are permitted without an excavation permit obtained from the Project Manager. The *Contractor* complies with the requirements of the Construction Regulations. Excavations are performed such that it imposes a minimum restriction on access to Site for Others. Excavation permits are only issued if the area has been scanned by the *Contractor*, to ensure that there are no underground services in the area to be excavated. Refer to 32-727, Eskom Safety, Health, Environment and Quality (SHEQ) Policy.

1.1.7 Underground services, other existing services, cable and pipe trenches and covers

- **Piping in Existing Areas** - Before installation of piping in existing areas, the routings of new piping to be installed shall be walked down to verify that the piping and supports can be installed as designed without interference. If the piping as designed would interfere with existing facilities and underground utilities, the pipe routing shall be reviewed with the Employer and shall then be altered or existing piping shall be relocated. All pipe revised routings shall be subject to approval by the Engineer.
- Before commencement of any excavation, the Contractor will apply for an excavation permit from the Employer
- See Appendix E which refers to drawings that show existing electrical services in the area.

11.2.1 Surveys

11.2.2 Site survey

The *Contractor* carries out a comprehensive site survey and verifies coordinates, elevations and dimensions with those shown on the *Employer's* drawings, a month prior to the commencement of any construction works. The *Contractor* submits this site survey in the form of a report for acceptance by the *Project Manager*. This report highlights any discrepancies, errors or omissions found in the survey.

11.2.3 Ground control survey

The *Contractor* conducts a ground control survey of underground utilities, services, trenches and tunnels that might affect the construction of structures. The *Contractor* submits the perimeters of the survey to the *Project Manager* for acceptance.

The position of underground services, underground utilities, trenches, vaults, exclusion zones and surface penetrations are physically identified by the *Contractor*. The outcome of this survey is submitted to the *Project Manager* in the form of a ground control survey report for acceptance.

The *Contractor* relocates underground services which interfere with the construction of the *works* only with prior acceptance from the *Project Manager*.

11.3 Structural Loading Certificates

Loading certificates are to be issued by a Professionally Registered Civil Engineer before construction can continue in certain instances as per the table below. Loading certificates to confirm that the structure has been constructed according to designs. The Contractor is to be in possession of the loading certificate before

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construction can continue as indicated below. Loading certificates to be added to data books once construction is completed.

Table 9 - Loading Certificate Holding Points

Loading Certificate issued after	Holding point for	Loading Certificate Issued by
Construction of piles, pile caps and plinths	Erection of building steel super structure	<p>Loading certificate for piles and pile caps issued by the Contractor's Professionally Registered Geotechnical Engineer</p> <p>Loading certificate for plinths issued by the Contractor's Professionally Registered Civil Engineer on behalf of the Employer</p>
Erection of steel super structure	Installation of building IBR cladding	Loading certificate for steel superstructure issued by the Contractor's Professionally Registered Structural Engineer on behalf of the Employer

Information/inspection sheets/certificates provided in the data books includes but is not limited to the following:

- Inspection Test Plan
- Founding conditions
- Contractor information requests
- Non-conformance reports
- Concessions
- Concrete inspection checklist
- Concrete cube register
- Post concrete inspection
- Slump test documents
- Survey (Alignment of Columns – Vertical, Horizontal)
- Remedial Works Approval (If required)

The Engineer may request any additional information required to determine that items have been constructed according to designs.

11.4 Completion, testing, commissioning

11.4.1 Commissioning

- Contractor is fully responsible for all commissioning and start-up activities for the mechanical and electrical systems installed by the Contractor, including, but not limited to, all craft labour and supervision. The Employer will provide assistance for coordination with other interfacing packages. Instrument calibration will be performed by the Contractor.
- Commissioning procedures are required for each of the systems and need to be accepted by the *Project Manager* prior to the commencement of any commissioning. The commissioning must be

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performed in accordance with; 240-56356376 - On-Site Commissioning for Low Pressure Systems Standards.

- Contractor is responsible for commissioning the entire electrical scope of this project. Commissioning procedures are required for each of the systems and need to be accepted by the *Project Manager* prior to the commencement of any commissioning.

11.4.1.1 Piping System

- Refer to 3.7.7

11.4.2 Start-up procedures required to put the Works into operation

- No alterations or adjustments will be made to the *Works* after functional checks are done without the *Employer's* written permission.
- At this stage the following must have been achieved:
 - Installation and pre-commissioning completed.
 - Testing report and the associated certificates received.
 - Signed erection and safety clearance certificates.
 - Final Draft of the Technical, Operating, Maintenance manuals delivered.
 - All Quality Control Plan (QCP) documentation received.

11.4.3 Performance tests after Completion

- Contractor to do tests and produce documentation to demonstrate that the equipment they provided meet the Employers performance requirements. E.g motors, lighting. The Employer to witness the testing.
- Contractor shall field performance test all centrifugal pumping systems. Contractor shall furnish all labour, materials and test equipment inclusive of temporary piping, valves, instruments, etc. Testing shall be performed in accordance with ISO 9906 and any allowances made for inaccuracies due to site testing shall be approved by the Engineer.

11.5 Plant and Materials standards and workmanship

11.5.1 Architectural & Building works

11.5.1.1 List of Standardised Specifications

During the construction of the *Works* there are numerous standards and specifications to which the *Contractor* must adhere to. The documents listed below, including normative references within, are not bound in this document but are obtained by the *Contractor* at his own expense and must be adhered to during the implementation of the *Works*.

Where a SANS standard referenced has been replaced by a newer standard, the *Contractor* is required to adhere to the latest revision of the newer standard. Where a SANS standard referenced is composed of several parts, all applicable parts are to be adhered to.

The following specifications are required to be complied to:

SANS 10400	The Application of the National Building Regulations
240-56364535	Architectural Design and Green Building Compliance Manual
203-1239	Kusile Architectural Specification
SANS 1129	Steel door frames

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SANS 10021	The waterproofing of buildings (including damp-proofing and vapour barrier installation)
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11.5.2 Particular Specifications

11.5.2.1 Materials, Workmanship and Products

11.5.2.1.1 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 *Supervisor* and is executed in accordance with the relevant manufacturer's written recommendations and instructions.

11.5.2.1.2 Proprietary Products

For the purpose of submission of tenders, rates for items described in the bills of quantities by trade names, catalogue references, etc., are for the particular type and manufacture specified.

Once the Contract has been signed the acceptance of the *Project Manager* is required to be obtained prior to any substitution and where products or materials, etc., other than those specified are used.

11.6 Civil engineering and structural works

11.6.1 List of Standardised Specifications

During the construction of the *Works* there are numerous standards and specifications to which the *Contractor* must adhere to. The documents listed below, including normative references within, are not bound in this document but are obtained by the *Contractor* at his own expense and must be adhered to during the implementation of the *Works*.

Where a SANS standard referenced has been replaced by a newer standard, the *Contractor* is required to adhere to the latest revision of the newer standard. Where a SANS standard referenced is composed of several parts, all applicable parts are to be adhered to.

The following specifications are required to be complied to (where applicable):

SANS 10400	The Application of the National Building Regulations
240-56364545	Structural Design and Engineering Standard
240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
240-84418186	Road Specification Manual
240-56364545	Structural Design and Engineering Standard
240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
203-770	Kusile Concrete Specification
203-1239	Kusile Architectural Specification
SANS 2001 Series	Construction Works
SANS 1200 Series	Standardised specification for civil engineering construction (except parts superseded by SANS 2001)
SANS 3001 Series	Civil Engineering Test Methods
SANS 10109-1	Concrete floors Part 1: Bases to concrete floors
SANS 10109-2	Concrete floors Part 2: Finishes to concrete floors

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TRH 9	Technical Recommendations for Highways 9: Construction of Road Embankments
SANS 927	Precast concrete kerbs, edgings and channels

11.6.1.1 Structural steelwork

11.6.1.1.1 List of applicable standards

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

Table 10: 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
SANS 1700	Fasteners
SANS 1921-3	Construction and management requirements for works contracts, Part 3: Structural steelwork
SANS 2001-CS1	Construction works Part CS1: Structural steelwork
SANS 3834	Quality requirements or fusion welding of metallic materials
SANS 4042	Fasteners – Electroplated coatings
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10085	The design, erection, use and inspection of access scaffolding
SANS 10094	The use of high-strength friction grip bolts
SANS 10104	Hand railing and balustrading (safety aspects)
SANS 10120	Code of practice for use with standardised specifications for civil engineering construction and contract documents
SANS 10143	Building drawing practice
SANS 10155	Accuracy in buildings
SANS 10160	Basis of structural design and actions for buildings and industrial structures
SANS 10162	The structural use of steel
SANS 10177	Fire testing of materials, components and elements used in buildings
SANS 10237	Roof and side cladding
SANS 10400	The application of the National Building Regulations
SANS 10684	Fasteners – Hot dip galvanised coatings

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

11.6.1.1.2 Specification data associated with SANS 2001 CS1 – Structural steelwork

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

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

Table 11: Specification data associated with SANS 2001 CS1 – Structural steelwork

Clause/No	Specification Data
Essential data	
4.1	Materials
4.1.1	“All structural steelwork is manufactured using grade S355JR steel.”
4.1.5	Structural fasteners are of the following grades and types: “All structural bolts and holding down bolts are of class 8.8 and nuts are of class 8, unless otherwise specified on the <i>Employer’s</i> drawings.”
4.2	Drawings
4.2.1.3	The format of drawings are as follows: “All drawings prepared by the <i>Contractor</i> are issued to the <i>Project Manager</i> in the form of two paper prints that are signed off in ink, one electronic printable document in “PDF” format that contains a digital signature in accordance with the <i>Employer’s</i> Documents and Records Management Procedure (32-6) and one editable softcopy in Native Format (.dgn or .dwg)”.
4.2.4.2	Attachments to facilitate erections do not remain as part of the permanent structure.
4.2.4.4	Hole sizes for holding-down bolts in excess of 36mm diameter are as per the <i>Employer’s</i> drawings. The <i>Contractor</i> requests clarification in writing from the <i>Project Manager</i> if this information is not available on the <i>Employer’s</i> drawings.
4.2.4.7	Connections to allow movement are as per the <i>Employer’s</i> drawings.
4.2.4.8	The requirement for machining is as per the <i>Employer’s</i> design.
4.3	Workmanship (General)
4.3.1.1	All steel elements are marked to be traceable to a specific cast or heat of steel.
4.4	Workmanship (Welding)
4.4.4.3	Tack welds are not to be incorporated into the final welds.
4.5	Workmanship (Bolting)
4.5.1.3	The maximum protrusion beyond the nut is not less than 3mm, but not greater than 5mm.
4.5.1.4	Washers under nuts and bolt heads on flat surfaces are required.
5.3	Non-Destructive testing of welds (Welding)
5.3.4	Ultrasonic or radiographic examination is required for all complete joint penetration welds.
5.3.5	The requirements for non-destructive tests are as follows: <ul style="list-style-type: none"> “50% of all fillet welds are tested with either dye-penetration (DPI) or Magnetic Particle Inspection (MPI). The testing positions for DPI and MPI are indicated by the <i>Supervisor</i>. All welds that fail the test are repaired. The scope of the welds to be tested is increased to 100% of the welds for the case where any welds fail the test.” 100% of all complete joint penetration welds are tested both with DPI or MPI and by Ultrasonic examination.”
Variations	
CS1.V.1	Clause 4.2.4.2 and 4.4.4.5: All attachments to facilitate erection are removed and holes are closed up after erection.

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Clause/No	Specification Data
CS1.V.2	Clause 4.4.4.3: All tack welds are removed before welding, tack welds are not to be incorporated into the final welds.
Additional clauses	
CS1.A.1	Add the following to clause 4.1.1: "In the event of specified steel not being available, the <i>Contractor</i> notifies the <i>Project Manager</i> in writing. The use of an alternative steel grade is subject to the acceptance of the <i>Project Manager</i> ."
CS1.A.2	Add the following to clause 4.1.2: The chemical composition and mechanical properties of all steel incorporated into structures is stated in the mill test certificates and submitted to the <i>Project Manager</i> for acceptance. Where required and prior to fabrication, test certificates or cast analysis certificates, or both, pertaining to the steel to be used, are supplied to the <i>Supervisor</i> by the <i>Contractor</i> .
CS1.A.3	The following clause is added to 4.2.4: "Fabrication drawings are prepared by the <i>Contractor</i> . The drawings are issued to the <i>Project Manager</i> for acceptance in the form of two paper prints and in "PDF" electronic format and in Native Format (dgn or dwg). The <i>Contractor</i> does not commence with fabrication until written acceptance from the <i>Project Manager</i> is received."
CS1.A.4	Add the following to clause 4.3: "The <i>Project Manager</i> is informed of the necessity for repair or rectification work before any attempt is made to carry out such repair. Approval is obtained from the <i>Project Manager</i> prior to commencement of the work."
CS1.A.5	Add the following to clause 4.3: "All waterproofing is to be in accordance with SANS 10021."
CS1.A.6	Add the following to clause 4.3: "All gutters and down pipes are provided to ensure free water flow away from the <i>works</i> ."
CS1.A.7	Add the following to clause 4.3: "Handling and lifting plant have sufficient capacity to ensure that steelwork is placed in its final position without distortion or undue stressing of members."
CS1.A.8	Add the following to clause 4.3: "Except where otherwise authorised in writing by the <i>Supervisor</i> , the <i>Contractor</i> ensures that the work is carried out strictly in accordance with the relevant drawings supplied to the <i>Contractor</i> by the <i>Project manager</i> or supplied by the <i>Contractor</i> and accepted by the <i>Project Manager</i> ."
CS1.A.9	Add the following to clause 4.3: "Steel sections are provided as specified on the relevant drawings except that substitution by larger sections is permitted with the <i>Project Manager's</i> prior acceptance. Where the <i>Contractor</i> wishes to make a substitution, he states his reasons and alternative proposals in writing."
CS1.A.10	Add the following to clause 4.3: "Splices: <ul style="list-style-type: none"> • When a beam is required to be spliced, the <i>Contractor</i> obtains acceptance from the <i>Employer</i> with regard to the location of the splice and the welding procedure

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Clause/No	Specification Data
	to be used. Visual inspections of the root pass and final welds are required for splice welds.”
CS1.A.11	Add the following to clause 4.3: “Tolerances: <ul style="list-style-type: none"> • Tolerances for overall dimensions (length, width, height, etc.) are 3mm unless otherwise specified by the drawing. • Tolerances for door locations are +/- 9mm. • Tolerances for stiffener, channels, angles and bars are +/- 3mm non-accumulative, unless noted of the drawing. • Tolerances for attachments such as supports, plates and pipes are located within 3mm of the required drawing location. • The centre line of a bolt hole is aligned within 1.5mm of the drawing dimension. • Bolt hole spacing is 3mm (non-accumulative) and 6mm (overall) of the drawing dimension. • Bolt hole diameter is within 2mm of the drawing dimension. • Special tolerances are shown on the <i>Employer’s</i> drawings and take precedence. Unless otherwise specified by the drawing, tolerances for all overall dimensions (length, width, height, etc.) are within 3mm.”
CS1.A.12	Add the following to clause 4.3.6: “Flame cutting of holes is not permitted.”
CS1.A.13	Add the following to clause 4.3.7: “Structures, composite units and bolted assemblies that comprise component parts are not subjected to excessive stresses during the assembly, fabrication, or erection process.”
CS1.A.14	Add the following to clause 4.3.8: “Any necessary straightening or forming is carried out by methods that neither weaken nor deface the material.”
CS1.A.15	Add the following to clause 4.4: “Arc strikes outside the area of permanent welds are to be avoided on any base material. Cracks or other damage caused by arc strikes are ground to a smooth contour.”
CS1.A.16	Add the following to clause 4.4: “All weld joints in areas to be covered by stiffeners are to be ground flush after welding and prior to installation of stiffeners.”
CS1.A.17	Add the following to clause 4.4.1: “All complete joint penetration welds have complete penetration and wherever practicable are welded from both sides. The backs of the first run are suitably gouged out.”
CS1.A.18	Add the following to clause 4.4.1: “The <i>Project Manager</i> may instruct the <i>Contractor</i> to replace any welding equipment which is unsuitable or unsatisfactory for the service in which it is being used.”
CS1.A.19	Add the following to clause 4.4.3: “The <i>Contractor</i> submits for acceptance full details of his proposed welding procedures

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Clause/No	Specification Data
	and the provisions of AWS apply to the acceptance thereof. Acceptance of the welding procedures does not relieve the <i>Contractor</i> of his responsibility for correct welding and for the minimising of distortion in the finished structure.”
CS1.A.20	<p>Add the following to clause 4.4.3:</p> <p>All welding procedures covering all forms of weld in the contract are in accordance with <i>Employer's</i> standard 240-106628253 and are submitted to the <i>Project Manager</i> and the Appointed Inspection Authority (AIA) for acceptance.</p> <p>Electrodes are selected, by the <i>Contractor</i>, to be suitable for the welding application to be used.</p> <p>The <i>Contractor</i> adheres to the following <i>Employer</i> standards where applicable;</p> <ul style="list-style-type: none"> • 240-106628253: Standard for Welding Requirements on Eskom Plant
CS1.A.21	<p>Add the following to clause 4.4.6:</p> <p>“Welds showing any planar defects such as cracks, lack of fusion or penetration and excessive slag inclusions or porosity are cut out and rewelded. Under-cutting is not permitted.”</p>
CS1.A.22	<p>Add the following to clause 4.4.6:</p> <p>“Weld repairs are made to the same procedure as for the original weld. All tests are repeated after the repair has been completed and reports on radiographic and ultrasonic tests are marked to indicate that the report refers to a repaired weld.”</p>
CS1.A.23	<p>Add the following to clause 5.2:</p> <p>“The <i>Contractor</i> submits properly documented evidence of the qualification of the welders to the <i>Project Manager</i> and the AIA for acceptance. The <i>Project Manager</i> reserves the right of testing the welder according to the welder's qualification. Welder qualifications are in accordance with <i>Employer's</i> standard 240-56241933.”</p> <p>“The welders are qualified on Site under conditions simulating the conditions in the plant prior to any change in welding procedures, materials and prior to employment.”</p>
CS1.A.24	<p>Add the following to clause 5.2:</p> <p>“Welders hold the relevant current welders qualification certificates.”</p>
CS1.A.25	<p>Add the following to clause 5.2:</p> <p>“All welders' tests are witnessed and/or accepted by the <i>Project Manager</i> before the welder or operator is permitted to work. The decision of the <i>Project Manager</i> regarding the acceptability of any test or existing qualification is final. Evidence of previous qualification tests are accepted solely at the discretion of the <i>Project Manager</i>.”</p>
CS1.A.26	<p>Add the following to clause 5.2:</p> <p>“Records showing the date and results of the qualification tests performed by each welder and weld operator together with the identification number assigned to him is at all times available for scrutiny by the <i>Project Manager</i>.”</p>
CS1.A.27	<p>Add the following to clause 5.2:</p> <p>“Each qualified welder and weld operator are assigned a unique identifying number. This number is marked on the work in indelible crayon to establish the extent of welds performed by the welder to whom it is assigned. Any welder or weld operator whose work is subject to multiple rejections will be required to undergo a re-qualification test on the</p>

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Clause/No	Specification Data
	appropriate weld procedure. At the discretion of the <i>Project Manager</i> any welder or weld operator failing a re-qualification test may be disqualified from any further welding on the works.”
CS1.A.28	Add the following to clause 5.3.2: “Visual examination of all welds check at minimum that: <ul style="list-style-type: none"> • there are no uneven leg lengths and there is no cracking or unacceptable undercutting or porosity, and • full fusion is being achieved while welding is in progress.”

11.6.1.1.3 Specification data associated with SANS 1921-3: Structural steelwork

Clause/No	Specification Data
Essential data	
4.1.1(b)	<i>Contractor</i> is to provide all labour, material, plant, equipment, scaffolding and tools.
4.2.1	The responsibility strategy assigned to the steelwork <i>Contractor</i> for the works is: For the portion of the works design by the Employer the responsibility strategy is B, “Contractor provides fabrication drawings” For the portion of the works design by the Contractor the responsibility strategy is C, “Design and build”
4.2.2	For the portion of the works design by the Employer, the steelwork structural engineer is the Employer For the portion of the works design by the Contractor, the steelwork structural engineer is the Contractor
4.3.2.1	The site will be ready for steelwork to commence as stipulated in the Contract Data or as agreed with the <i>Project Manager</i> .
4.3.3.2	The <i>Contractor</i> is required to provide the <i>Supervisor</i> with a detailed method statement for the erection of each structure prior to commencing with the erection of the structure.
4.5.1.1	Information, drawings and calculations provided to the <i>Contractor</i> will be provided, where applicable, in the following format via email or transmittal: <ul style="list-style-type: none"> • Drawings – pdf • Calculations – pdf
4.5.1.2	The <i>Contractor</i> provides information in the following format: <ul style="list-style-type: none"> • Information – All information is provided in its native form, together with a pdf version. • Drawings – Drawings are submitted in an editable (not locked) native format (dgn), pdf (digitally signed) and the original hard copy signed in ink (A0). • Calculations – Calculations are provided in its native form (for example the Excel spreadsheet where the formulae for the calculations can be viewed), together with a signed pdf version. All information received to align with the requirements of the Eskom Drawing Standard (240-86973501), Smart Plant Take-On Strategy (240-107305502), Engineering Drawing Office and Engineering Documentation Standard (36-943) and Document and Management Procedure (32-6) as applicable.
4.5.3.4	The <i>Contractor</i> is required to submit the following additional information with general

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Clause/No	Specification Data
	arrangement drawing to the <i>Employer</i> for acceptance: The Contractor submits the same documents as stated under 4.5.3.2
4.5.3.6	For the portion of the works designed by the Contractor, the <i>Contractor</i> is required to submit all <i>as-built drawings to the Employer for his acceptance</i> . For the portion of the works designed by the <i>Employer</i> , the <i>Contractor</i> submits marked up redlined drawings showing all deviations of the as-built plant to the <i>Employer's construction drawings</i> to the <i>Employer</i> for his acceptance.
4.7.9	The requirements for the provision and erection of sign boards are: <ul style="list-style-type: none"> • 240-103414344 Summary of Corporate Identity Manual • SANS 1186 Symbolic safety signs • SANS 23601 Safety identification - Escape and evacuation plan signs
4.10.2	The requirements for the protection, termination, diversion or maintenance of existing services are: <ul style="list-style-type: none"> • The <i>Contractor</i> may not affect existing services on Site without prior acceptance from the <i>Project Manager</i>.
4.11.1	The specific health and safety requirements are as per the South African Occupational Health and Safety Act No. 85 of 1993 and Eskom Safety, Health, Environment and Quality (SHEQ) Policy (32-727).
4.11.3	The <i>Contractor</i> is required to submit a report on the assessment and management of risk.
4.11.4	The <i>Contractor</i> is required to enclose steelwork for the protection of others in cases when exposed steelwork poses a safety risk.

11.6.1.2 Sundry items

11.6.1.2.1 Specification data associated with SANS 1200HA – Sundry items

Table 12: Specification data associated with SANS 1200HA – Sundry items

Clause/No	Specification Data
Additional clauses	
1200HA.A.1	Add the following to clause 5.1.2: The shop details and other drawings are submitted to the <i>Project Manager</i> for acceptance at least 1 month prior to fabrication.
1200HA.A.2	Add the following to clause 5.2.10: Where no corrosion protection system is specified, open grid flooring is to be hot dipped galvanised.
1200HA.A.3	Add the following to clause 7.1: Test certificates and cast analysis certificates is submitted by the <i>Contractor</i> to the <i>Project Manager</i> for acceptance.
1200HA.A.4	Add the following to clause 5: Grating is fixed with suitable grating clips and not welded such as Lindapter types GF A.

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Clause/No	Specification Data
1200HA.A.5	Add the following to clause 5: "All metalwork for metal stairways, ladders, walkways and platforms are galvanised."

11.6.1.3 Cladding and sheeting

11.6.1.3.1 List of applicable standards

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

Table 13: List of applicable standards for cladding and sheeting

Code	Description
SANS 517	Light steel framed building
SANS 3575	Continuous hot-dip zinc-coated carbon steel sheet of commercial and drawing qualities
SANS 4998	Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of structural quality
SANS 10120-2 HB	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 2: Project specification Section HB: Cladding and sheeting
SANS 10120-3 HB	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 3: Guidance for design Section HB: Cladding and sheeting
SANS 10120-4 HB	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 4: Typical schedule of quantities Section HB: Cladding and sheeting
SANS 10120-5 HB	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 5: Contract administration Section HB: Cladding and sheeting
SANS 10237	Roof and side cladding
SABS 1254	Sealing compounds for the building industry, oleo-resinous base, for interior and exterior use

11.6.1.3.2 Specification data associated with cladding and sheeting

The *Employer* uses extracts and variations from SANS 1200HB as part of the *Employer's* requirements, even though this standard has been withdrawn. All cladding and sheeting conform with the requirements of SANS 10237.

Except if explicitly stated otherwise, specifications relating to sheeting are also applicable to cladding and specifications relating to cladding are also applicable to sheeting.

All references to the Engineer in SANS 1200HB are to be read and interpreted as referring to the *Project Manager*. All references made in SANS 1200HB to "approval by the Engineer" are to be read and interpreted as "acceptance from the *Project Manager*".

Table 14: Specification data associated with cladding and sheeting

Standard	Clause/No	Specification Data
Essential data		
SANS 10120-2 HB	3.2.1	Basic data

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Standard	Clause/No	Specification Data
SANS 10120-2 HB	3.2.1.a	Add the following to clause 3.2.1.a: "The material for the cladding and sheeting to be used is pre-painted hot-dip galvanised steel."
SANS 10120-2 HB	3.2.1.a	Add the following to clause 3.2.1.a: "The profile for the cladding and sheeting to be used is as per the <i>Employer's drawings</i> "
SANS 10120-2 HB	3.2.1.a	Add the following to clause 3.2.1.a: "The cladding and sheeting is curved or kept straight as per the <i>Employer's design</i> ".
SANS 10120-2 HB	3.2.1.a	Add the following to clause 3.2.1.a: "The cladding and sheeting is coated with a minimum of 275g zinc per m ² (coating type Z275) and is to be free from white rust."
SANS 10120-2 HB	3.2.1.a	Add the following to clause 3.2.1.a: "The finishing of the cladding and sheeting is colour painted to match the existing structures on the station or as indicated on the <i>Employer's drawings</i> . The <i>Contractor</i> obtains acceptance from the <i>Project Manager</i> for the colour of the paint prior to procuring the paint."
SANS 10120-2 HB	3.2.1.b	Add the following to clause 3.2.1.b: "The overall dimensions of the area to be covered with cladding and sheeting are as per the <i>Employer's design</i> ".
SANS 10120-2 HB	3.2.1.b	Add the following to clause 3.2.1.b: "The tolerance for hot-dip galvanised steel is as per Table 2 in SANS 10237."
SANS 10120-2 HB	3.3	Sub-economic and labour-based projects
SANS 10120-2 HB	3.3	Delete the clause 3.3.
SANS 1200HB	2.1	Supporting specifications
SANS 1200HB	2.1	Replace the following: "b) SABS 1200AH or SABS 1200 A or SABS 1200 AA, as applicable;" With the following: "b) SANS 2001-CS1, SANS 1200AH or SANS 1200 A or SANS 1200 AA, as applicable;"
SANS 1200HB	2.1	Replace the following: "c) SABS 1200H or SABS 1200 HA or SABS 1200 HE, as applicable" With the following: "c) SANS 2001-CS1, SANS 1200H or SANS 1200 HA or SANS 1200 HE, as applicable"
SANS 1200HB	2.3	Definitions and abbreviations
SANS 1200HB	2.3	Add the following to the definition of the Contractor: "All references to the Contractor in this standard refer to the <i>Contractor</i> ."
SANS 1200HB	2.3	Add the following to the definition of the Sheeting contractor: "All references to the Sheeting contractor in this standard refer to the <i>Contractor</i> ."

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Standard	Clause/No	Specification Data
SANS 1200HB	3	Materials
SANS 1200HB	3.1	Add the following to clause 3.1: "The minimum thickness for cladding and sheeting is as per the <i>Employer's Design</i> "
SANS 1200HB	3.2	Add the following to clause 3.2: "The profile for the cladding and sheeting to be used is as per the <i>Employer's Design</i> "
SANS 1200HB	3.2	Add the following to clause 3.2: "The cladding and sheeting is coated with a minimum of 275g zinc per m ² (coating type Z275) and is to be free from white rust."
SANS 1200HB	3.7.1	Add the following to clause 5.5.3: "Fasteners have corrosion protection equal to or better than that of the cladding and sheeting with which they are to be used. Where the use of nails and screws is required: <ul style="list-style-type: none"> • Galvanised iron nails and screws are used for galvanized sheet iron and sheet zinc. • Copper and copper alloy nails and screws are used for sheet copper and sheet lead. • Aluminium alloy or stainless steel nails and screws are used for sheet aluminium."
SANS 1200HB	3.7.3	Replace the following: "Fasteners used for side stitching shall be as recommended by the sheeting manufacturer and as approved by the Engineer." With the following: "Fasteners used for side stitching are as recommended by the sheeting manufacturer and as accepted by the <i>Project Manager</i> ."
SANS 1200HB	3.10	Replace the following: "Sealants shall comply with the relevant requirements of SABS 110, SABS 1254 or SABS 1305, as applicable, or with the sheeting manufacturer's recommendations as approved by the Engineer." With the following: "Sealants comply with the relevant requirements of SANS 110, SABS 1254 or SANS 1305, as applicable, or with the sheeting manufacturer's recommendations as accepted by the <i>Project Manager</i> ."
SANS 1200HB	5	Construction
SANS 1200HB	5.2.2	Add the following to clause 5.2.2: "All cladding and sheeting and other materials subject to wet-storage stain be coated with a suitable inhibitor during the course of manufacture."
SANS 1200HB	5.2.3	Add the following to clause 5.2.3: "The <i>Contractor</i> takes special measures to ensure that cladding and sheeting is not damaged by corrosive or dusty environments or during handling of the cladding and sheeting."
SANS 1200HB	5.5.3	Remove the following from clause 5.5.3:

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Standard	Clause/No	Specification Data
		<p>"Fasteners that are not compatible with the sheeting shall be insulated with insulation materials."</p> <p>Add the following to clause 5.5.3:</p> <p>"Only fasteners that are compatible with the sheeting and cladding are used."</p>
SANS 1200HB	5.5.3	<p>Add the following to clause 5.5.3:</p> <p>"The <i>Contractor</i> adheres to the recommendations provided in SANS 10237 Table 5 as a minimum with regard to minimum end laps."</p>
SANS 1200HB	5.5.3	<p>Add the following to clause 5.5.3:</p> <p>"All end laps are to be sealed."</p>
SANS 1200HB	6	Tolerances
SANS 1200HB	6.2.2	<p>Add the following to clause 6.2.2:</p> <p>"The tolerance requirement with regard to misalignment of side joints, end joints and finishings against openings, to ensure a finished structure that is aesthetically acceptable are in accordance with SANS 10237."</p>
Variations		
SANS 10120-2 HB	3.2.2	<p>The following statement:</p> <p>"Where any detail given on a detail sheet does not comply with the applicable requirements of the project specification, the detail given on the said detail sheet (amended, if necessary, and approved by the Engineer) shall prevail."</p> <p>is replaced with:</p> <p>"Where any detail given on a detail sheet does not comply with the applicable requirements of the project specification, the detail given on the said detail sheet (amended, if necessary, and approved by the <i>Project Manager</i>) prevails."</p>

11.6.1.4 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.

Except if explicitly stated otherwise, specifications relating to sheeting are also applicable to cladding and specifications relating to cladding are also applicable to sheeting.

All references to the Engineer in SANS 1200HC are to be read and interpreted as referring to the *Project Manager*. All references made in SANS 1200HC to "approval by the Engineer" are to be read and interpreted as "acceptance from the *Project Manager*".

11.6.1.4.1 List of applicable standards

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

Table 15: List of applicable standards for structural steelwork

Code	Description
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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
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

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Code	Description
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)
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

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11.6.1.4.2 Specification data associated with SANS 1200HC – Corrosion protection

If no exclusions or qualifications are submitted at the time of tender, the requirements as prescribed in this Standard and/or ISO 12944: Parts 1 to 8 apply.

The *Contractor* complies with the requirements in the Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings (240-106365693) and the specification data listed in Table 16: Specification data associated with SANS 1200HC and SANS 10120-2HC – Corrosion protection.

Table 16: Specification data associated with SANS 1200HC and SANS 10120-2HC – Corrosion protection

Standard	Clause/No	Specification Data
Essential data		
SANS 10120-2 HC	1	Essential project specification clauses
SANS 10120-2 HC	1.1.a	With reference to SANS 1200HC sub-clause 5.3, sharp metal edges are to be ground to a smooth radius of at least 1mm.
SANS 10120-2 HC	1.1.b	With reference to SANS 1200HC sub-clause 5.4.3.1, in all cases the degree of cleanliness for coating systems is Sa 2.5 in accordance with ISO 8501/1.
SANS 10120-2 HC	1.1.c	With reference to SANS 1200HC sub-clause 5.4.3.1, unless otherwise specified by the [<i>Employer's / Contractor's</i>] design, the blast profile provisions of SANS 10064 are adequate. Add the following: "The required blast profile height are carefully considered and be within the range of the specified coating system and as recommended in the Product Data Sheets. It is important that the blast profile does not exceed the specified thickness of the primer or first coat, especially where delays in over-coating are expected / encountered. Any primed or coated surfaces showing signs of "measle" corrosion are considered defective and are re-blasted." "For surface preparation, the blast profile is measured in accordance with SANS 5772 (ISO 8503-4)."
SANS 10120-2 HC	1.1.d	With reference to SANS 1200HC sub-clause 5.4.3.1, recycling of blast-cleaning medium is not permitted.
SANS 10120-2 HC	1.1.d	With reference to SANS 1200HC sub-clause 5.4.3.1, the blast medium to be in accordance with 240-106365693.
SANS 10120-2 HC	1.1.e	With reference to SANS 1200HC sub-clause 5.4.3.1, the <i>Contractor</i> produces samples of each standard of blast cleaning in accordance with 240-106365693 for the <i>Supervisor</i> to keep as standards by which to judge subsequent work. Add the following: "The <i>Project Manager</i> or his authorised representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the samples place a hold on the use of material of the same batch number and may lead to rejection of that batch of material and the reworking of any components that have already been coated with rejected material. The <i>Contractor</i> supplies the relevant batch certificate for each of the coating products used in the submitted test sample panels."

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Standard	Clause/No	Specification Data
SANS 10120-2 HC	1.1.f	With reference to SANS 1200HC sub-clause 5.4.3.1, abrasive blast cleaning is to be by dry abrasive blast cleaning.
SANS 10120-2 HC	1.1.g	With reference to SANS 1200HC sub-clause 5.4.3.2 and in accordance with SIS 05 59 00, the standard of hand cleaning or power tool cleaning is in accordance with 240-106365693.
SANS 10120-2 HC	1.1.h	With reference to SANS 1200HC sub-clause 5.8, add the following: "Coatings are not applied when the ambient air temperature or the steel temperature is outside the coating manufacturer's recommended range, for additional requirements on temperature refer to 240-106365693."
SANS 10120-2 HC	1.1.i	With reference to SANS 1200HC sub-clause 5.8, the method of coating application complies with the manufacturer's recommendations, the data sheets and 240-106365693.
SANS 10120-2 HC	1.1.j	With reference to SANS 1200HC sub-clause 5.8, add the following: "All edges, corners, bolt holes, mouse holes, cut ends and weld beads are stripe coated by brush application, prior to the application of the intermediate coat. The stripe coating is an additional coat of the specified intermediate coat. In order to assist in its identification, the stripe coat is of a different colour to both the specified intermediate coat and finishing coat. Under no circumstances is stripe coating carried out by roller or spray-application." "The stripe coat is not intended to increase the overall specified dry film thickness of the system but to ensure that the minimum thicknesses required are actually achieved at edges."
SANS 10120-2 HC	1.1.k	With regard to the distance into concrete that steel is to be coated where it is to be embedded in concrete (where this distance is to be other than 75mm), add the following: "Coated steel to be embedded in concrete or soil are painted so that the coated areas extend at least 100 mm into the concrete or soil, unless otherwise specified."
SANS 10120-2 HC	1.1.l	With reference to SANS 1200HC sub-clause 5.8 and friction-grip areas, add the following: "Friction grip areas are left uncoated with the exception of steel work that is either galvanized or primed with inorganic zinc silicate. The uncoated friction grip areas are sealed to prevent the ingress of corrodants. The sealer used are either a polyisobutene coating, or recommended by the coating manufacturer as being suitable for the environment and compatible with the protective coating system. The sealing material is applied either by gun or spatula after erection. Where possible the sealant should be the same colour as the finishing coat."
SANS 10120-2 HC	1.1.m	With reference to SANS 1200HC sub-clause 5.8, a coating system is to be applied to surfaces which are inaccessible for coating after fabrication or erection. The coating system to be applied is in accordance with 240-

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Standard	Clause/No	Specification Data
		106365693.
SANS 10120-2 HC	1.1.n	With reference to SANS 1200HC sub-clause 7.1.d, the following tests are to be carried out after each intermediate coat: <ul style="list-style-type: none"> • Section 4.6.5 a), b), c) of 240-106365693 rev 1 • Section 4.7.3 e) and f) of 240-106365693 rev 1 • Section 4.7.4 d) of 240-106365693 rev 1 • Section 4.7.5 a) of 240-106365693 rev 1 • Section 4.7.9 d), g), h), i) of 240-106365693 rev 1 • Section 4.9.2 and 4.9.3 of 240-106365693 rev 1
SANS 10120-2 HC	1.1.o	With reference to SANS 1200HC sub-clause 7.3, add the following: <p>“All test, instruments, methods and criteria stipulated in 240-106365693 are applicable.”</p>
SANS 10120-2 HC	1.1.p	With reference to SANS 1200HC sub-clause 7.3.8, add the following: <p>“The frequency of dry film thickness readings is a minimum of three readings per square metre of coated surface or more as per the applicable QCP or as agreed between the <i>Contractor</i> and the <i>Project Manager</i> prior to commencement of coating applications.”</p>
SANS HC	10120-2	2
SANS 10120-2 HC	2.1.a	With reference to SANS 1200HC sub-clause 5.4.1, add the following: <p>“The method of cleaning and preparing the substrate of steelwork prior to the application of the coating system are in accordance with the applicable provisions of SANS 10064, unless otherwise noted, and takes place at a location proposed by the <i>Contractor</i> and reviewed and accepted by the <i>Supervisor</i>.”</p> <p>and</p> <p>“The method of cleaning and preparation are in accordance with Section 4.6 of 240-106365693 revision 1”.</p>
SANS 10120-2 HC	2.1.b	With reference to SANS 1200HC sub-clause 5.7, the coating system is hot-dip galvanising which is carried out in accordance with SANS 121. <p>Add the following: <p>“To apply a holding primer is optional and would be specified by the applicator and coating manufacturer.”</p> <p>and</p> <p>“The colours of the finish coat are in accordance with SANS 1091 and SANS 10140. Unless a duplex coating system is specified, galvanizing is available only in the zinc metallic colour. Galvanizing can only be accomplished at galvanizer shops. On site galvanizing repairs are affected with zinc rich coatings or zinc metal spraying.</p> <p>The finish colours would be dictated by the function of the engineering system that the plant and equipment belongs to, e.g. brown for fuel. This is specified by the <i>Project Manager</i> accordingly.”</p> </p>
SANS 10120-2 HC	2.1.c	With reference to SANS 1200HC sub-clause 5.8, the method of protection to be applied to fasteners which are to be embedded in concrete. Is as per SANS 1200HC Section 5.8 and 240-106365693 revision 1 Section 4.7.4.i.
SANS 10120-2 HC	2.1.d	With reference to SANS 1200HC sub-clause 5.8, the coating system is as specified and applied prior to mating in accordance with Section 4.7.3.g of 240-106365693 revision 1.

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Standard	Clause/No	Specification Data
Variations		
SANS 10120-2 HC	3.2	Remove this section.
SANS 1200 HC	7.3.1	With reference to SANS 1200HC sub-clause 7.3.1, replace "Articles for galvanizing shall comply with the applicable requirements of SABS 763" with "Articles for galvanizing comply with the requirements of the Hot Dip Galvanizers Association of South Africa (HDGASA) guideline, Chapter 9, Design for Hot Dip Galvanizing".
SANS 1200 HC	7.3.4	With reference to SANS 1200HC sub-clause 7.3.4, replace "HDG shall be tested in accordance with SABS 763 or SABS 934, as appropriate" with "Hot dip galvanizing is in accordance with the requirements of SANS 121 (ISO 1461)".
SANS 1200 HC	7.3.5	With reference to SANS 1200HC sub-clause 7.3.5, replace "Steelwork shall be tested for the presence of water-soluble contaminants in accordance with SABS Method 770 or any other approached method" with "Steelwork to be tested for the presence of water-soluble contaminants in accordance with Section 4.6.6 of 240-106365693 rev 1".
SANS 1200 HC	7.3.6	With reference to SANS 1200HC sub-clause 7.3.6, replace "The blast profile of steelwork shall be determined in accordance with SABS Method 772" with "The blast profile of steelwork is determined in accordance with Section 4.6.4 of 240-106365693 revision 1".
SANS 1200 HC	7.3.7	With reference to SANS 1200HC sub-clause 7.3.7, replace "Steelwork shall be tested for the presence of residual dust and debris in accordance with SABS Method 769 see also 5.6)" with "Steelwork is tested for the presences of residual dust and debris in accordance with Section 4.6.5 of 240-106365693 revision 1".
SANS 1200 HC	7.3.8	With reference to SANS 1200HC sub-clause 7.3.8, replace "DTF measurements and frequency of readings shall be measured in accordance with SABS Method 141, unless the frequency of readings is specified in the project specification" with "DTF measurements and frequency of readings are measured in accordance with Section 4.9.3 of 240-106365693 revision 1".
SANS 1200 HC	7.3.9	With reference to SANS 1200HC sub-clause 7.3.9, replace "Except for coatings containing conductive pigment such as zinc, aluminium and micaceous iron oxide, wet sponge electrical insulation defect testing of the coating system shall be carried out in accordance with SABS 1217" with "Electronic Insulation Defects are only tested for in coatings subjected to immersion. If this is the case then all lining systems intended for immersion service are tested for continuity in accordance with SANS 1217, either low voltage 'wet sponge' or high spark techniques, depending

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Standard	Clause/No	Specification Data
		upon the system being used.”
Additional clauses		
SANS 1200 HC	5.4	Preparation for coating
1200HC.A.1	3.3	Add the following: “The <i>works</i> are adequately protected from physical damage and corrosion during storage and erection.”
1200HC.A.2	3.3	Add the following: “All finished surfaces of ferrous metals, including screw threads that will be exposed while awaiting installation are thoroughly cleaned and given a heavy uniform coating of an approved petroleum soluble rust-preventive compound.”
1200HC.A.3	5	Add the following: “All plant and material are constructed of suitable material so that no internal and external corrosion, erosion or distortion occurs when subjected to water or corrosive substances, by virtue of its installation in the process. Plant service environment is classified as atmospheric inland as defined by ISO 12944 C3.”
1200HC.A.4	5	Add the following: “The <i>Contractor</i> is not to weld, cut, braze or grind any metal which has been painted with a zinc coating or any galvanised steel without first removing the coating.”
1200HC.A.5	5.4	Add the following: “After erection, the <i>works</i> is to be inspected and any damage to painted areas must be thoroughly cleaned, re-primed and painted.”
1200HC.A.6	5.4	Add the following: “All visible oil, grease, soil and other contaminants are removed” and “Before blasting, deposits of oil or grease are removed.”
1200HC.A.7	5.4	Add the following: “Any loose paint, loose corrosion or any other type of loose particles are removed.”
1200HC.A.8	5.4	Add the following: “Sand or soft glass bead blasting are not acceptable for blasting the inside surface of any pressure part components.”
1200HC.A.9	5.4	Add the following: “Sand or soft glass bead blasting are acceptable for surface that are to be non-destructively examined by ultrasonic method.”
1200HC.A.10	5.4	Add the following: “Grit of shot blasting is not used on surfaces that are to be non-destructively examined by ultrasonic method unless the surfaces are to be ground or machined after blasting and prior to examination.”

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Standard	Clause/No	Specification Data
1200HC.A.11	5.4	Add the following: "All machined surfaces are adequately masked off to avoid damage during blasting operation."
1200HC.A.12	5.4	Add the following: "All openings, which could trap the blasting media and are not readily accessible for inspection or cleaning are plugged."
1200HC.A.13	5.4	Add the following: "After blast cleaning, all deposits are removed."
1200HC.A.14	5.4	Add the following: "Metal surfaces cleaned by blasting are subject to inspection by the <i>Supervisor</i> prior to painting."
1200HC.A.15	5.6	Add the following: "Prepared surfaces are to be coated before any visible or detrimental corrosion occurs."
1200HC.A.16	5.7	Add the following: "The coating system is as follows for structural steel and sundry items respectively: All steel are derusted by sand blasting to ISO-SA 2.5. After derusting, apply two part epoxy. The paint is applied strictly in accordance with the manufacturer's instruction. Each coat is of a different colour and the second coat matches the existing paint colour. All paint damages caused during transportation, storing and erection are touched up with the same paint system. If due to the paint damage the steel is exposed, clean with abrasive paper grade 220 to a bright metal surface before applying the paint. Paint thickness is 200 microns. Grating/ flooring, stair treads and hand railing are hot dipped galvanised, not less than 325 g/m ² in accordance with SANS 121:2011."
1200HC.A.17	5.8	Add the following: "Paints and preservatives are to be stored and applied in a manner consistent with their manufacturer's recommendations, including method of application, mixing and application restrictions. Paint is not applied to damp or frosted surfaces."
1200HC.A.18	5.8	Add the following: "Lead containing paints are not used."
1200HC.A.19	5.8	Add the following to clause 5.8: "Coatings containing metallic zinc are not to be applied to stainless steel."
1200HC.A.20	5.8	Add the following to clause 5.8: "The <i>Contractor</i> paints all applicable surfaces of the <i>works</i> . The <i>Contractor</i> ensures that all Plant and Material are protected by means of suitable paint systems, surface coatings, linings, or finishes that are appropriate for the duty and environmental conditions typically found in a

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Standard	Clause/No	Specification Data
		<p>power station's flue gas plant. As a minimum, all exposed non- stainless steel is coated with the applicable spec for paintings and coatings.</p> <p>In no event do any items, Plant and Material, or equipment delivered hereunder contain chemicals, substances, or materials in amounts or quantities greater than those specified in the Works Information. This includes, but is not limited to; Asbestos, Lead, and DICHAN (dicyclohexylamine-nitrite or dicyclohexylammonium-nitrite).</p> <p>The <i>Contractor</i> provides touch-up finish paint with delivery at no additional cost to the <i>Employer's</i> recommendations.</p> <p>The <i>Contractor</i> uses the following standards for paint,</p> <ul style="list-style-type: none"> • SANS 1091 • SANS 10140 • SANS 10064 • SANS 121 • SANS 2808 <p>Where other standards are called for on drawings the <i>Contractor</i> follows the instructions on the <i>Employer's</i> drawings.</p> <p>Metal surfaces that will be in contact with hydraulic cement grouts are cleaned, by the <i>Contractor</i>, of all paint, oil, grease, loose rust, and other foreign matter. The metal surface is sandblasted to bright metal and an epoxy primer consisting of resin and converter is used over sandblasted surfaces to prevent corrosion. Final surface preparation, by the <i>Contractor</i>, before application of grouting is in compliance with the <i>Contractor's</i> grout manufacturer's recommendations."</p>
1200HC.A.21	5.10	<p>Add the following:</p> <p>"If corrosion forms after preparing the surface, then the surface is to be re-cleaned prior to painting."</p>

11.6.1.5 Concrete works

11.6.1.5.1 List of applicable standards

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

Table 17: 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

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Code	Description
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
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

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Code	Description
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
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

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Code	Description
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
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)

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Code	Description
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
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

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Code	Description
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)

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

Table 18: Specification data associated with SANS 2001 CC1 – Concrete works (structural)

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

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Clause/No	Specification Data
	<p>his acceptance:</p> <ul style="list-style-type: none"> • The trade name of the admixture, its source and the manufacturers' recommended method of use • Typical dosages and possible detrimental effects of under and over doses. • Whether compounds are likely to cause corrosion of the reinforcement or deterioration of the concrete. • The average expected air content of freshly mixed concrete containing an admixture that causes air to be entrained when the admixture is used at the manufacturer's recommended dose.
4.2.6	<p>The grade of concrete is as follows:</p> <ul style="list-style-type: none"> • The minimum concrete grade for structural concrete is 35/19MPa. • The minimum grade of blinding is 15/19MPa. • The minimum grade of mass concrete is 15/19MPa. • Mass concrete is defined as unreinforced concrete cast for fill in voids etc.
4.2.7	<p>The material requirements for grout are as follows:</p> <p>Cement complies with SANS 50196-1.</p> <ul style="list-style-type: none"> • Sand-cement grout <ul style="list-style-type: none"> ○ The grout has a minimum crushing strength of the concrete. The sand aggregate is capable of freely passing a filter mesh of 1.5 mm. • Non-shrink grout <ul style="list-style-type: none"> ○ A grout is regarded as non-shrink if its volume is not less than the initial volume, after hardening for 28 days. During this period, the test specimens are completely protected against drying, evaporating, carbonation and exposure to temperatures outside the range 23 °C ± 3 °C. <p>The type and brand of non-shrink grout, after approval, are indicated on the drawings and/or specification for concrete work.</p> <p>In general, one of the following types of non-shrink grout are used:</p> <ul style="list-style-type: none"> • Cement-based non-shrink grout is not less than the strength of the concrete. • Special proprietary non-shrink or expansive grout is not less than the strength of the concrete.
4.2.11.1	<p>Joint fillers, sealants, waterstops, bearings, and accessories complies with the following requirements:</p> <ul style="list-style-type: none"> • Expansion joints are generally be filled with closed cell expanded polyethylene foam and sealed against the ingress of dirt or water with a gun grade sealant material all as detailed on the Drawings.
4.3.1.5	<p>Where Earth cuts are to be used as forms for vertical surfaces acceptance from the Project Manager is required.</p>
4.3.1.8	<p>Formed Concrete</p> <p>The formed surfaces are as follows:</p> <ul style="list-style-type: none"> • Foundations (below 150 mm from finished floor level) – Rough finish is

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Clause/No	Specification Data
	<p>acceptable.</p> <ul style="list-style-type: none"> All concrete from 150 mm below finished floor level which receives and additional finish – Smooth finish is required Off-shutter concrete (not receiving any further finishes) – Smooth special finish is required.
4.3.1.8	The degree of accuracy required is II.
4.3.2.1.4	The design and drawings for the formwork and false work is submitted to the <i>Project Manager</i> for acceptance.
4.3.8.3	The false work and supporting formwork on continuously reinforced concrete structures are removed as follows: -On acceptance by the <i>Supervisor</i> that the false work and formwork may be removed.
4.4	Reinforcement
4.4.1.3	Bars may not be bent hot.
4.4.2.2	Welding of bars is not permitted.
4.4.3.1	The cover is as follows: <ul style="list-style-type: none"> Severe exposure conditions as listed in Table 3 or as shown on the <i>Employer's</i> Drawings
4.5	Holes, chases and fixing bolts
4.5.1	Fixtures to be embedded in the concrete are as per the drawings.
4.6	Embedded items
4.6.2.1	The type and location of waterstops are as specified on the Drawings.
4.7	Quality of concrete
4.7.3.2	Pumping of concrete is permitted.
4.7.4.1	Efflorescence on exposed concrete surfaces is not permitted
4.7.12.1.1	Construction joints are required and the location and details are submitted for acceptance to the <i>Project Manager</i> prior to construction.
4.7.12.1.4	Proprietary bonding compounds between old and new concrete is permitted.
4.7.14.6	Concrete is not to be placed during periods of heavy or prolonged rain.
4.7.15.1	Exposed surfaces of concrete not finished against forms have the following surface finishes: <ul style="list-style-type: none"> The surface, after the concrete has hardened sufficiently, is floated by hand or machine sufficient only to produce a uniform surface free from screed marks.
5	Compliance with the requirements
5.1	Testing
5.1.1.7	The test results from a ready-mix production facility, as part of its quality control system, are used.
5.1.1.8	The test for the percentage of alkali-aggregate is ASTM C289 – Potential reactivity of aggregate (chemical method) or alternative method proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
5.1.2.3	The test results may be assessed statistically.
5.2	Tolerances
5.2.1.1	The degree of accuracy is III for surfaces cast against earth cuts and II for other concrete surfaces.
Variations	

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Clause/No	Specification Data
CC1.V.1	Add the following to clause 4.7.8.2: The uninterrupted supply of the correct volume to Site is guaranteed if "ready-mixed" concrete is used.
CC1.V.2	Add the following to clause 4.6.3: The space between pipes and ducts that are to be cast into reinforced concrete and any adjacent reinforcement is not smaller than the larger of the following: <ul style="list-style-type: none"> • 40mm, or, • 5mm plus the maximum size of the coarse aggregate.
CC1.V.3	Add the following to clause 4.7.8.2: The <i>Project Manager</i> may permit production of concrete at a central production facility other than on the Site of construction and reserves the right to inspect for acceptance of these central production facilities. The <i>Contractor</i> is responsible for conducting all control testing.
CC1.V.4	Add the following to clause 4.7.10: Concrete may not be placed before the <i>Supervisor</i> has given permission in writing. A minimum written notice period of 24 hours prior to pouring is required for each part of the structure.
CC1.V.5	Add the following to clause 5.1.1.7: the <i>Contractor</i> receives from the ready-mixed concrete Supplier, a certificate with the following information: <ul style="list-style-type: none"> • The nature and source of each constituent material. • The proposed quantity of each constituent material per m³ of supply compacted concrete.
Additional clauses	
CC1.A.1	Cement and cement extenders are free flowing and free of lumps, and are supplied in the manufacturer's sealed unbroken bags or in bulk. Material that has become hardened or lumpy or fails to comply with the relevant standards in any way is removed from the Site, without delay.
CC1.A.2	The materials used in the construction of falsework and formwork are suitable for the purpose for which they are required and is of such a quality that will produce the standard of work specified. The <i>Contractor</i> submits his proposal of the materials that is used for the construction of the falsework and formwork to the <i>Project Manage</i> two weeks prior to use for his acceptance.
CC1.A.3	The minimum blinding thickness is 75mm.
CC1.A.4	All reinforcement is hot rolled steel grade 450MPa.
CC1.A.5	All cement and cement extenders used in the works are tested by the manufacturer or the <i>Contractor</i> in a laboratory. Copies of all test results so obtained accompany each delivery of cement and cement extender to the site and included As Executed records. The <i>Contractor</i> keeps full records of all data relevant to the manufacture, delivery, testing and use of all cement and cement extenders used in the <i>Works</i> .
CC1.A.6	Prevention of plastic shrinkage cracks The <i>Contractor</i> takes measures as necessary to prevent plastic shrinkage cracking in the concrete. Particularly on dry windy days or hot sunny days, the <i>Contractor</i> makes provision for fine spraying of the concrete surface with water as soon as it has taken its

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Clause/No	Specification Data														
	<p>initial set or covers the concrete with plastic sheeting. It may be necessary to change the aggregates or the concrete mix proportions. In order to deal with shrinkage cracking, it may be necessary to change the time at which, or the manner in which, floating is carried out.</p> <p>If plastic shrinkage cracking occurs, the cracks are to be closed up by re-vibrating the concrete while the concrete is still in a plastic state. Once the cracks have been closed, the concrete is kept thoroughly wet, or covered with plastic sheeting for at least a further three hours.</p>														
CC1.A.7	<p>Curing of concrete</p> <p>Details of the <i>Contractor's</i> proposals for curing concrete are submitted to the <i>Supervisor</i> for acceptance before the placing of concrete commences.</p> <p>Membrane curing compounds are not permitted, where the aesthetic appearance of the finished surface is of importance and there is any danger of the membrane becoming difficult to remove.</p>														
CC1.A.8	<p>Add the following to clause 5.1:</p> <p>The average strength of the 3 cubes crushed is referred to as one test result. The results are submitted to the <i>Supervisor</i> for his acceptance.</p>														
CC1.A.9	<p>Add the following to clause 4.7.14</p> <ul style="list-style-type: none"> • Provided the ambient air temperature does not fall below 10°C, no special precautions need be taken to protect concrete from the effects of cold weather. • If the ambient air temperature is in the range 0°C to 10°C and freezing conditions are confined to ground frosts during the night, the <i>Contractor</i> takes the necessary precautions to ensure that concrete is placed and compacted at a concrete temperature of not less than 5°C and that it is subsequently covered and protected from cold winds and frosts to ensure that its temperature does not fall below that shown in Table CC1.A.9 for at least the period shown in the table. Such precaution must be presented to the <i>Supervisor</i> for his approval. • When it is likely that the ambient air temperature will fall below 0°C, the <i>Contractor</i> ceases with placing of concrete when the air temperature falls to 2°C and does not resume until it rises to 5°C, <p>Table CC1.A.9: Concrete temperature during early life</p> <table border="1" data-bbox="532 1430 1377 1780"> <thead> <tr> <th data-bbox="532 1430 837 1612" rowspan="2">Characteristic Strength of Concrete</th> <th colspan="2" data-bbox="837 1430 1377 1528">Concrete to be maintained at not less than temperature shown for a minimum period of:</th> </tr> <tr> <th data-bbox="837 1528 1052 1612">2°C</th> <th data-bbox="1052 1528 1377 1612">5°C</th> </tr> </thead> <tbody> <tr> <td data-bbox="532 1612 837 1696">10 MPa</td> <td data-bbox="837 1612 1052 1696">10.0 days</td> <td data-bbox="1052 1612 1377 1696">8.0 days</td> </tr> <tr> <td data-bbox="532 1696 837 1738">20 MPa</td> <td data-bbox="837 1696 1052 1738">4.5 days</td> <td data-bbox="1052 1696 1377 1738">3.5 days</td> </tr> <tr> <td data-bbox="532 1738 837 1780">30 MPa and above</td> <td data-bbox="837 1738 1052 1780">3.0 days</td> <td data-bbox="1052 1738 1377 1780">2.5 days</td> </tr> </tbody> </table> <p>Notes: 1. The above periods are those estimated as necessary for the concrete to gain a</p>	Characteristic Strength of Concrete	Concrete to be maintained at not less than temperature shown for a minimum period of:		2°C	5°C	10 MPa	10.0 days	8.0 days	20 MPa	4.5 days	3.5 days	30 MPa and above	3.0 days	2.5 days
Characteristic Strength of Concrete	Concrete to be maintained at not less than temperature shown for a minimum period of:														
	2°C	5°C													
10 MPa	10.0 days	8.0 days													
20 MPa	4.5 days	3.5 days													
30 MPa and above	3.0 days	2.5 days													

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Clause/No	Specification Data
	<p>compressive strength of 5 MPa.</p> <ol style="list-style-type: none"> 2. The periods required for other concrete strengths and temperatures may be interpolated, but in no case shall the maturing temperature fall below 2°C. 3. The temperature referred to is the minimum at any part of the concrete. <p>Concrete not placed within formwork or in contact with reinforcement with a temperature which is at or below 0°C and it is not placed against any surface bearing frost or ice.</p>
CC1.A.10	<p>Add the following to clause 4.7.14:</p> <p>No placing of concrete takes place if the ambient temperature exceeds or is likely to exceed 32°C or if there are hot drying winds during the casting period, without the acceptance of the <i>Supervisor</i>.</p> <p>Fresh concrete having a temperature exceeding 32°C are not placed in the <i>works</i>. For pours of large volume where control of temperature rise or temperature differential is critical, a lower maximum placing temperature, to be agreed with the <i>Supervisor</i>, may be imposed. The <i>Contractor</i> takes all measures necessary to ensure that the specified maximum placing temperature is not exceeded and that loss of moisture during transporting and placing is reduced to the minimum. Such measures are agreed with the <i>Supervisor</i>.</p> <p>Areas in which concrete is to be placed are shielded from direct sunshine and rock or concrete surfaces are thoroughly wetted if instructed by the <i>Supervisor</i> to reduce absorption of water from the concrete placed on or against them.</p> <p>After placing of concrete in any part of an area, the specified curing process commences as soon as possible. If any interval occurs between completion of placing and start of curing, the concrete are covered for this interval with polythene sheet to prevent loss of moisture.</p>
CC1.A.11	Particular attention will be paid to heat of hydration, especially for large pours.
CC1.A.12	<p>Cement extenders are only used where specified - an accepted cement extender is only blended with a CEM1 Portland Cement. The use of Fly Ash is preferred.</p> <p>Blending of CEM1 cement with an extender may be done in the batch plant, or at an accepted commercial blending plant.</p> <p>All cement extenders used comply with SANS 1491 Parts 1, 2 or 3 as appropriate for Ground Granulated Blast - Furnace Slag (GGBS) or Ground Granulated Corex Slag (GGCS), Fly Ash (FA) or Condensed Silica Fume (CSF) respectively, and carries the SANS mark, or similar accepted.</p>
CC1.A.13	If mixing concrete on Site, the <i>Contractor</i> prepares trial mixes using the approved material, and the Plant used for these trials is the Plant used in the <i>works</i> .
CC1.A.14	The <i>Contractor</i> submits full details of the trial mixes and test results and of the mixes proposed for use in the <i>works</i> , which are based on the satisfactory results of these preliminary tests and on the methods of mixing and placing the concrete in the <i>works</i> .
CC1.A.15	<p>Commencing of concreting:</p> <p>No concreting commences in any portion of the <i>works</i> until the preparations have been accepted and written permission given by the <i>Project Manager</i> that concreting in such portion of the <i>works</i> may commence.</p> <p>The <i>Contractor</i> provides to the <i>Project Manager</i> an accepted checklist for concrete pours</p>

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Clause/No	Specification Data
	<p>at least four hours before the placing of any concrete. All relevant items are checked by the <i>Contractor</i> and the checklist signed off by the <i>Contractor's</i> representative as to its completeness and correctness.</p> <p>The following information is recorded by the <i>Contractor</i> and forms part of the data books in respect of each delivery of concrete:</p> <ul style="list-style-type: none"> • Position in the structure where the concrete is placed. • Results of workability tests. • Details of test cubes taken. <p>The concrete is compacted and placed in its final position within 2 hours of the introduction of cement to the aggregates. The time of such introduction is recorded on the delivery note. When truck mixed concrete is used, water is added under supervision either at the Site or at the central batching plant, but in no circumstances is water added in transit.</p>
CC1.A.16	<p>Check Tests on Hardened Concrete</p> <p>The <i>Contractor</i>, if directed by the <i>Project Manager</i>, carries out the following tests on hardened concrete either for routine inspection, quality control or as a verification of defects found by visual inspection or low cube strengths:</p> <ul style="list-style-type: none"> • Tests on drilled cores, sawn beams or other elements of the structure in accordance with SANS 5863, SANS 5864 and SANS 5865. Loading tests on a completed structure or on precast elements are conducted if there is reasonable doubt as to the adequacy of the structure. • Tests to determine the ingredients used, permeability, loss of pre-stress, resistance to damage by other materials.
CC1.A.17	<p>Placing and compaction of concrete is carried out under supervision of suitably qualified Personnel. Control procedures are established to cover all aspects of workmanship including placing, compacting, finishing, curing, hot and cold weather concreting, large concrete pours, etc. The concrete consistence is appropriate to the location in which it is to be placed and suitable placing and compacting equipment and procedures are employed to ensure that a high level of compaction without segregation is achieved. It is particularly important that full compaction is achieved in areas close to construction and movement joints, embedded water bars, reinforcement and against previously placed, hardened concrete.</p> <p>The following precautions are taken by the <i>Contractor</i>:</p> <ul style="list-style-type: none"> • Placing and compacting procedures ensure that reinforcing bars and built-in fittings (embedments) are not displaced and that damage is not caused to the face of the formwork. • Concrete is placed in one continuous operation, rising uniformly in the formwork at a rate of at least 2m per hour. Concrete is not placed directly against vertical formwork; it flows to this surface during the compaction process. • The depth of lift to be concreted, is to the acceptance of the <i>Supervisor</i>. Concrete is not dropped freely more than 1.5 m unless adequate precautions have been taken to prevent segregation, displacement of reinforcing bars, tendons and built-in fittings (embedments) and damage to formwork. The design and slope of chutes are to the acceptance of the <i>Employer</i>; chutes are kept clean and in good repair. • Concrete is thoroughly compacted by vibration or other means during placing, to

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Clause/No	Specification Data
	<p>ensure that it is homogeneous. The concrete is worked around the reinforcing bars, tendons and built-in fittings (embedments), etc. and into corners of the formwork to form a solid void-free mass having the required surface finish. Vibration is applied in a manner that does not promote segregation, until all the air has been expelled. Vibrators are only used to compact concrete; they are not used to move concrete across the formwork. Over-vibration is avoided. When external vibrators are used, the design of formwork and vibrator characteristics ensures efficient compaction while avoiding surface defects.</p> <ul style="list-style-type: none"> • Overworking of the concrete is avoided and the addition of water to aid in finishing is not permitted. • Where permanent formwork is incorporated in the structure, its energy absorption is taken into account when deciding on the method of vibration to be used. Extra precautions are taken to ensure full compaction of the concrete since this cannot be checked when the formwork is removed. • Concrete is not placed in flowing water. Underwater concrete is placed in position by tremies or by pipeline from the mixer and is not allowed to fall freely through water. • Air-entraining admixtures and plasticizing admixtures, to improve the handling and placing characteristics of fresh concrete, are in accordance with this Works Information and are used only if accepted by the <i>Project Manager</i>. • Concrete is not placed against concrete which has been in position for more than one hour, unless a construction joint is formed. The concrete in each section between joints or corners are placed in successive pours, working away in both directions from the centre-most panel of that section. The minimum interval between placing adjacent panels is 3 days, unless directed otherwise. • Where it is specified that concrete is placed directly in contact with the ground, the ground surface is suitably prepared and protected against intermixing, water suction, etc, and the concrete is placed before this surface has deteriorated. <p>Once placed, the concrete is not subsequently disturbed and not vibrated or rammed.</p>
CC1.A.18	<p>All vibrating is carried out under the direction of a Specialist and to a plan accepted by the <i>Project Manager</i>. No workman is allowed to operate a vibrating tool without having received instruction and training in its use. Vibrators are immersion-type, of approved pattern, and they may be electrically or pneumatically driven. Care is taken to avoid segregation and excessive vibrating.</p>
CC1.A.19	<p>Defective Concrete</p> <p>No repairing of any concrete is done without the written permission of the <i>Project Manager</i> and then only in such manner as he accepts.</p> <p>Concrete which does not comply with this Works Information is removed and replaced with sound concrete. This may involve the removal and replacement of otherwise satisfactory concrete associated with the defective material.</p>
CC1.A.20	<p>Formwork</p> <p>Formwork with damaged edges or faces is not used. Open joint in timber forms are sealed. Plywood surfaces and cut edges are sealed to prevent the absorption of moisture.</p> <p>Immediately before concreting, the forms and all other surfaces which are in contact with the fresh concrete, are cleaned of loose materials and debris including shavings, woods chips, sawdust, pieces of wire, nails, foamed plastic, fragments of hardened concrete and mortar.</p>

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Clause/No	Specification Data
CC1.A.21	In the case of precast concrete units constructed in a factory or yard remote from the Site, details of the concrete ingredients, mix design, and compression test cube results are made available on delivery to Site
CC1.A.22	Corners to concrete items which are permanently exposed, are chamfered to avoid sharp edges which are liable to be damaged
CC1.A.23	<p>Holding Down Bolts and Embedded Fixtures</p> <p>Threads of holding down bolts are protected with “Densotape” or similar material accepted by the Project Manager, during delivery and storage. After concreting, the bolt projections with attached nuts and washers, are protected against corrosion with similar sealing tape and protected against mechanical damage with a timber shield or as otherwise approved, until the erection of the steel works or other Plant or fixtures commences.</p> <p>Holding down bolts, embedded fixtures and recesses are located in the correct position by means of templates. These are constructed using steel sections fabricated to 1mm tolerance, or as otherwise approved and are held rigidly in position during concreting.</p> <p>Particular attention is directed to the placing of reinforcement around bolt assemblies and embedded fixtures.</p> <p>Holding down bolts and holding down bolt assemblies are located in the position shown on the Drawings.</p>
CC1.A.24	<p>All reinforcement is cleaned of salt depositions, loose mill scale, rust, grease, set mortar or other harmful matter, by power brushing or acid dipping. The <i>Contractor</i> ensures that such reinforcement is protected against chemical deposits at all stages of the work, until the concrete is poured.</p> <p>Reinforcement placing is checked against the design drawings before concreting is permitted.</p>

11.6.1.6 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.

11.6.1.6.1 Specification data associated with SANS 2001 BS1 – Site clearance

Table 19: Specification data associated with SANS 2001 BS1 – Site clearance

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

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Clause/No	Specification Data
4.4.1	<p>Materials from clearing and grubbing operations are disposed of at a suitable disposal site.</p> <p>Cleared combustible materials are taken to an approved waste disposal site.</p> <p>The <i>Contractor</i> keeps disposal certificates on record.</p>
4.4.2	Tree trunks and cleared tree debris are taken to a suitable waste disposal site.
4.4.3	Fencing material is stacked at a site proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
4.4.4	The material which is to be reused is stacked at a site proposed by the <i>Contractor</i> and accepted by the <i>Project Manager</i> .
4.6	<i>The Employer's acceptance is required prior to the removal of any trees</i>
4.7	<i>The Employer's acceptance is required prior to the removal of any turf, plants, bushes and shrubs</i>
4.9	<p>Topsoil together with any grass and other suitable vegetation are removed and placed in stock piles not higher than 1.5 and placed in <i>areas accepted, in writing, by the Project Manager</i>.</p> <p>Material suitability is determined by the intended re-use of the material. Where temporary stockpiles hold materials intended for rehabilitation of ground, stockpiles that can deteriorate if exposed are protected against erosion and weathering.</p> <p>Unsuitable materials not intended for re-use are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i>. Materials are disposed of in accordance with local and national laws and regulations.</p>
Variations	
BS1.V.1	<p>Add the following:</p> <p>Topsoil stripping is scheduled for the dry season, as far as possible.</p> <p>Topsoil is handled twice only - once to strip and stockpile, and secondly to replace, level, shape and scarify.</p> <p>Topsoil stripped from different sites is stockpiled separately and clearly identified as such.</p>
Additional Clauses	
CS1.A.1	The size of areas subjected to land clearance is kept to a minimum.
CS1.A.2	All vegetation not required to be removed is protected against damage.
CS1.A.3	No trees are removed without prior permission in writing from the <i>Project Manager</i> .
CS1.A.4	Scanning and marking of underground works precedes site clearance.
CS1.A.5	The <i>Contractor</i> does not excavate before a method statement is submitted and accepted by the <i>Project Manager</i> .
CS1.A.6	In areas of known shallow water table or perched seasonal water table conditions, caution is exercised with regard to the removal of trees and/or shrubs which may contribute to the overall water balance of the site.
CS1.A.7	Site clearance works are planned and executed in a manner such that the safety of personnel, the work and adjacent property is guaranteed and such that minimum inconvenience is caused.

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11.6.1.7 Earthworks

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

11.6.1.7.1 Specification data associated with SANS 2001 BE1 – Earthworks

Table 20: Specification data associated with SANS 2001 BE1 – Earthworks

Clause/No	Specification data
Essential data	
4.1	Materials
4.1.5.1	Topsoil is conserved.
4.1.5.2	<p>Materials from excavation is disposed of as follows:</p> <p>Suitable materials intended for re-use are stock-piled in areas accepted, in writing, by the Project Manager</p> <p>Material suitability is determined by the intended re-use of the material. Where temporary stockpiles hold materials intended for rehabilitation of ground, stockpiles that can deteriorate if exposed are protected against erosion and weathering.</p> <p>Unsuitable materials not intended for re-use are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i>. Materials are disposed of in accordance with local and national laws and regulations.</p>
4.2	Methods and procedures
4.2.1.1	All areas in which excavation is to take place or that are to be covered by terraces, banks or structures is cleared in accordance with the requirements of SANS 2001-BS1.
4.2.1.2	<p>Topsoil is conserved for later use in the following manner:</p> <p>Vegetation intended for re-use is removed to a location <i>accepted by the Project Manager</i> and is neatly stacked and regularly watered and tended until required for replanting.</p> <p>Top soil intended for re-use is stock-piled and/or spread to a location <i>accepted by the Project Manager</i></p>
4.2.1.3	The overburden is stripped and removed to depth of 300mm.
4.2.3	Surplus and unsuitable material are removed from the work site and disposed of at a location accepted by the <i>Project Manager</i> . Materials are disposed of in accordance with local and national laws and regulations.
5	Compliance with the requirements
5.2.1	A degree of accuracy I is required in respect of position, dimensions, levels, etc.
5.2.2	A degree of accuracy I is required in respect of moisture content and density.
Variation	
BE1.V.1	With reference to clause 4.2.2.1.1: Materials from excavation will not be used.
Additional Clauses	
BE1.A.1	<p>Design of Excavations:</p> <p>The <i>Contractor</i> is solely responsible for the design and installation of all temporary works to ensure the stability of the excavations. The <i>Contractor</i> provides his proposals to the Project Manager for acceptance before excavation work commences on site.</p>

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

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

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

11.6.1.8 Roads earthworks

11.6.1.8.1 Roads General

The following codes are required to be complied to:

- SANS 1200M: Roads (General)

The table below indicates particular specifications pertaining to SANS 1200 M and must be read in conjunction with the code.

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Clause	Particular Specification
Variations	
7.3	Delete and replace with: The compliance of earthworks and layerworks with respect to layer density is to be determined in accordance with Appendix B - Statistical Judgement Plan.
7.4	Replace "TMH1" add "SANS 3001 Series." Add the following: Refer to Clause 7.3: Methods of Test
Additions	
5.1.3 New Clause	Site survey, area and volume calculations
5.2 Watching, Barricading, Lighting, and Traffic Crossings	<p><u>Temporary Traffic-Control Facilities</u></p> <p>The <i>Contractor</i> provides, erect, and maintain the necessary traffic-control devices, road signs, channelisation devices, barricades, warning devices and road markings (hereinafter referred to as traffic-control devices) in accordance with these special provisions and in the SARTSM and remove them when they are no longer required. It is incumbent upon the <i>Contractor</i> to see to it the abovementioned traffic-control devices and are present where they are required at all times and are functioning properly.</p> <p>Traffic-control facilities lost or damaged by the <i>Contractor</i> are replaced at his own cost. Where it can be proved that loss of or damage to such facilities is beyond the <i>Contractor's</i> control and not the result of his actions or omissions, the <i>Project Manager</i> may order the facilities to be replaced and paid for at scheduled rates.</p> <p>The type of construction, spacing and placement of traffic-control devices is in accordance with the SARTSM.</p> <p>(a) Road signs and barricades</p> <p>The Contractor is responsible for the protection and maintenance of all signs and will at his own costs replace any that have been damaged, lost, or stolen.</p> <p>All temporary road signs required to remain in position for some time are be pole mounted.</p> <p>(b) Channelisation devices and barricades</p> <p>Channelisation devices includes delineators, cones, barricades, guardrails, barriers, roadstuds or road markings or any appropriate combination of these devices. The use of drums as channelisation devices is not permitted.</p>

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	<p>(c) Warning devices</p> <p>All construction vehicles and plant used on the works are equipped with rotating amber flashing lights and warning boards as specified. All vehicles and plant before being allowed onto the site will obtain a clearance permit from the <i>Project Manager</i>.</p> <p>(d) Vehicle mounted flashing lights</p> <p>Rotating lights have an amber lens of minimum height of 200mm and are mounted in such a way as to be highly visible from all directions. The lights on construction vehicles are switched on while construction vehicles are operating within the accommodation of traffic area, as the vehicles decelerate to enter a construction area, and as the vehicles accelerate to the general speed when entering the road from a construction area.</p> <p>Rotating lights and the “construction vehicle” signs on the <i>Contractor’s</i> vehicle and plant are not be paid for separately but included in the rates covering the use of the vehicles.</p> <p>The <i>Contractor</i> supplies and maintains lights together with temporary mounting brackets, to the acceptance of the <i>Project Manager</i>. Vehicles and plant that do not comply with these requirements will be removed from the site.</p> <p>(e) Other traffic control measures ordered by the <i>Project Manager</i></p> <p>The <i>Project Manager</i> may instruct the <i>Contractor</i> to provide any other road sign, reflective tape, etc. not measured in the standard pay items. Such road signs to confirm to the requirements of the SARTSM, or specification provided by the <i>Project Manager</i>.</p>
<p>5.9 Hold Points (New Clause)</p>	<p>The following hold points are minimum requirements only, and additional inspections during the construction phase may be required by the Supervisor:</p> <ul style="list-style-type: none"> • Following setting out. • At least seven (7) working days working prior to commencement of clearing the Contractor gives notice of intention to commence clearing operations within any given area. The supervisor will mark or indicate the contractor any other items that are to be removed and which are to be retained. • At least seven (7) working days prior to commencement of earthworks the Contractor considers areas of the ground survey shown on the drawings to be inaccurate; the Contractor gives notice of intention to commence earthworks operations within that area. The <i>Supervisor</i> will check the survey of the area in question and give the <i>Contractor</i> instruction as to how to proceed. • At least one (1) working day prior to reaching subgrade level the <i>Contractor</i> provides notification that subgrade level will be reached. The <i>Supervisor</i> will inspect the subgrade and may direct removal of unsuitable.

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	<ul style="list-style-type: none"> • At least one (1) working day prior CBR results of subgrade earthworks, the <i>Supervisor</i> will consider the submitted test results, inspect the prepared subgrade and may direct further action. • At least five (5) working days prior laying concrete pipes, the <i>Supervisor</i> will check the survey of the piping works and give the <i>Contractor</i> instruction as to how to proceed, as well as inspect the trench.
<p>5.10 Construction method statements (New clause)</p>	<p>The Construction Work Method Statements includes, at minimum, the following:</p> <ul style="list-style-type: none"> • Details of the construction approach. • The method statements constraints and risks • The method statement includes list of plant and equipment that will be used to execute the Works • Proposed material sourcing plan • The following activities: <ul style="list-style-type: none"> * Setting out * Clearing and grubbing * Earthworks and layerworks * Laying concrete block paving * Modification of existing road markings * Stormwater drainage Works including locating and connecting to existing drainage infrastructure <p>The <i>Contractor</i> submits a Detailed Construction Work Method Statement, one (1) month prior to commencement of any construction activities, which covers all the aspects listed above and any additional activities.</p>

11.6.1.8.2 **Subgrade**

The following codes are required to be complied to:

- SANS 1200 DM: Earthworks (Roads, Subgrade)

The table below indicates particular specifications pertaining to SANS 1200 DM and must be read in conjunction with the code.

Clause	Particular Specification
Variations	
<p>3.2.3 Selected layers</p>	<p>Amend points:</p> <p>b)a minimum grading modulus of 1.2 for G6</p> <p>c) a minimum CBR at 95% of modified AASHTO maximum density for material other than sand and at 100% of modified AASHTO maximum density for sand of</p> <p>1) in the upper 150mm of the layer, 25 for natural material</p> <p>2) in the lower part of the layer, 10 for natural material</p>
<p>5.2.3.3 Treatment of road-bed</p>	<p>Replace the first sentence, add “Upon stripping of unsuitable material, any part of the road-bed which is classified as being suitable for use in situ, save that it fails to meet density</p>

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	requirements, it is scarified, watered and compacted to a percentage of modified AASHTO density. The type of compaction and the depth of compaction is as shown on the Drawings and as directed by the <i>Supervisor</i> .”
5.2.4.2 Placing and compaction	Replace items 1, 2 and 3; add “The degree of compaction is as shown on the Drawings.”
7.3.1	Replace “THM1” add “SANS 3001 series”
8.2.5 Verifying Quantities	Replace clause add “Verification is done as agreed with the <i>Project Manager</i> before commencement of activity”

- Colto Documents

The table below indicates particular specifications pertaining to Colto Standards and must be read in conjunction with the document.

Clause	Particular Specification
Variations	
3307 Fills	<u>(d) Benching</u> Consider Method B for benching.

- TRH 9: Construction of Roads Embankments

The following additions must be done confirming with the code.

At the edge of the paved surface of road 6, there must be a clear distance of 3m, and the embankment shall be constructed using the material on site if it is suitable

The embankment shall slope at most 1:1.73 as the space is available. The drainage of the embankment shall be ensured. The measures of avoiding erosion shall be put into place.

11.6.1.8.3 Subbase

The following codes are required to be complied to:

- SANS 1200 ME: Subbase

The table below indicates particular specifications pertaining to SANS 1200 ME and must be read in conjunction with the code.

Clause	Particular Specification
Variations	
3.4 Water	Replace clause, add “Water used for the Works conforms to the requirements of SANS 51008.”
5.5.1 Rate of Application	“Chemical stabilising agents The average rate of application of a chemical stabilising agent, when applied by mechanical bulk-spreading equipment and measured by the canvas-patch method, is equal to the specified rate of application + or – 5% of the rate of application measured over any section

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	not exceeding 1.0km in length, and no single measurement show a value deviating by more than 20% from the specified rate. When spotted, stabilising agents is spread exactly to the specified rate of application.”
7.2.2 Routine Inspection and Testing	Replace “THM1” add “SANS 3001 series” Replace Table 3 and add Table x below.
7.3.1 Testing for Quality of Material and Rate of Application of Stabilizing Agent	Replace “submit to the Engineer representative samples of the material he proposes to use in the mix, to enable the Engineer to test-check the materials for quality and,” Add “Submit to the <i>Supervisor</i> results of stabilization tests carried out on the material the <i>Contractor</i> proposes to use.”

Table x.

Prescribed compaction	Unit of measurement	Minimum average relative compaction for the following sample sizes						Minimum value for any single test for the following sample sizes					
		4	5	6	7	8	9	4	5	6	7	8	9
93%	Mod. AASHTO density	93.1	93.4	93.6	93.7	93.9	94.0	89.4	89.2	89.0	88.9	88.8	88.7
95%	Mod. AASHTO density	95.1	95.4	95.6	95.7	95.9	96.0	91.4	91.2	91.0	90.9	90.8	90.7
96% Stabilized	Mod. AASHTO density	96.1	96.4	96.6	96.7	96.9	97.0	92.4	92.2	92.0	91.9	91.8	91.7
97% Stabilized	Mod. AASHTO density	97.1	97.4	97.6	97.7	97.9	98.0	93.4	93.2	93.0	92.9	92.8	92.7

11.6.1.8.4 Base

- SANS 1200 MF: Base

Clause	Particular Specification
Variations	
7.3 Route inspection and Testing	Replace “TMH 1” and “SANS 3001 series” of clause 7.3.1 Replace “Table 4” and add “Table y”

Table y

Prescribed compaction	Unit of measurement	Minimum average relative compaction for the following sample sizes						Minimum value for any single test for the following sample sizes					
		4	5	6	7	8	9	4	5	6	7	8	9
93%	Mod. AASHTO	93.1	93.4	93.6	93.7	93.9	94.0	89.4	89.2	89.0	88.9	88.8	88.7

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	density												
95%	Mod. AASHTO density	95.1	95.4	95.6	95.7	95.9	96.0	91.4	91.2	91.0	90.9	90.8	90.7
96% Stabilized	Mod. AASHTO density	96.1	96.4	96.6	96.7	96.9	97.0	92.4	92.2	92.0	91.9	91.8	91.7
97% Stabilized	Mod. AASHTO density	97.1	97.4	97.6	97.7	97.9	98.0	93.4	93.2	93.0	92.9	92.8	92.7

11.6.1.9 Ancillary Road Works

The following codes are required to be complied to:

- SANS 1200 MM: Ancillary Road Works

The table below indicates particular specifications pertaining to SANS 1200 MM and must be read in conjunction with the code.

Clause	Particular Specification
Variations	
2.1	Add the following: The Southern African Development Community Road Traffic Signs Manual (3 rd Edition) verify latest forms part of this specification as well as the attached Transportation Management Plan who does this document.
3.2.1	Add the following: Road signs are not detailed on the Drawings. They are to, however, conform to the requirements of the latest Southern African Development Community Road Traffic Signs Manual. The supports do not require breakaway devices.
5.2.4	Add the following: Road signs are to be erected so that the lower edge of the sign is a minimum of 2,10m above final ground level.
8.4.1	Delete and replace the last paragraph as follows: The rate is to cover the cost of supplying all materials (including reflecting glass beads) and equipment necessary and for painting and protection (see 5.3.8), including the setting out of character, symbols and traffic islands marking <u>and</u> including the setting out and premarking of lines.

11.6.1.10 Stormwater drainage

The following codes are required to be complied to:

- SANS 2001 DP5: Stormwater Drainage
- SANS 677: Concrete non-pressure pipes

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- SANS 1200 LE: Stormwater Drainage (Only Clause 8 – Measurement and Payment)

The table below indicates particular specifications pertaining to SANS 2001 DP5 and must be read in conjunction with the code.

Clause	Particular Specification
4.1	Materials
4.1.1	General
4.1.1.1	Stormwater pipes are to be constructed using the following types of pipes: a) Precast concrete pipes
4.1.1.2	The nominal internal cross-sectional dimensions/internal cross-sectional area of rectangular culverts are provided in construction drawings
4.1.2	Concrete pipes and fittings
4.1.2.1	Concrete pipes are to <ul style="list-style-type: none"> • be precast reinforced units; • be provided in-the-wall with rolling rubber rings; • have a D-load designation of 100D.
4.2.3	Bedding is to be Class B
4.3.3	Pipes are to be laid with an open joint.
4.4.4.3	A single layer of tape is to be applied to the joints on the outside of the manhole.
5.3.1	Stormwater drainage, including manholes, is to be tested in accordance with the requirements of SANS 2001-DP4. The following tests are to be carried out: a) an air test; b) a water test; c) Water drop down test. Visual internal inspection is required. Manholes are to be tested separately from pipelines for water tightness.

11.6.1.11 Building works

Only new and undamaged materials are used in the works. Materials permanently installed in to the works are not used for any temporary purposes on Site. Materials used in accordance with the relevant manufacturer's written recommendations and instructions.

11.6.1.11.1 List of applicable standards

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

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Table 21: List of applicable standards for building works

Code	Description
Materials	
SANS 683	Roof paints
SANS 1090	Aggregates from natural sources - Fine aggregates for plaster and mortar
SANS 10209-1	Concrete floors Part 1: Bases to concrete floors
SANS 10209-2	Concrete floors Part 2: Finishes to concrete floors
SANS 10021	The waterproofing of buildings (including damp-proofing and vapour barrier installation)
SANS 10155	Accuracy in buildings
SANS 10246	Accessibility of buildings to disabled persons
SANS 10305	Painting of buildings
SANS 10313	Protection of structures against lightning
240-56364535	Architectural Design and Green Building Compliance Manual

11.6.1.11.2 Materials and Workmanship

Materials and workmanship, etc., are of the best of their respective kinds. Only new and undamaged materials are used in the works. Works are for the acceptance of the Supervisor and are executed in accordance with the relevant manufacturer's written recommendations and instructions.

11.6.1.11.3 Waterproofing

Damp proofing and waterproofing comply with the Specifications and requirements given. Waterproofing materials are applied in accordance with SANS 10021. All joints in damp-proof course on walls are lapped a minimum of 150 mm except at junctions and corners where the lap is equal the full thickness of the wall.

Insulation is "Sisalation 420" heavy industrial grade aluminium foil based or other accepted insulating sheets.

Table 22: Waterproofing materials

Material	SANS	Type and/or Additional Requirements
Bituminous damp-proof course to wall, sills, etc.	248	Type FV/ as specified on the drawings.
Polyethylene sheet in damp-proof course to walls, sills etc.	952	Type B/ as specified on the drawings
Ditto to floors and basements	952	Type C/ as specified on the drawings
Mastic asphalt for roofing	297	-
Mastic asphalt for damp-proof coursed and tanking	298	-
Bituminous roofing felt	92	Type 60/ as specified on the drawings
Polyethylene sheet for the waterproofing of flat roofs	952	Type A/ as specified on the drawings
Chloroprene rubber sheet (for waterproofing)	580	At least 2.5 mm thick and 1200 mm wide

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Material	SANS	Type and/or Additional Requirements
Sealing compounds with two-component polysulphide base	110	Type 2 Gun Grade/ as specified on the drawings

11.6.1.11.4 Roofing

Roof sheeting is as specified on the architectural drawings; sheeting is free of white rust. Sheets are laid with a side lap of one corrugation (narrow flutes uppermost) and fastened with stainless steel hex-head fasteners to steel unless otherwise described, placed through narrow crowns of sheets at alternate ribs that is one at each side lap and one in middle flute. Side laps are sealed with continuous Seelastick sealing strips and are stitched with sheetbolts or self-tapping screws at maximum 600 mm centres. All fasteners including sheetbolts, inside laps are fitted with round bitumen and flat galvanised steel washers.

11.6.1.11.5 Metalwork

11.6.1.11.5.1 Bolts and Nuts

Bolts and nuts, other than fitted bolts and nuts for friction grip joints, comply with the requirements of SANS 1700 or SANS 1143 as applicable. Nuts are of at least the strength grade appropriate to the grade of bolts or other threaded element with which they are used.

11.6.1.11.5.2 Screwing of Metalwork to Steel, Wood, Concrete, etc.

Where metalwork is described as "screwed" to steel, wood, etc., or "plugged" to brickwork or concrete, descriptions are deemed to include for fixing at not exceeding 500 mm centres, with necessary holes, countersinking, threading, screws, set screws, self-tapping screws and fibre, plastic or metal plugs.

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11.7 Master Document List (MDL)

Kusile Power Station									
DRAWINGS AND SPECIFICATION SCHEDULE									
Doc Code	Rev.	Cust. Doc No.	Title	Action	Actual date	Client receipt date	Client Document status	Client ref letter for doc status	Document status

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11.8 Documentation Requirements for Final Handover

Dossier Chapter	Dossier Sub-Chapter	Dossier Sub-Sub Chapter	Documents for Final Handover
Engineering Documentation	1.6	1.6	Risk Assessments
	1.7	1.7	Non-Conformance Management
Final System Design Package	2C	2.38	Functional Descriptions (Control)
	2A	2.39	Alarm Response Procedures
	2C	2.40	Control System Functional Specification/Design
	2B, 2C, 2D, 2E, 2F	2.41	Design Philosophy
	2A	2.42	Material, Mass & Energy Balance Diagrams
	2C	2.43	Control System IT Architecture
	2C	2.44	Plant Protection Logics
	2B	2.45	Safety Studies
	2B	2.47	Plant System/Process Description
			Technical Tender Evaluation Reports
			Functional Descriptions (Control)
	Operating and Maintenance Documentation	3.6	3.6
3.7		3.7	Operating Instructions
3.8		3.8	Commissioning/Shutdown Procedures
3.9		3.9	Storage and Handling Instructions
3.10		3.10	Installation, Operating & Maintenance Manuals (IOM's)
3.11		3.11	Datasheets and Product Brochures
3.12		3.12	Licences & Approvals (Regulatory, Statutory)
Commissioning Documentation	4.1	4.1	Commissioning Procedure / Manual
	4.2	4.2	Handover Certificate

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

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

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

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

1.9 VDSS

- Please refer to FGD Salt Hold Pad VDSS

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11.8 Quality

- Please refer to Kusile Quality Management Plan (KQMP)

11.9 Electrical Appendices

Appendix A: Electrical Equipment Layout for this project (Sketch)

Appendix B: Eskom Standard Code for Power & Control Cables (Extracted from Eskom drawing 0.00/1310)

Appendix C: Direct Buried Cable Typical Details and Section Cuts (0.90/95563)

Appendix D: Schematic Diagrams [LV Switchgear Sump Pump Direct Online Schematic Diagram (0.90/2532) and LV Switchgear, Typical Circuit Types: SC1, SC8, SC10, SC14, SC16, SC18, SC20, SC 48 Schematic Diagrams (0.90/2532)].

Appendix E: Electrical Services in the vicinity

- TERRACE UNDERGROUND FACILITIES-SITE PLAN- AREA 14 (0.90/157591)
- TERRACE UNDERGROUND FACILITIES-SITE PLAN- AREA 14 (0.90/20093)
- TERRACE UNDERGROUND FACILITIES-SITE PLAN- AREA 14 (0.90/20094)

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