



Scope of Work

Engineering

Title: **KENDAL EMERGENCY DUMP IN-LOADING FACILITY PROJECT - CIVIL & MECHANICAL SOW**

Unique Identifier: *

Alternative Reference Number: **NA**

Area of Applicability: **Kendal Power Station**

Functional Area: **Engineering**

Revision: **00**

Total Pages: **76**

Next Review Date: **NA**

Disclosure Classification: **CONTROLLED DISCLOSURE**

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1. Introduction

Kendal Power Station is situated in Mpumalanga near the town of eMalahleni at coordinates 26.083423 S, 28.9746 E. Construction started in July 1982 and was completed in 1993. The last unit (Unit 6) is due to be decommissioned in 2054 and thus a remaining operating life of 37 years. The Eskom Kendal Power Station Emergency Dump or commonly known as “E-Dump” is located between the Power Station and the existing Ash Dump, just off the Power Station terrace. The facility operates as an emergency discharge and storage of ash if the overland conveying system to the existing continuous Ash Disposal Facility (ADF) is not available. Once the equipment is available again, the ash is loaded onto the overland conveyor system to be conveyed to the ADF. Currently, this area is cleared by means of trucking the ash to ADF, which will be the emergency method of removal of ash in the event that the on-loading conveyor is not available, in order to clear the emergency dump area as quick as possible.

The current E-Dump facility at Kendal Power Station, situated at Transfer House E at the head end of the Transverse ash conveyors (ETK 11/21), is being upgraded from a two (2) day to a seven (7) day mixed ash storage facility. An in-loading facility is required to reclaim the ash from the E-Dump onto the Overland ash conveyors (ETK 12/22). The E-Dump storage facility receives mixed ash from the Transverse ash conveyors (ETK 11/21), by means of a third position on the moving head. The E-Dump facility receives ash during unavailability of both the Overland ash conveyors (ETK 12/22) and when the storage capacity of the Electrostatic Precipitator (ESP) hoppers and fly ash bunkers on the Dust Handling Plant (DHP) are full. The ash is moved by Bulldozers/Front End Loaders (FELs) to facilitate the construction of a temporary ash storage pile.

Ash is recovered from the storage pile when the Overland conveying system (ETK 12 and onward) is available and unloaded. FELs are used to recover the ash from the storage pile and feed the in-loading conveyor that discharges it onto the tail end of the Overland Conveyor (ETK 12) on the overland conveyor system which conveys the mixed ash to the Ash Dump. A basic design assessment was performed for the E-Dump In-loading Facility in order to determine the *works* required accommodating the new In-loading Facility on the upgraded seven (7) day E-Dump mixed ash storage facility. A detailed design should therefore be conducted by the *Contractor* in order to implement the new In-loading Facility.

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2. Supporting Clauses

2.1 Scope

The scope of the works includes the provision of the design, procurement, fabrication, manufacture, factory testing, storage, delivery to Kendal Power Station site, off-loading, erection, installation, site testing, cold and hot commissioning, project management, quality control of an Emergency Dump In-loading Facility for CIVIL & MECHANICAL BMH systems

2.1.1 The Mechanical BMH Scope of works includes:

- Decommissioning and disposal of the existing E-Dump In-loading Facility.
- Detailed design, manufacture, factory testing, supply, delivery, installation, site testing and commissioning of a new E-Dump In-loading Facility for the upgraded E-Dump storage facility at Transfer House 'E'.

2.1.2 Civil and Structural

The Civil and Structural scope of *works* includes:

- Detailed design, manufacture, factory testing, supply, delivery, installation, site testing and commissioning of all Civil and Structural *works* required for the new E-Dump In-loading Facility, which includes:
 - In-loading Facility surface bed, structures, steelwork, plinths and foundations.
 - Loading ramps with side safety barriers.
 - Tail section temporary barriers.
 - V-drain channel underneath In-loading Facility.
 - Drive unit associated supporting structures, MCC Panel foundations, cable trenches, earth grid/mesh and cables tunnel/servitudes where necessary.

2.1.3 Purpose

The purpose of this document is to capture the detailed requirements for mechanical scope for e-dump in-loading facility project.

2.1.4 Applicability

This document is applicable, but not limited, to all stakeholders identified within this report. This includes, among others, individuals within Kendal Power Station Engineering, Maintenance and Operating.

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2.2 NORMATIVE / INFORMATIVE REFERENCES

2.2.1 Normative

- [1] ISO 9001: Quality Management Systems.
- [2] ISO 14001: Environmental management Policy
- [3] ISO 7919: Mechanical Vibrations

2.2.2 Informative

- [4] 240-53114002: Engineering Change Management Procedure.
- [5] 36-667 Generation Division Project Management Policy
- [6] 36-40 Plant Asset Management Directive
- [7] 36-155 Generation Project Execution Model and Reference Book (Project Model) Manual
- [8] 36-300 Project and Outage Risk Management Guideline
- [9] *1017523 Kendal Power Station Business Roles and Responsibilities
- [10] ESKASAAA3 Approval of personnel performing quality related special processes on all Eskom plant

2.3 Definitions

Term	Definition
Contractor	In the context of this document, the “Contractor” will be regarded as the service provider who is authorised by the station to execute the specific work outlined in this document.
Employer	In the content of this document, the “Employer” will be regarded as the Eskom power plant receiving the service from the Contractor.

2.3.1 Classification

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

2.4 Abbreviations and Acronyms

Abbreviation	Description
A	Ampere
ADF	Ash Disposal Facility
AFC	Approved for construction
BoD	Basis of Design
BMH	Bulk Materials Handling
CIDB	Construction Industry Development Board
C&I	Control & Instrumentation
C-value or C ₁	Run-off coefficient
DB	Distribution Board
DSO	Dam Safety Office

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Abbreviation	Description
FEL	Front End Loaders
FoS	Factor of Safety
FSL	Full Supply Level
FTA	Field Termination Assembly
GAA	Golder Associates Africa
GN	Government Notice
Ha	Hectare
HDPE	High Density Poly Ethylene
HECU	Head End Control Unit
H&S	Health & Safety
IEC	International Electrotechnical Commission
ITP	Inspection Test Plan
JGA	Jeffares Green Africa
KKS	Kraftwerk Kennzeichen system (Power Plant Classification System)
kVA	kilo Volt Ampere
LOSS	Limits of Supply and Services
LT	Low Tension
M	Metre
Mm	Millimetre
m.a.m.s.l.	Metres above mean sea level
MCC	Motor Control Centre
QCP	Quality Control Plan
RDF	Recommended Design Flood
RO	Reverse Osmosis
RP	Return Period
SANS	South African National Standards
UHMWPE	Ultra-High Molecular Weight Polyethylene
UV	Ultraviolet
V	Volt
WUL	Water Use Licence
SEF	Safety Evaluation Flood
WULA	Water Use Licence Application

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2.5 Roles and Responsibilities

Each department plays a pivotal role in making sure that projects are successful and systems are returned to service on time, and efficiently. Refer to the Kendal Power Station business Organisation Roles and Responsibilities *1017523. The roles and responsibilities of each department are summarised below:

2.5.1 Projects Department

- Implement projects in line with the planned programme
- Management of contract services for the projects
- Ensure quality control of activities during projects
- Management of time cost and quality of projects

2.5.2 Contractor

- The responsibilities of the contractor are as per NEC, compliance to the scope and the relevant standards.

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3. Works Information

The works information is outlined in the sections below.

3.1 Plant Overview

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

The *Contractor* is responsible to incorporate the information in this section into the design that he conducts.

3.2 Detailed Scope Requirements

The new In-loading Facility will be a Movable Head Feeder Belt constructed on the upgraded seven (7) day mixed ash E-Dump storage facility. It will replace the existing In-loading Facility, which must be decommissioned. The general layout of the new Facility can be seen on the figure below.

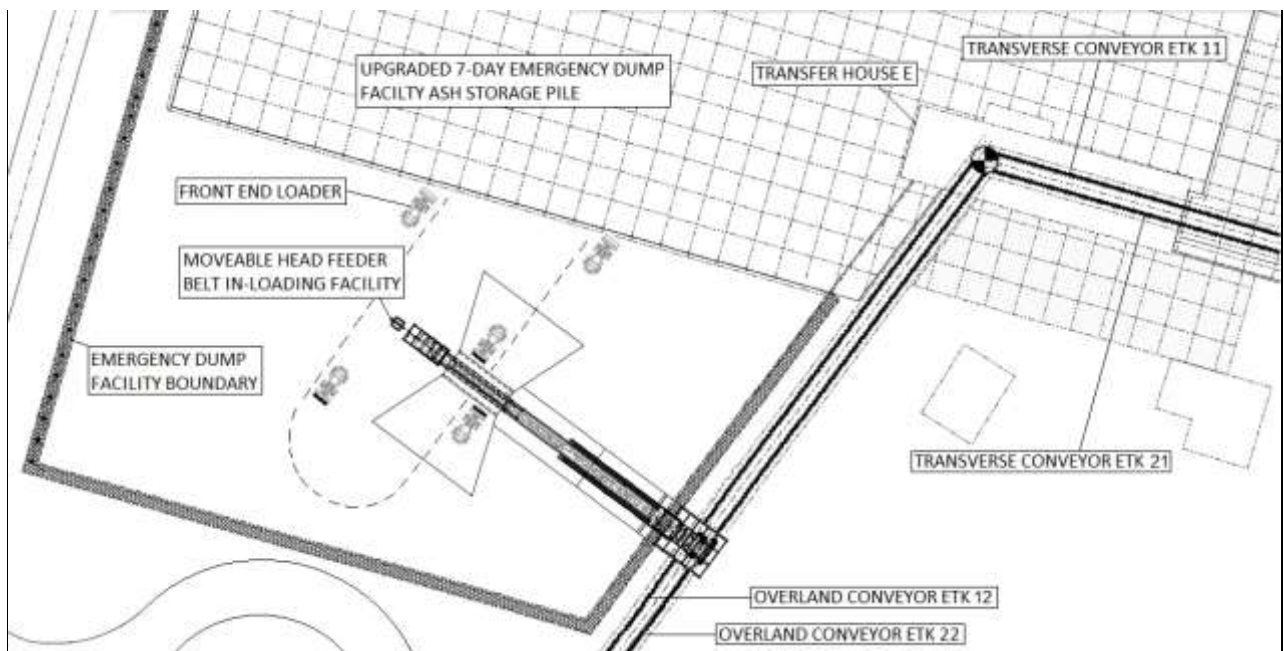


Figure 1: General Layout of In-loading Feeder Belt on the Upgraded E-Dump

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- Mixed ash will be discharged onto the E-Dump Facility slab, utilizing the third moveable head position of either of the Transverse conveyors (ETK 11/21) at Transfer House 'E'.
- The dumped ash will be dozed into position to shape the seven (7) day ash storage pile on the upgraded E-Dump.
- FELs will be utilized to collect the ash from the storage pile and load the Moveable Head Feeder Belt in-loading hopper.
- The Moveable Head Feeder Belt shall be constructed perpendicular to the existing Overland ash conveyors at a distance of approx. 100 m from Transfer House 'E' centre point in order to be positioned in close proximity to the upgraded ash storage pile.
- The Feeder Belt shall be equipped with an in-loading hopper that can be loaded with up to four (4) FELs at a time in order to achieve a constant feed rate of approx. 800 t/h.
- The Feeder Belt moveable head capability will facilitate discharge onto either of the Overland conveyors.

The Moveable Head Feeder Belt will incorporate:

- A balanced moveable head for discharge onto either Overland conveyor (ETK 12/22).
- Reversible motorised winch for positioning of the moveable head.
- In-loading hopper enabling loading from two (2) FELs from either side of the hopper.
- Loading ramps on either side of the in-loading hopper for FELs.
- Tail end barrier for protection of the In-loading Facility.
- A wash down V-drain along the full length of the Feeder Belt from the retaining wall.
- Feeder Belt cross-over structure at the head end of conveyor incorporating stairs and car ladders for access on either side of the In-loading Facility.
- Standard components, used on the existing systems on the station will include:
 - EP 2000, 4 ply fabric reinforced conveyor belt (with belt loading facility),
 - T-Bottom pulleys with pulley diameter 700 mm, main shaft diameter 240 mm, bearing shaft diameter 220 mm, face width of 2.3 m and bearing centre distance of 3 m,
 - Carry idlers with three (3) roll, 152 mm diameter, series 40,
 - Return idlers with two (2) roll, 152 mm diameter, series 40.
- A gravity take-up system.

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3.3 Employer's Basic Design

The *Employer's* Basic Design is limited to preliminary designs for the new Moveable Head Feeder Belt In-loading Facility on the upgraded E-Dump facility along with general component upgrades of the *works*. These preliminary designs are intended to provide the *Contractor* with a workable design and to serve as a basis for the Contract.

The *Employer's* design is provided in the form of the following information:

- Mechanical, Electrical, Control and Instrumentation: Multidiscipline Basic Design Report (see report 379-KEN-BDDD-D00185-2 in Appendix A)
- Mechanical: Ash Overland Conveyors (ETK 12 & 22) Design Review Report (see report 474-10897 in Appendix A)
- Civil: Basic & Detailed Design Report (see report 15067-45-Rep-001 in Appendix A)

The *Contractor* is responsible to verify all details provided in the *Employer's* design and incorporate these into the *Contractor's* design documents to be submitted as specified.

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3.3.1 *Contractors* Scope of works

3.3.1.1 Bulk Materials Handling

Deliverables of the *Contractor* should include but shall not be limited to the following:

- a) Decommissioning of the existing In-loading Facility within the programming constraints of the civil and mechanical. The piling and disposal of all materials on site as part of the decommissioning of the In-loading Facility shall also be the responsibility of the *Contractor*.
- b) Review the existing Mechanical Basic Design Report and provide Detail design, selection, procurement, fabrication, workshop assembly, corrosion protection, testing, inspection, quality assurance, labelling, packing, delivery to site, erection of entire facility, project management, cold and hot commissioning of the entire mechanical engineering *works* to ensure fully functional In-loading Facility.
- c) All the related structural steelwork, civil foundations and mechanical equipment necessary to provide complete and fully functional In-loading Facility.
- d) Discharge chutes onto and modifications required on the existing Overland conveyors (ETK 12/22).
- e) Design, supply, install, commission all required drive systems and winch systems on the new In-loading Facility.
- f) Update the detail design documentation as per the comments received from the *Project Manager*.
- g) As built General Arrangement (GA) [according to 36-943], Layout and detail drawings (2D) [according to 36-943] of the designed conveyor system and all relevant infrastructures with documentation [according to 240-53113685].
- h) Validation of civil *works* for new In-loading Facility area surface bed, retaining walls and temporary barriers interfaced with new In-loading Facility.
- i) Provision of four (4) sets of operating and maintenance manuals and one electronic copy provided according to *Employer's* specifications, GGSS 1423.
- j) Provide a Quality Control Plan (QCP) for approval by the *Employer*.
- k) Detail codification and labelling of all additional equipment according to *Eskom* KKS configuration system and drawing no. 0.64/14507
- l) Interfacing with other discipline *Contractors* during the construction and commissioning phases.
- m) Training of *Eskom* personnel for operation and maintenance.
- n) HAZOP Study to be conducted of the feeder conveyor and submitted to the *Employer* according to 240-49230111.

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- o) FMEA Study to be conducted of the feeder conveyor and submitted to the *Employer* according to 240-49230046.
- p) Guards shall be installed.
- q) Maintainability and accessibility study to be conducted by the *Contractor*.

All the above activities shall hereafter be referred to as the civil & mechanical *works*.

3.3.1.2 General Requirements

The *Contractor* must comply with the following general requirements:

1. All designs shall be submitted to the *Project Manager* and approved by a suitably qualified competent person in the relevant engineering discipline for acceptance. The *Employer's* Project Life Cycle Model [according to 32-1155] and the Design Review Procedure [according to 240-53113685] must be followed during the project.
2. GA and layout drawings of the new proposed In-loading Facility are provided for information purposes only. It will be the responsibility of the successful tenderer to compile detail design drawings for construction purposes.
3. It will be the responsibility of the successful tenderer to validate the correctness and completeness of civil *works* in the new In-loading Facility area for Phase 1 and 2 of construction on the E-Dump before starting construction.
4. All manufacturers of equipment required to adhere to SANS standards shall be SABS permit holders.
5. Provision of all scaffolding, site crainage, lifting equipment, etc. which shall be required during the *works*, shall be provided for by the *Contractor*.
6. All consumables etc. shall be included under miscellaneous items.
7. The *Contractor* shall install all equipment for ease of maintenance and accessibility.

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3.3.1.3 Moveable Head Feeder

The scope of work to accomplish a fully functional In-loading Facility shall include, but not be limited to the following equipment:

Design, supply, fabricate, install and commission:

- a) New In-loading Facility in the proposed In-loading Facility area. Survey of the In-loading Facility final position shall be the responsibility of the *Contractor*.
- b) In-loading Facility hopper with ultra-high molecular weight polyethylene (UHMWPE) liners and support structure with four (4) loading positions, two (2) either side of the In-loading Facility.
- c) Drive system at In-loading Facility head end to include:
 - o Fix speed motor
 - o High speed fluid coupling
 - o Gearbox
 - o High and low speed connection couplings
 - o Torque arm drive base frame
 - o Guards
 - o Earthing lugs
- d) Discharge chute arrangement with top moveable head chute section and bottom fixed chute sections, at existing Overland conveyors' (ETK 12/22) loading points, for two (2) position moveable head positioned via a reversible motorised winch system at the head end of the In-loading Facility.
- e) Install standard conveyor off-set troughing carry frames and idlers. Idlers shall be three (3) roll, 152 mm diameter, series 40 and 35 degree trough angle.
- f) Install standard conveyor V-return frames and idlers. Idlers shall be two (2) roll, 152 mm diameter, series 40 and 10 degree trough angle.
- g) Transition idlers at the transition ends and vertical curves of the In-loading Facility feeder for specific transition configurations.
- h) Impacts idlers and skirt plates at In-loading Facility hopper load point and existing Overland conveyors (ETK 12/22) loading points.
- i) All required standard conveyor pulleys complete with plummer blocks and bearings.
- j) 2 100 mm wide EP 2 000, 4 ply fabric reinforced conveyor belt. Feeder belt to comply with standard station T4 coal feeder system and include a conveyor belt loading facility.
- k) Gravity take-up arrangement and counterweight mass with maintenance winch installed on a take-up platform at the tail end of the In-loading Facility.

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- l) One (1) primary and two (2) secondary belt scrapers at the head end (drive) for belt cleaning during normal operation of the In-loading Facility.
- m) One (1) diagonal plough on the return side of the feeder belt before entry of the tail pulley.
- n) Optimization of the drive assembly by lining the In-loading Facility drive pulley with ceramic lagging. All other pulleys to be lined with diamond grooved rubber lagging.
- o) Earthing and lighting protection on the In-loading Facility structure according to the earthing and lighting standard
- p) Sufficient access must be provided to operate and maintain all equipment. Access platform as part of In-loading Facility head end structure to be provided with stairs and cat ladder on either side of the In-loading Facility
- q) Access corridors on either side of the in-loading hopper (between the hopper and the in-loading ramps) to be provided, to facilitate inspection of feeder belt equipment at tail end, while operation of the In-loading Facility can continue
- r) Permanent maintenance access to the moveable head positioning winch system and discharge chutes at the head end of the In-loading Facility must also be provided as well as access to the take-up winch system.
- s) Permanent operating access to the standalone control panel, to be fitted on the In-loading Facility structure, must be provided.
- t) Self-training idlers to be provided

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3.4 IN-LOADING FACILITY SPECIFICATIONS

3.5 OVERVIEW

The In-loading Facility is designed as a 100% utilized Moveable Head Feeder Belt emergency system, capable of supplying a constant feed rate of 800 t/h utilizing the feed from multiple FELs.

3.5.1 Function

The function of the In-loading Facility shall be to convey mixed ash from the upgraded E-Dump storage facility and discharge onto either of the existing Overland conveyors (ETK 12/22).

3.5.2 Performance Requirements for In-loading Facility

The following In-loading Facility feeder belt conveyor system performance requirements are indicated as per the *Employer's* Basic Design assessment

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3.5.2.1 Performance Requirements

Table 1: Ash Systems Performance Requirements

System	Performance Requirement	Value
In-loading Facility	Maximum Allowable Belt Speed	1 m/s
	Design Capacity	800 t/h
Overland Conveyors	Belt Speed	3.5 m/s
	Design Capacity	1 865 t/h

3.5.2.2 Material Properties

Material	: Mixed ash
Size	: +0 to -100 mm
Conveyor section bulk density	: 850 kg/m ³
Moisture content	: 20%
Angle of repose	: 45°
Effective angle of internal friction, δ	: 55°
Min ash temperature	: -6 °C

3.5.2.3 In-loading Hopper Requirements

Minimum storage capacity	: 60 tonnes
Hopper bulk density	: 950 kg/m ³
Hopper half angle, α	: 25°
Wall friction angle, ϕ	: 23°
Clearance at rear of hopper, y_c	: 0.1 m
Velocity distribution @ hopper exit, C_e	: 0.5
Volumetric efficiency, η_v	: 0.75
Feeder angle at hopper, θ_f	: 0°

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3.5.3 Operating Philosophy

The E-Dump storage facility will be utilized when both the Overland conveyor systems (ETK 12/22) are not available and storage capacity in the ESP hoppers and fly ash bunkers are full. The new In-loading Facility will recover the backlog ash from the E-Dump storage facility when the Overland ash conveyor systems are back in operation.

The new In-loading Facility drive system operation and moveable head positioning function will be operated from a local control standalone panel with a push button stop/start control on the Feeder Belt structure at a central operating position. The following mode of operating will be available for the Feeder Belt:

- Manual start-up of the new In-loading Facility will only be possible, if the moving head is selected on a running overland conveyor system. .
 - It is the new In-loading Facility operator's responsibility to check that the Overland conveyor being loaded onto is completely empty (not receiving ash loads from the station units).
 - The selected moveable head position (for the operational Overland conveyor selected) and take-up counterweight must make limit in order for the In-loading Facility to start-up.
 - The new In-loading Facility will trip if the receiving Overland conveyor trips or any of the conventional conveyor system belt protections are triggered.

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3.6 CIVIL AND STRUCTURAL

The In-loading Facility will be constructed on a prepared surface bed within the In-loading Facility area. Deliverables of the *Contractor* should include but shall not be limited to the following:

- a) Review the existing Civil: Basic & Detailed Design Report and Mechanical Basic Design Report in order to provide Detail design, selection, procurement, fabrication, workshop assembly, corrosion protection, testing, inspection, quality assurance, labelling, packing, delivery to site, erection of entire facility, project management, cold and hot commissioning of the entire civil and structural *works* required for the new In-loading Facility to ensure a fully functional In-loading Facility.
- b) The existing Civil surface bed design must be verified for the requirements of the new In-loading Facility and if upgrades are required in the area demarcated for the new in-loading, the *Contractor* is responsible to complete the civil and structural *works* required.
- c) Design, supply, install, commission:
 - Hopper loading ramps with side safety barriers at a maximum inclination angle of 10°.
 - Tail section (of the In-loading Facility) temporary barrier (see drawing no. TD-S-P-1001-V1)
 - V-drain channel/s underneath In-loading Facility for the diversion of wash water runoff.

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3.7 PARTS OF THE WORKS WHICH THE CONTRACTOR IS TO DESIGN

3.7.1 Bulk Materials Handling

The Contractor shall provide the detail design of the Bulk Materials Handling works for the new In-loading Facility on the upgraded E-Dump facility at Transfer House 'E'.

NOTE: THE SPECIFICATIONS IN THIS SECTION ARE BASED ON BASIC DESIGN; THE FINAL DESIGN REMAINS THE RESPONSIBILITY OF THE CONTRACTOR.

3.7.1.1 In-loading Facility Feeder Belt Conveyors

In the event of a conflict between requirements, the Engineer shall decide which shall apply. Any deviation from these requirements shall be clearly stated in writing. Absence of such statements shall be interpreted to mean that the offer is in compliance with these requirements.

ALL COMPONENTS AND MATERIALS OF CONSTRUCTION SHALL BE NEW.

3.7.1.2 General

THE INFORMATION INCLUDED IN THIS SCOPE OF WORK IS BASED ON A BASIC DESIGN; THE FINAL DETAIL DESIGN SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

- a. The Contractor shall be responsible for all the aspects of the final design and Plant layout and details. The detail design and layout of the Plant shall limit spillages, dust generation or accumulation of conveyed material at any point to a minimum. Adequate access for inspection, cleaning, maintenance and repairs shall be provided in the Plant layout and facilities.
- b. The feeder belt In-loading Facility shall be capable of being started and stopped under fully loaded conditions. The selection of all components and motors shall also be based on their suitability for maximum duty conditions applicable to the specific component.
- c. The Contractor shall submit the detail design of the feeder belt In-loading Facility with its associated components to the Project Manager for evaluation. All the belt tensions shall be indicated clearly for different operating conditions.
- d. The Plant shall be of weatherproof construction, suitable for outdoors operation in climatic conditions prevailing at site, without undue maintenance and deterioration. Emphasis shall be placed on the selection of primary devices, control panels, etc. to ensure that unnecessary/spurious trips are eliminated.
- e. The entire Plant i.e. mechanical, electrical, control and instrumentation, etc. equipment shall be designed to be cleaned by water washing at a pressure of up to 10 bar, without impairing the performance of any component. All components shall be designed for operation in a dusty and wet environment.
- f. The nature of the ash handled is extremely abrasive and utmost consideration shall be given to the design of sealing arrangements, selection of materials, bearings, etc. throughout the Plant.
- g. Full accessibility shall be provided for maintenance and replacement of component parts on all equipment. Jacking/lifting points shall be provided to facilitate replacement of components, if necessary.

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- h. The system design, including all components, shall be approved by the Project Manager.
- i. Lubrication components to have lubrication access for maintenance to lubricate it.
- j. The feeder belt In-loading Facility shall be designed to have the expected operational life of the station from the dates of commercial operation, with a current remaining station life of 37 years.
- k. All components, requiring removal for maintenance purposes during its life, who's mass exceeds 50 kg shall be fitted with lifting lugs.
- l. At all discharge positions the sealing under all loading points must be maintained by reduced impact idler pitch.
- m. All feeder belt In-loading Facility mechanical equipment shall comply with the Employer's standard, 240-55864503.
- n. Standardisation of specifications of equipment utilised throughout the system shall be provided as far as practically. Latest version of specifications/standards shall be utilised.

3.7.1.3 Feeder Belt Conveyor Design

- The Contractor is required to carry out all design required for the works. Submit the Contractor's design calculations, drawings and other documents to the Project Manager for review.
- The Contractor assumes final responsibility to ensure that the works comply with all requirements of the Works Information, and any other governing laws or codes. Compliance with the Works Information does not relieve the Contractor of this responsibility.

3.7.1.4 Design Method

Feeder belt conveyor design calculations carried out in accordance with ISO 5048:1989 and other suitable method that includes consideration of transient conditions (starting and stopping, etc).

FEEDER BELT CONVEYOR DESIGN CALCULATION MUST DEMONSTRATE THAT THE SUBSTANTIAL SHEAR FORCES AT THE LOADING ZONE/INTERFACES HAVE BEEN CONSIDERED.

3.7.1.5 Load Cases

The design includes consideration of all possible load cases and changes in geometry (e.g. furthest moveable head position) including, but not limited to:

- Empty belt
- Partly loaded belt
- Fully loaded belt (at design capacity)
- High and low friction cases
- Empty loading hopper
- Partly loaded hopper
- Fully loaded hopper

The design includes consideration of the following operating conditions:

- Normal operation
- Initial starting
- Operational stop
- Aborted stop

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3.7.1.6 Belt Loading, Speed and Width

The Contractor detail design must comply with the specifications indicated as per the Employer's Basic Design assessment.

The follow specifications are indicated:

- The In-loading Facility must be able to supply an instantaneous and continuous load of 800 t/h.
- The feeder belt conveyor maximum allowable running speed is 1 m/s.
- The feeder belt conveyor width must be 2.1 m in order to standardize with existing T4 coal feeder conveyor systems on the plant.
- The maximum allowable belt loading shall be limited to 80% of ISO 5048:1989, at a material surcharge angle of 5° and material density of 850 kg/m³.

3.7.1.7 Friction Factor

- All applicable friction factors are to be considered in the design.
- The artificial friction factor in the DIN/ISO methods may be used, subject to the limitations described in these codes.
- The minimum recommended value of the coefficient is 0.025.
- It is recommended that this be verified during detail design in the implementation phase where these resistances can play a significant role.

3.7.1.8 Take-Up Tension

The take-up tension is selected to:

Maintain the required slack side tension on the drive pulley to ensure that slip do not occur when accelerating or stopping under any design load condition.

Ensure that the belt sag between adjacent idlers does not exceed 1.5% during normal operation, 2% during transient conditions and 5% during coasting.

Take the following factors into account when calculating the take-up mass:

- The friction factor between the belt and pulley lagging
- The horizontal distance between the drive and the take-up
- The force to overcome friction of belt, hopper load section material shear force, skirt plates, idlers and pulleys between drive and take-up
- The force required to accelerate the belt, hopper load section material shear force, idlers and pulleys between the drive and take-up
- The efficiency and arrangement of the take-up mechanism

3.7.1.9 Drive Power and Starting

In general the minimum installed motor power has a minimum of 20% safety margin on the maximum required absorbed motor power. Select the closest IEC standard rated motors above this value. Standardization with existing LV switchgear supply limits must also be taken into consideration.

3.7.1.10 Feeder Belt Conveyor Length

The Feeder Belt conveyor length between pulley centre-to-centre distances, including the gravity take-up system and temporary barrier structures, must allow for FELs to be able to travel in both directions between the In-loading Facility and civil retaining walls on the upgraded E-Dump in order to load on both sides of the In-loading Facility hopper.

3.7.1.11 Overland Conveyors Loading Position

The Feeder Belt conveyor final loading position over the existing Overland ash conveyors (ETK 12/22) must enable sufficient space for the FELs operations on the upgraded E-Dump facility to enable loading on both sides of the In-loading Facility hopper, while limiting the unutilized storage space provided on the E-Dump facility where ash can be stored.

FEL operations include collection and dumping/relocation of ash on the E-Dump and discharging of ash into the In-loading Facility hopper.

3.7.1.12 Inclination angles

The Feeder Belt conveyor layout has to comply with the following requirements:

- Horizontal feeder belt conveyor hopper loading points at the tail end of the conveyor wherever practical in order to minimize FEL's loading heights and cycle times. Where this is not possible or is impractical, the inclination angle at the load point should not exceed 5°.
- Horizontal feeder belt conveyor discharge points wherever practical which includes: Discharge between different conveyors, discharge utilizing moveable heads.
- The maximum allowable inclination angle is 11°.

3.7.1.13 Vertical Curves

Select concave curves to prevent excessive centre tension or edge buckling of the belt and so that the empty belt do not lift off the idlers. Provide suitable rollers to limit the lift of unloaded belts where it is not practical to achieve this (e.g. trippers on major equipment).

Select convex curves to prevent excessive idler pressure, excessive belt edge tension or to prevent centre buckling of the belt.

3.7.1.14 Transitions

Select the length and shape of the transition from trough to flat belt such that the following belt tension limitations are not exceeded under any design load conditions.

Select the idler pitch at transitions such that any increase in idler bearing loads due to the transition geometry, do not reduce the specified L10 life of the bearings.

3.7.2 Feeder Belt Conveyor System

- a. Shall conform to requirements set out in the Employer's standards, 240-55864504 and 240-55864505.
- b. The In-loading Facility feeder belt structure shall be a fixed permanent structure on steel foundations, installed on a prepared surface bed in the allocated In-loading Facility area
- c. The drive unit shall be located at the head of the feeder belt and the gravity take-up shall be located at the tail end.
- d. One (1) loading point shall be located directly underneath the in-loading hopper. One (1) loading point shall be positioned on either of the existing Overland conveyors (ETK 12&22).

3.7.3 Feeder Belt Conveyor Drive Unit

3.7.3.1 General

- All drive unit components shall conform to requirements set out in the Employer's standard, 240-55864503.
- Design all drive unit components for heavy duty mining application, to allow the drive assembly to achieve a service life of at least 50 years, with due consideration for fatigue and wear factors.
- Drive unit assemblies include the following major components mounted on a common base frame:
 - Motor
 - Fluid Coupling
 - High Speed Connection Coupling
 - Gearbox
 - Rigid Low Speed Coupling
 - Torque Reaction Arm
 - Guards
 - 2 separate earthing lugs
- Select all bearings in drive assembly equipment, including but not limited to reducers and fluid couplings for an L10 life of 100 000 hours for both directions of rotation. Calculate bearing life on installed motor power.
- Torque arm mount drive unit assemblies to the conveyor drive pulley via a rigid coupling. Hollow shaft connection to the conveyor drive pulley is not permitted.
- Ensure that all drive components are sourced through Southern African agents to ensure local support during commissioning and throughout the life of the equipment.
- Assemble all free issue and/or sub-supplier components to strict conformity to the suppliers' installation instructions.

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3.7.3.2 Motor

- The motor is a free issue item within the selected drive unit in accordance with IEC standard rated motors.
- The Contractor's detail design calculations should indicate that a minimum installed motor power of 20% safety margin on the maximum required absorbed power is achieved and the closest IEC standard motor size above this value must be selected.

3.7.4 Fluid Couplings

3.7.4.1 Fluid Couplings General Requirements

Fluid couplings are specified as constant fill; coupling type and size must be selected based on:

- Shall conform to requirements set out in the Employer's standard, 240-55864498.
- Select fluid coupling type and size based on the installed motor power and torque, the required conveyor system transferred inertia and standardization with the existing conveyor drive unit's fluid couplings. Limit transmitted torque through delay fill to the specified level for each conveyor by appropriate selection of the fluid fill level and nozzle combination.
- Use bi-directional fluid couplings (i.e. motor rotation clockwise or anti clockwise).
- Ensure that the couplings have an external facility for adjusting the torque behaviour during commissioning and/or operation.
- Balance the coupling assembly in accordance with ISO 1940.
- Use mineral oil in all fluid couplings. Use the same grade of fluid in all couplings throughout the year and under all ambient conditions.

3.7.4.2 Fluid Coupling Performance Requirements

- Ensure that fluid couplings are suitable for operation to the specified minimum (-6 °C) and maximum ambient conditions (40 °C).
- Provide modelled start-up curves of each application to demonstrate the performance of the coupling and cooling system to handle multiple loaded starts.
- Incorporate primary thermal protection in all fluid couplings in the form of a BTS, non-contacting Thermal Switch Unit, to monitor the temperature of the couplings. Operate the thermal switch at approximately 160 °C. Ensure that the thermal switch can be reset without the replacement of parts. Ensure that secondary protection is fusible plugs operate at approximately 180 °C.
- Ensure sufficient thermal capacity to allow the fluid couplings to have a minimum of six (6) multiple starts and three (3) consecutive starts from the normal working equilibrium temperature under full load conditions. Ensure that the temperature achieved at completion of these starts (Tmax) does not exceed the thermal switch setting temperature. In addition ensure that the coupling is capable of sufficient cooling from Tmax during a 10 minute period of steady full load running to allow a further full load start such that the coupling temperature achieved at the end of this additional start does not exceed the original Tmax temperature as defined above.
- Ensure that during acceleration of the motor, the torque/speed curve of the coupling at no stage intersects the torque/speed curve of the motor before peak motor torque has been developed. Submit the torque characteristic curves for fluid couplings to the Project Manager.
- Do not exceed 3% coupling slip when running under full load conditions at the specified oil level.

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3.7.4.3 Fluid Coupling Configuration Requirements

- Ensure that fluid couplings are externally driven and self-supported from their own bearing chassis.
- Buffer Roller couplings must be utilised to connect the fluid coupling to the motor and gearbox.
- Ensure that couplings are capable of being removed from between the motor and gearbox without disturbing the location and alignment of either the motor or gearbox.
- Provide a nameplate adjacent to the coupling that specifies the oil type and quantity required as well as nozzle size and quantity installed. Ensure that the nameplate gives the correct oil fill level as the height measured from the drive base top surface to the housing site glass when the site glass is aligned with the correct fill level or a similar simple method recommended by the manufacturer.

3.7.5 Gearboxes

3.7.5.1 General

- Ensure that gearboxes are suitable for continuous 24 hour operation for the specified minimum (-6 °C) and maximum ambient conditions (40 °C) based on installed motor power. Submit calculations supporting the design of all gearboxes to the Project Manager.
- Ensure that all gearboxes run in the factory on no-load at the maximum input speed for minimum four (4) hours, during which noise, backlash, tightness and contact reflection are monitored and recorded and after which the temperature rise is checked and general leaks etc. repaired.
- Ensure that thermal capacities of gearboxes are at least the same as the respective motor, allowing for constant power transmission and ignoring the overload factor.
- Supply the conveyor gearboxes with provision for fitment of all required condition monitoring sensors.
- Ensure that due regard is given to loads imposed on gearbox shafts due to other equipment such as brake components and fluid couplings.
- Submit full bearing life calculations to the Project Manager.
- Construct gear casings from GGG40 SG Iron to the manufacturer's standard design, and ensure that gear casings are oil tight, watertight against water sprays, hosing and weather, dust proof and of robust design.
- Stress relieve fabricated gearboxes prior to machining of joining faces and boring for gear assemblies. Ensure that cast gearboxes are sound and show no sign of porosity. Ensure that gearboxes are horizontally split for ease of assembly and maintenance. Ensure that gearboxes are suitable for reassembly in either a left or right-handed configuration. Make provision in the casing design for horizontal alignment of the gearbox in longitudinal and transverse direction, as well as vertical adjustment.
- Provide gearbox casings with lifting lugs. Provide mounting areas for attachment of vibration monitoring transducers adjacent to all bearings. The vibration transducers may be either fixed or temporary magnet mounted type. Ensure that access to the measurement positions is not inhibited by guards or other fabricated items associated with the equipment.
- Provide a ½ " BSP drilled and tapped connection for installation of a temperature transducer. Ensure that the connection is such that the transducer oil well is covered with oil and ensure the hole is plugged.
- Arrange all gearboxes so that the gears and bearings that they enclose are splash lubricated automatically using mineral oil.
- Permanently protect exposed sections of shafts against corrosion with an approved coatings system.

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3.7.6 Housings

- The gear housing shall be provided with a suitable breather. Ensure that breather vents do not allow the discharge of oil under any circumstances when the gearbox is filled with the correct quantity of oil.
- Fit both the input and output shafts with taconite seals whilst all joint faces, inspection covers and bearing covers must be fitted with gaskets to maintain oil tightness.
- Make all elastomeric components of shaft seals from "Viton" material. Ensure oil seals are capable of withstanding all pressure fluctuations within the gearbox.
- Ensure that drainage facilities include a stop valve and plug located in an easily accessible position to allow drainage and catchment of oil without spillage.
- Paint the inner surface of the gearbox casing using a suitable oil resistant protective treatment. Similarly treat non-contacting surfaces of internal mechanical items.
- Guards shall be provided for cooling fans.
- Have a facility for NDT at bearings without requirement to remove guards.

3.7.7 Design Parameters

- The gearbox shall be selected on the basis of 1.5 times the absorbed motor power or 1.25 times the installed motor power, whichever is the greater.
- Rate gear sets for 100 000 hours life to AGMA standards for both directions of rotation based on installed motor power. Ensure that in addition to the requirements stated in AGMA 6010 – F97, all gearing are capable of safely withstanding not less than the full stalled torque of the drive motor applied twice in direct succession. Ensure that when the braking torque is applied to the high speed shaft and the braking torque exceeds the starting torque, the braking torque is considered in the selection of the gearbox.

3.7.8 Lubrication

- Select gearboxes with a thermal rating that avoids the use of supplementary cooling in the form of a fan fitted to the input shaft. If supplementary cooling cannot be avoided then input shaft mounted fan cooling is used. Prior approval for the use of input shaft mounted fan cooling is required from the Project Manager's.
- In addition to any of the manufacturers recommended products that have been approved by Eskom, the following standards shall apply:
- SABS 053, SABS 344, SABS 351, SABS 406, SABS 1014, BS 1399.

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3.7.9 Couplings (Non-Fluid)

3.7.9.1 Couplings (Non-Fluid Type) General Requirements

- Ensure that couplings are selected to allow for the expected shock load and misalignment. Ensure that the minimum service factor is three times full load motor torque corrected for gear ratio or stalled motor torque corrected for gear ratio, whichever is greater.
- Ensure that couplings are installed within the manufacturers axial and radial tolerances and consequently the couplings shall be machined to allow measurement of such tolerances.
- Ensure that the coupling torque rating exceeds the required braking torque of the driven equipment.
- Machine coupling bores concentric with the coupling body. Attached couplings to their shafts using a light interference fit equal to H7 P6, as defined in ISO 286, and a rectangular parallel key in accordance with ANSI/AGMA 9112-A04 Bores and Keyways for Flexible Couplings (Metric Series).
- Dynamically balance couplings operating above 500 rpm speed. Statically balance low speed couplings. Balance couplings in accordance with ISO 1940. Ensure that the balance quality grade is selected to suit the particular application in accordance with ISO 1940.

3.7.9.2 Flexible Couplings

- Use Buffer Roller rubber element type flexible couplings on gearbox input shafts and fluid coupling input shafts. Buffer Roller couplings comprise of two separate flanges bolted together, each with an inner and outer ring connected together by flexible buffer roller inserts.
- Size the couplings and buffer inserts correctly for the normal operating loads and transient loads that occur during stopping and starting.

3.7.9.3 Rigid Couplings

Shall conform to requirements set out in the Employer's standard, 240-55864503.

Use rigid couplings on gearbox output shafts and drive pulley input shafts.

Condition Monitoring

Provide condition monitoring sensors for the conveyor drives for:

- Drive
- DE & NDE Bearing Temperatures
- Motor Winding Temperatures
- Fluid Coupling Temperature
- Gearbox
- Oil Level
- Oil Temperature
- DE & NDE Vibrations

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3.7.10 Base Frames

- The base frame may be fabricated or cast. Ensure that the baseplate is sufficiently rigid in all directions to withstand the static and dynamic loading of the equipment, including transport and erection forces
- Design drive bases such that ponding of rainwater does not occur. Ensure that fabricated drive bases are continuously seal welded to prevent corrosion and any enclosed areas that cannot be satisfactorily abrasive blast cleaned and painted are sealed.
- Ensure that the finished surface and profile of all welding is smooth and free from sharp edges or crevices that are detrimental to the performance of the drive baseplate or to the protective treatment.
- For shaft mounted drive bases, provide the torque arm with a flexible connection between the drive base and foundation, designed to transmit all loads generated by the drive. Arrange the position of the torque arm to minimise load on the gearbox output shaft due to reaction torque and drive overhanging mass. As identical drives may be used in different applications the torque arm reaction may be in tension or compression.
- Ensure that after final assembly, alignment and testing, all drive components are located in position on their respective base plates to prevent movement of the components in any direction. Locate individual drive components on the base plate by corner blocks, fitted with Grade 316 stainless steel set screws and Grade 304 stainless steel lock nuts, at each of the four corners of the unit.
- Provide drive bases with mounting pads at all hold-down bolt locations for motor and reducer. Ensure that pads protrude a minimum of 40 mm outside the feet of the motors and reducer for levelling and alignment of equipment. Accurately machine the mounting surfaces for uniform seating of equipment.
- Ensure that machined pads are flat and parallel with a maximum vertical linear tolerance of ± 0.25 mm. Ensure that the maximum angular misalignment of pads in the same or parallel place is 10 minutes of arc.

3.7.11 Assembly on Base Plate

If shims or packers are necessary, ensure that it is of Grade 304 stainless steel and has the same bearing area as the base of the member that rests upon them. Permanently mark shims for location after fitting.

3.7.12 Lubrication

- Ensure that all lubricating points are conveniently accessible and approved pipes are provided for all points behind guards and casings or in inaccessible positions.
- Ensure the lubrication nipples for grease lubrication are only of the button-headed type in accordance with BS 1486 with type 21A, 8 mm ISO R7 pipe threads.
- Ensure lubrication comply with the following standards: SANS 351 and BS 1399.

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3.8 TESTING AND INSPECTIONS

- Assembled drive units are to be tested by the Contractor. These tests must be witnessed by the Project Manager. After a machine has successfully passed the test it is inspected by the Project Manager prior to leaving the Contractor's or his Subcontractor's workshop for delivery.
- If a drive unit is rejected during this inspection, repair or replace the unit to the satisfaction of the Project Manager. It is subject to complete pre-delivery tests and inspections.
- Ensure the provision of assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be a requisite to performing the tests and inspections and as may be reasonable demanded to carry out such tests efficiently. Ensure that all gauges, templates, tools and other equipment required to check the accuracy of the work are calibrated at regular intervals by a laboratory approved by the National Calibration Services of the Council for Scientific and Industrial Research of South Africa, or by the respective authority in the country of origin of the equipment.
- Ensure the supervision of commissioning of drive units on site and that drive units are commissioned correctly, and operate as per the design.

3.9 CONVEYOR PULLEYS

Shall conform to requirements set out in the Employer's standard, 240-55864503. In addition, the following requirements shall apply:

3.9.1 Design

- Design pulleys for the maximum forces that can be imposed by the belt tension, drives and brakes, with due regard for the angle of wrap of the belt around the pulley.
- Design shafts so that deflection angle at the hub is within the maximum deflection specified for the locking elements, or a maximum of 5 minutes.

3.9.2 Construction

Pulleys

Crowned pulleys are not allowed.

Pulley face width shall be 150 mm wider than the belt.

For standardisation purposes, the pulleys have the following drum diameters:

- 550 mm
- 630 mm
- 710 mm
- 800 mm
- 900 mm
- 1 000 mm
- 1 120 mm
- 1 250 mm

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3.9.3 Pulley Shafts

- Calculate the minimum required shaft diameters required to satisfy the belt tension and brake torque values determined from the conveyor calculations.
- Submit final shaft sizes for standardisation purposes to the Project Manager for approval once the required diameters are known.
- Only have one extension on brake pulley shafts.
- Ensure that brake pulley shafts have a step down to the bearing and another step down where the brake disks are fitted.
- The following design criteria apply to pulley shafts:
 - Free shaft deflection (at pulley hub) : 5 minutes
 - Free shaft deflection (at shaft end) : 8 minutes
 - Stress Limit (bending / torsion) : 90 MPa / 40 MPa
 - Stress concentration factor (torsion) : $K_t = 1.2$
 - Stress concentration factor (bending) : $K_b = 1.5$
 - Locking Elements
- Shaft deflection shall be limited to 6 minutes of arc and a taper locking device shall be used.

3.9.4 End Discs

End disc type pulleys can be recommended by the Contactor; however T-Bottom type end discs are preferred on high tension pulleys.

3.9.5 Shell

Recommend a suitable shell thickness for pulleys, and comply with the requirements within SANS 1669-1.

3.9.6 Plummer Block Assemblies

- All pulley bearings are of the self-aligning double spherical roller type, mounted in split bearing housings. Housings are installed such that the cap bolts are not under tensile load and are mounted on adjustable sole plates. Provide pulley bearing lubrication points with extended grease lines to an easily accessible point outside of the guards.
- Fit all bearing housings with button head grease nipples.
- Fill all bearing with grease prior to delivery to site.

3.9.7 Pulley Assemblies

- All pulley assemblies shall be statically balanced in accordance with BS 5265 Part 1.
- Dynamically balance all pulleys where belts speeds are above 3 m/s.
- The equipment shall be corrosion protected in accordance with SANS 121.

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3.9.8 Testing and Inspections

- Perform non-destructive testing on pulley welds and submit test certificates to the Project Manager. These tests must be witnessed by the Project Manager (or a suitably qualified competent person). After a pulley has successfully passed the test it is inspected by the Project Manager prior to leaving the Contractor's or his Subcontractor's workshop for delivery.
- If a pulley is rejected during this inspection, repair or replace it to the satisfaction of the Project Manager and subject to complete pre-delivery tests and inspections.
- Provide assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be a requisite for him to perform the tests and inspections and as may be reasonable demanded to carry out such tests efficiently.
- Statically balance each complete pulley assembly and submit test certificates to the Project Manager.
- Statically balance the brake pulleys (if applicable) before and after installation of the brake disc.

3.9.9 Conveyor Pulley Lagging

- All pulleys are to be provided with either ceramic or hot vulcanised rubber lagging. The lagging must be a single sheet and have only one joint. Pulley lagging has the following properties:
- Drive/Brake pulleys: Lined with 12 mm thick ceramic lagging
- Other pulleys: Shore A hardness of 50-60 and minimum thickness of 10 mm with diamond groove pattern.
- All lagging of pulleys to comply with SANS 1669-2.

3.9.10 Guards

- Shall conform to requirements set out in the Employer's standard, 240-55864503.

3.10 TRANSFER CHUTES

3.10.1 Transfer Chute Design

- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- Transfer chutes must be designed specifically to handle ash with a high fines fraction and high moisture content. The Contractor shall submit arrangement and detail drawings of chutes to the Project Manager for approval before manufacture commences.
- Use transfer chutes with minimal material contact at all transfer points. Transfer chutes must include the following salient features other than stated in the Employer's standards:
- Deflection plate/s (bonnet) must only be utilized for ash transfer chutes that cannot be designed with minimal material contact in which case minimal contact guided flow transfer chutes must be installed and still obtain no blockages during chute maximum duty conditions.
- A rubber dust curtain shall be provided at the point of entry and exit of the chute by ash. The dust curtain shall have split ends to allow unrestricted movement of ash on the belt.
- Fit discharge head boxes with access panels over the full width of the head box top to allow for inspection and cleaning of the chutes.
- Ensure that the transfer point chutes and feed skirts are such that the centreline of feed skirts deviate from the conveyor plan view centreline by no more than ± 3 mm over the length of the skirts.

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- Ensure material central loading from one conveyor to the next to reduce risk of belt misalignment and spillages.
- The chute shall be lined with ceramic at areas in contact with material flow trajectory and HDPE will be used on areas outside of the material flow trajectory, including areas in contact with the dribbles.
- The design shall avoid having sharp corners that can result in material blockages; it shall be ensured that all corners are bevelled to avoid such blockages.

3.10.2 Skirts and Curtains

- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- Contractor shall be responsible for selecting the skirt length and width to suit the conveyor configuration, speed and ash characteristics. The length of loading skirts shall be sufficient to ensure that the ash stream is settled on the belt and shall prevent any backward running of ash and dust emission behind the loading chute. Skirt width to be selected considering the maximum material throughput for through loading transfer points with maximum conveyor throughput as indicate in section 3.5.2.1. Any adjustment or modification required during commissioning to attain correct product control shall be carried out by the Contractor.
- Include a blanking plate with sealing rubbers for skirt enclosures, which are not required for through loading, at the rear of the skirts.
- Install a rubber curtain 12 mm thick cut into finger strips and profiled to match the product flow at the outlet of all skirt enclosures and inlets of transfer chutes.
- Design skirts so that the skirt rubbers are standard size and shape. Ensure dust tight skirt enclosures in construction with minimised dust emissions.
- Install belt protection equipment at all conveyor loading points as described in the Section 3.32 and **Error! Reference source not found.**

3.11 CONVEYOR BELT CLEANING

3.11.1 General

- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- The Contractor shall install Hosch cleaning scrapers.
- Submit a list with the estimated life of each component to the Project Manager.

3.11.2 Belt Scrapers

- Supply scrapers that feature the capability to remove and refit the blade tips without the requirement to access the inside of chutes.
- Overall scraper blade widths to be at least 85% of the belt width.
- Ensure that the cleaner blades are loaded against the belt by spring-loaded mechanism.
- Ensure that scraper tensioning devices maintain a constant pressure of the scraper blades against the belt and automatically compensate for uneven blade wear and belt wear.
- Fit cross members with two emergency support chains designed to prevent the scraper from falling into the chute in the event that the cross member supports fail. Fit chains to each side of the chute.
- Install all scrapers so that there is sufficient room to allow removal and replacement without disturbing other equipment, for example the gearbox and drive assembly. Provide inspection

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openings in head chutes at each end of scraper assemblies to enable inspection in operation and make adjustment if necessary or to withdraw the assembly entirely for maintenance purposes. Seal the openings by easily removable covers during operation. Ensure that scraper adjustments are possible from outside any guarding so that adjustment can be undertaken while the conveyor is running.

3.11.3 Return Belt Ploughs

- Provide gravity pivoted V-type plough scrapers, diagonally positioned, to clean spillage from the return side of the belt. Position the scrapers ahead of take-ups, tail pulleys and any other place where product spilt on the return strand of the belt would be carried into the nip point of a pulley. Position these scrapers as close to the following pulley as practical.
- Provide adjustable setting to the plough scraper polyurethane blades. Position these scrapers above flat return idlers to ensure uniform contact with the belt.
- Provide at least 150 mm clearance in plan view between stringers and belt at the plough location to allow for exit of the scraped material from the belt. Locate ploughs in areas where fines can be cleaned from under the belt.
- Fit safety chains to each side of the plough.

3.12 CONVEYOR BELTING

3.12.1 General

NOTE: FABRIC REINFORCED CONVEYOR BELTING TO BE UTILIZED IN ORDER TO COMPLY WITH STANDARD SIZE T4 COAL FEEDER BELT SYSTEMS CONVEYOR BELT ON STATION.

- Fabric reinforced ply conveyor belting to comply with the following:
- Select belt width as 2.1 m.
- Ensure that fabric belts are multi-ply with minimum four (4) plies.
- Ensure that conveyor belt complies with SANS 1173.
- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- Hot vulcanise all belt splices if required.
- No transverse or longitudinal joints shall be allowed.
- Select conveyor belting to provide a minimum expected service life of 10 years for carcass, splice and cover material. Ensure that conveyor belting is suitable for handling the material as specified in the climatic conditions given and at design conditions specified in data sheets. Ensure that the belting selected is in accordance with and is suitable for the following:
 - The material transported
 - All design loads including material impact
 - Speed
 - Environmental conditions
 - Material properties
- Ensure that conveyor belt tensions do not exceed the belt manufacturer's recommendations.
- Ensure that the safety factors for conveyor belting for all operating loaded or empty belt conditions are no less than the values in the table below. Obtain written warrantee from the belt manufacturer if lower belt safety factors are applied.

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Table 2: Belt Tension Safety Factors

Belt Carcass	Belt Tension Safety Factor	
	Running	Braking or Accelerating
Fabric	10.0	6.0

- Ensure that the belting selected is adequate for supporting the material load and ensure good 'troughability' for empty and loaded belt conditions and also that contact between the belt and all idler rolls in an idler set is maximised.
- Ensure that the 'troughability' of all belts are suitable for the current conveyor system design of 35° trough idlers.
- Supply the belting in the longest possible length to minimise field splicing.

3.12.2 Fabric Belting

- Ensure absolute uniformity of top, interplay and bottom covers.
- The belting must be straight and easily trainable. Design and install conveyor such that the use of training rollers is not necessary.
- Submit the fabric belt supplied by the manufacturer to the Project Manager for approval.

3.12.3 Cover Materials

- Ensure that the cover compound is selected to withstand the chemical and atmospheric requirements of the application.
- Ensure uniform chemical and physical properties of covers throughout the cross section.
- Carry out abrasion tests on both covers.
- Ensure the belting has high resistance to effects of atmospheric ozone. Conduct the tests for the ozone resistance in accordance with ISO 1431. Ensure that ozone resistance is for NIL cracks at 96 hours duration at 7 times magnification with the specimen stretched at 20% length.
- Ensure that cover hardness of both covers is 63° ±5° Durometer Shore A when tested in accordance with ISO 7619.

3.12.4 Factory Repairs

- Shall conform to requirements set out in the Employer's standard, 240-120532564.
- Ensure that all factory repairs carried out are hot vulcanised and buffed level with the original belt surface.
- Detail and identify all vulcanised factory repairs relative to the brand/cure identification. Submit a copy of this recorded detail along with other test certificates to the Project Manager. Where no repairs are required submit a written statement to that effect to the Project Manager.
- Factory splices and cable joints are not permitted.
- Properly finish belting and remove all flash. Minimise surface blemishes (patches), as this is an indication of poor quality. Conveyor belts are not accepted if the total number of repairs exceeds 1 per 50 m² of manufactured belting (single belt roll). The area of the belt roll is calculated using belt width x roll length irrespective of the top and bottom cover.
- A lifetime guarantee shall be applicable to repairs conducted during manufacturing.

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3.12.5 Non Destructive Testing

Conduct digital X - Ray and Magnetic Scan (only on steel cord) on all conveyors as being rolled. Submit the test results to the Project Manager for consideration before dispatch. Incorporate a visual inspection of both the scans by means of a video camera and the digital outputs of damage sites (i.e. repairs, blemishes, Patches). The belt is accepted or rejected at the Project Manager's sole discretion.

3.12.6 Packing, Transportation, Handling and Storage

Shall conform to requirements set out in the Employer's standard, 240-55864434.

3.12.7 Splicing

Fabric reinforced conveyor belting splicing shall be conducted in accordance with Employer's standard, 240-120532564 and SANS 484. Hot vulcanising shall be utilised. The Employer's standard quality control plan shall be adhered to Employer's standard, 240-120532564 and a plan shall be submitted to the Project Manager for approval.

3.13 CONVEYOR IDLERS

3.13.1 General

- Shall conform to requirements set out in SANS 1313-1 and 1313-3.
- Ensure that all idlers are of heavy duty construction, free from vibration under all conditions of load and belt speed. Select idlers to comply with the duty requirements for the conveyors nominated.
- Except where specified, multiple roll idler sets comprise of equal length rolls. All rolls for each idler set is equally rated and is interchangeable.
- Mount Idler rolls so that they are firmly and positively located in the bracket but can be removed without use of tools. Rolls requiring vertical restraint may be restrained such that tools are required for removal.
- Specify idler roll diameter to provide minimum rolling resistance. Use the same diameter rolls on all idlers for the given belt width.
- Permit ease of replacement in locations where idlers are located under skirted sections of the conveyor belt.
- Make all surfaces as smooth as possible which can come into contact with the belt as a result of belt miss-tracking or dislodged rolls.
- Ensure that idler sets made up of more than one roller have the roller shafts within ± 1 mm of alignment unless the idler set incorporates staggered or offset idlers.

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3.13.2 Idler Types

- Carry idlers shall be inline 3 rolls, 35° troughing angle and return idlers shall be inline 2 rolls V, 10° troughing angle for conveyor standard extension sections.
- Impact Idlers shall be inline 3 rolls, 35° troughing angle at loading points only.
- Transition idlers shall be inline 3 rolls. Transition troughing angles shall be intermediately adjustable from flat to fully troughed in accordance with the conveyor belt manufacturer's recommendations.
- Idler brackets where specified, of the troughing, impact and return idlers shall conform dimensionally to SABS 1313 unless otherwise specified by the Project Manager.
- Design of the idler brackets shall ensure easy roll replacement and minimise belt damage in the event of roll detachment.

3.13.3 Idler Spacing

- Idler standard spacing shall be 1 m on the carry side and 2 m on the return side and must be verified with the conveyor detail design requirements and approved by the Project Manager. Specific areas such as vertical or horizontal curves transition areas may require deviations from the standard spacing selected.

3.13.4 Idler Roll Configuration

- Component parts of rolls including roll shell, bearings, seals, lubrication and assembly, shall be designed for basic life rating of not less than 100 000 hours.
- Ensure that the design of the roll minimise axial movement between the shafts and roll. Ensure that the construction of the idler rolls is such that the roll is fixed axially to the roll shaft by one bearing only with the other bearing floating.
- Roll shaft ends shall be closed-end type.
- Ensure that the idler surfaces are highly resistant to ozone and ultra violet light attack. Manufacture idlers from fire resistant materials.
- Ensure that end discs are fully welded and all welds are full penetration, smooth, and free from imperfections that may cause high local stresses. Press fit or rolled in ends without welding is only accepted on non-metallic rolls.
- Ensure that all idlers have a tolerance on their required length of +1.5 mm and +1.0 mm on the diameter.
- Ensure that the peripheral run-out of the shell and total roll imbalance does not exceed the values specified in table below.

Table 3: Idler Run-out and Total Roll Imbalance Limits

Idler Roll Type	Total Torque Imbalance	Total Indicator Reading (TIR)
Weigh Idlers	0.014 Nm	0.13 mm
Low Noise Idlers	0.028 Nm	0.3 mm
Plain Roll Idlers (<750mm face width)	0.056 Nm	0.5 mm
Plain Roll Idlers (≥750mm face width)	0.056 Nm	0.0007 x Face Width
Rubber Covered or Disc	0.056 Nm	1.0 mm

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- The Maximum Indicated Slope (MIS) per 6 degrees of idler rotation is 0.05 mm for all plain roll idlers and low noise idlers.
- Notwithstanding the tabulated values for weigh idlers, ensure that the TIR and imbalance is in accordance with the scale manufacturer's recommendations as a minimum.
- Idler rolls manufactured to these tolerances but still generating undue vibrations are not acceptable.

3.13.5 Idler Barrels

- Fabricate idler roll barrels from steel tubing in accordance with SANS 657-3. Ensure that the roll barrels are free from surface defects and internal weld fins.
- Ensure that roll ends have a minimum corner radius of 3.0 mm over 90 degrees.
- Ensure that the thickness of barrels for carry and return rolls are not less than 3.0 mm.
- Ensure that all idlers have a length tolerance of ± 1.5 mm and a diameter tolerance of ± 0.5 mm.

3.13.6 Idler Mounting Frame

- Machine all idler mounting brackets to fit closely to the shaft ends of the idler, such that no audible rattle of any idler can be detected during operation.
- Configure the idler support brackets and idler frames so that the belt does not contact an idler support bracket in the event of a roller failure.
- Support the troughing rolls and V-return rolls each by a one piece fabricated steel frame. The main cross-member is an inverted steel angle or steel tube of suitable size. Limit frame deflection under full load condition to 1/300 of the frame hold-down bolt centres.
- Fabricate the frame so that there are no dead pockets where water or material can be retained. Fully seal all hollow section members.
- Design the frame to prevent accumulation of spillage between the frame and rolls. Design the roll support brackets not to damage the belt in the event of a roll being dislodged. Deburr all edges.
- Fit diagonal braces between the cross-member and outer brackets where required.
- Set the roll support brackets on tubular cross-members below the top of the tube. This arrangement is designed to protect the belt in the event that a roll is dislodged. In this case, the belt runs on top of the tube rather than on support brackets.
- Allow sufficient clearance between the idler roll perimeter and frames on all idler sets to ensure that, should the rolling elements collapse within the roll bearings, a clearance is maintained between the idler rolls and frames.
- Unless otherwise specified, provide four mounting holes on each frame for M16 size bolts. Slot these holes to allow at least 16 mm lateral movement parallel to the conveyor centreline.
- Ensure that the longitudinal axis of all rolls is parallel within $0^{\circ} 15'$ and roll shafts are in alignment within ± 1 mm.
- Provide troughing idler frames with connection points to accept wind guards.
- Paint or hot dip galvanise idler steel frames to the requirements of the Protective Treatment Specification. Test frames for idler fit after protective coating.
- Adequately protect equipment against physical damage and corrosion during transport and storage.
- Ensure that all unprotected finished surfaces of ferrous metals, including screw threads that are exposed while awaiting installation, are thoroughly cleaned and given a heavy uniform coating of an approved petroleum soluble rust preventive compound.

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3.13.7 Idler Shafts

- Ensure that all shafts are stationary (dead shaft) and manufactured from bright drawn bar and are machined. Ensure that the shaft tolerances are in accordance with the bearing manufacturer's recommendations.
- Roller shaft deflection due to load shall not exceed 6 minutes of arc for a ball bearings.
- Ensure that the maximum allowable axial end float between the shaft and shell of the assembled roll is 0.2 mm.

3.13.8 Bearing Assembly

- The end disc bearing housing shall be accurately aligned relative to each other and assembled together with the roll shell prior to fitting the bearing assembly. Tolerances of the bearing housings shall ensure interference fit recommended by the bearing manufacturer.
- The inner race of each bearing shall be positively located on the shaft on at least one side.

3.13.9 Basic Rating Life

Basic rating life L10, as defined in BS 5512 for each bearing, shall not be less than 100 000 hours.

Idler sets that require swapping centre and wing rolls to achieve the required life are not acceptable.

3.13.10 Allowable Deflection

Ensure that bearings have a minimum allowable deflection of 12 minutes of arc.

3.13.11 Lubrication

Bearing lubricant shall be SKF LGMT 2 or equivalent FAG, Timken recommended lubricant.

Grease all bearings for life. Grease bearings with grease-packed using grease specially selected for the duty and the temperature conditions. Sodium based greases are not acceptable.

3.13.12 Materials

- Idler brackets shall be manufactured from carbon steel to SABS 1431 Grade 300WA or other material subject to the Project Manager's approval.
- Rolls shafts shall be manufactured from bright drawn steel bar complying with a minimum of BS 970 Part 1, Grade 070M20 or equivalent.
- Roll shells shall be fabricated from steel tube. Rubber discs (for return idlers only), non-ferrous material such as high-density polyethylene (HDPE) or PVC, combination of steel tube lagged with polyethylene, polyurethane, PVC or other corrosion/wear resistance materials are acceptable subject to the Project Manager's approval.

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3.14 TRANSITIONS IDLERS

3.14.1 General

- Provide adjustable transition idlers at vertical curve positions as well as head and tail ends of feeder belt conveyor to suit the specific transition such that belt sag does not exceed the limits specified herein.
- Ensure that transition idlers comprise of rigid mounted idler sets having idlers interchangeable with those of the standard trough idler sets and with wing idlers adjustable a minimum of 15°. Ensure that the frame is adjustable by a series of round offset holes to allow adjustment by increments. Provide a minimum of five specific positions. Slotted holes for adjustment are not permitted.

3.14.2 Transition Distances

- Transitions shall be of the half - or full trough depth type, whichever results in the lowest edge tension in the belt for the specific location.
- Troughing angles shall be intermittently adjustable by use of transition idlers from flat (pulley face) to fully troughed at head and tail ends of the feeder belt conveyor. Transition idlers from tail pulley to loading point and from conveyor discharge at head pulley shall be 0/20/35 & 35/20/0 respectively.
- Transition distances shall be 150% of the values as per CEMA Tables issue 5.

3.14.3 Impact Idlers

- Install impact idlers at the conveyor loading points only (if not provided in current conveyor design) where specified or where impact loads are too great for the use of closely spaced standard carry idlers. Ensure that impact idler design is adequate to absorb the impact forces caused by the falling material.
- Impact idlers frames shall be of a retractable type to enable easy exchange idlers during maintenance.
- Ensure that the impact idler spacing does not allow the conveyor belt to sag between idlers to the extent of affecting the skirt seal.
- In case where rubber discs are used for impact idlers make it from abrasion resistant vulcanised rubber.

3.14.4 Self-Aligning/Training Idlers

- In general avoid training or guide rollers. Fit inverted V-return idlers if necessary during commissioning if training problems are encountered.
- Self-aligning/training/tracking devices (at least three (3)) shall be installed in the area preceding the tail pulley on the return side to ensure that the conveyor belt is centralized when reaching the loading areas. Also in the sections of unsupported belting preceding the take-up pulley.
- It shall be mounted such that it can be adjustable in the vertical direction and will be able to endure all tensions acting on it when pressed against the belt.

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3.15 MANUFACTURING AND FABRICATION

3.15.1 General

The Project Manager's approval is required before placement of an order, to the detail drawings relating to the proposed materials, heat treatment, machining and surface roughness tolerances in order to perform a design check.

3.16 WELDING PRACTICE

Welding shall be done as per the Employer's structural steelwork specification, 240-55864504.

3.17 MACHINING AND SURFACE ROUGHNESS TOLERANCES

- Machining fits and tolerances shall be in accordance with BS 4500.
- Surface roughness tolerances shall be in accordance with BS 1134.
- All machined surfaces to be free of marks and scratches after machining.
- The roll shaft bearing ends shall be manufactured to the tolerances recommended by the bearing manufacturer and to a surface finish not rougher than 1.6 microns in accordance with the Ra values given in BS 1134.

3.18 FEEDER CONVEYOR STRUCTURE

Elevated conveyor structures shall be prevented from collision by heavy mobile equipment.

Conveyor system structure shall conform to Employer's standard, 240-55864504.

All structural steelwork shall be galvanized in accordance with SANS 121.

The erection of the conveyor shall conform to Employer's standard, 240-55864505.

3.19 FEEDER CONVEYOR ALIGNMENT

- Ensure that a qualified surveyor produce a set of permanent survey marks on the steelwork adjacent to each pulley to indicate the perpendicular to the conveyor centreline. Set-up the pulleys by measurements from these to pulley shaft.
- Align idlers under transfer point skirts to permanent survey marks as described above.
- Align all trough and return belt idlers perpendicular to the conveyor centreline by the use of an optical device such as Prok "Convey Line" or an equivalent device as approved by the Project Manager. Use this device in strict accordance with the manufacturer's instructions and recommendations, and to the minimum nominated alignment requirements below.
- Ensure that the vertical deviation of each idler is within ± 2 mm of the designed vertical belt profile. In addition, ensure that vertical deviation between consecutive idlers do not exceed 3 mm, using the design belt profile as a datum.
- Ensure that the transverse deviation of idlers is within ± 3 mm of the belt plan view centreline.

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- Ensure that the transfer point chutes and feed skirts are such that the centreline of feed skirts deviate from the conveyor plan view centreline by no more than ± 3 mm over the length of the skirts.

3.20 GRAVITY TAKE-UP

- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- The arrangement shall be a gravity type. The arrangement is a counter weight mass installed in a separate tower, trolley take-up pulley with a reeve and sheave arrangement.
- Ensure that take-up weights are separately removable sections of no more than 2 ton each. Clearly mark masses of counter weights on each element/s.
- Seal top of counterweight boxes off with polystyrene foam or similar material. Provide drain holes in counterweight boxes.
- Where take-up weights are suspended by ropes, make due allowance for friction losses in the rope system.
- Equip take-up with a permanently installed supporting structure to accommodate an installed electric winch for easy and swift raising or lowering of the take-up mass in cases when the belt needs to be slackened for maintenance purposes. Include a lockout system when the take-up mass is lifted or dropped to a maintenance position. Mount the electric winch at accessible height.
- Ensure that the take-up has sufficient travel to accommodate belt for two (2) overlap splice repairs (i.e. cut out a splice and re-splice belt).
- Install impact absorbing material on any surface within the take-up system where the possibility of impact between two surfaces exists.

3.21 WINCH SYSTEMS

- An electric winch system, for maintenance purposes, must be utilized on the gravity take-up arrangement with the following requirements:
- Shall conform to requirements set out in the Employer's standard, 240-55864503.
- Mount the winch drive, including drum, gears, bearings, couplings, brakes, geared reducer and motor, on a common support base.
- Design the winch drive for continuous repeated start-stop operations.

3.22 TAKE-UP ARRANGEMENT

- A winch type system shall be used to operate the gravity take-up arrangement.
- Take-up arrangement shall incorporate a suitable system to ensure adequate lifting, lowering and positioning of the take-up counter weight mass (to make limit) for normal feeder belt conveyor operation or take-up maintenance requirements.
- The system shall move in a controlled manner in a straight line, no crabbing or shuddering allowed.
- A permanent take-up support structure shall be provided to enable access to the take-up winch system drive and wire rope arrangements for maintenance and inspection purposes.

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3.23 MOVEABLE HEAD ARRANGEMENT

- A reversible winch type system shall be used to activate moveable head positioning.
- Moveable head arrangement shall incorporate a suitable system to ensure adequate belt support during extension and retraction of the discharge pulley.
- Movable head arrangements shall be able to start and stop with minimal shock loads introduced into the components or structure.
- A permanent access platform, as part of the head end, shall be provided to enable access to the reversible winch system drive and wire rope arrangements for maintenance and inspection purposes.

3.24 DRIVE

The design of the winch drive unit shall include but not be limited to the following:

- The winch and drive unit shall be one complete selected off the shelf unit.
- All drive components shall be designed for heavy duty mining application, to allow the drive assembly to achieve a service life of at least 30 years, with due consideration for fatigue and wear factors.
- All drive units shall be mount on a common support base and will including a drum, gears, bearings, couplings, brakes, reducer and motor.
- Design the drive units for continuous repeated start-stop operations.
- All drive units and its components shall be manufactured and installed according to best modern engineering technology and practices.
- All components shall comply with their relative specifications.
- All free issue and/or vendor supplied components shall be assembled in strict conformity to their suppliers' installation instructions.
- IP rating on winch assembly and components shall be 67 or higher.
- Winch gearbox gears shall be made of heat treated alloy steel to BS 970: Part 1.
- The design and machining of the gear teeth shall be in accordance with the following specification in priority shown:
 - AGMA requirements, or
 - BS 436 and BS 545, or
 - DIN specification.

3.25 WIRE ROPE AND FITTINGS

- Prior to installation, lubricate the wire rope in accordance with the manufacturer's recommendations.
- Provide test certificates to the Project Manager for all wire rope.
- Design all wire rope fittings and attachments to have the same breaking strength as that of the rope.
- Ensure that the fleet angles of the ropes to drums or sheaves are always less than 2.5°. For grooved drums, this is measured relative to the direction of the grooves in the drum.

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3.26 SHEAVES

- Ensure that all sheaves are of heat treated manganese steel with ground grooves.
- Drilled and tap pins for lubrication and mount in a manner to prevent accidental loss by use of double lock nuts, cotter pins or other similar devices.
- Ensure that that sheave design allow for their removal as a unit with no pressing of shafts, bearings required in situ.

3.27 DRUMS

- Ensure the drums are of steel construction and have a grooved machined face to accommodate the rope size selected.
- A larger drum diameter may be chosen in order to properly store the required rope. Select the drum length so as to provide for complete storage of all the required rope in one layer. Random windings on the drum are not accepted.

3.28 TRANSPORT AND STORAGE

- Without derogating from or limiting the provisions of the Contract, the following shall supply:
- If the unit is to go into storage for a long period it shall be filled with the correct protective fluid for use during storage.
- The equipment shall be adequately protected against physical damage and corrosion during transportation and storage.
- All unprotected finished surfaces of ferrous metals, including screw threads that shall be exposed while awaiting installation, shall be thoroughly cleaned and given a heavy uniform coating of an approved petroleum soluble rust preventative compound.
- Packing shall be done in such a way and be of a suitable size, as to allow transportation by road.
- All winch components shall be adequately protected from physical damage.

3.29 ACCESS

3.29.1 General

- A minimum walkway width of 750 mm shall be provided on both sides of the feeder belt conveyor and a minimum corridor width of 1 200 mm shall be provided on both sides of the feeder belt conveyor, at the tail end between the loading hopper and the in-loading ramps, according to the Employer's standard, 240-55864504.
- Ensure that elevated transfer points in conveyor systems have direct stairway access from ground level in addition to access by conveyor walkways.
- The platform must conform to safety requirements as in Occupational Health and Safety Act of 1993.

CONTROLLED DISCLOSURE

3.29.2 Maintenance Access

- Provide access to all areas requiring inspection or maintenance.
- On gravity take-up towers, provide platform adjacent to the nominal position of the take-up pulley. Provide ladder access to all components requiring maintenance on the take-up tower.
- Where crane access is restricted, provide adequate lifting beams and monorails complete with trolleys and built into conveyor structures at drive and transfer points for the handling of heavy components during maintenance operations.
- Ensure that all areas of plant requiring lifting of heavy equipment for maintenance are accessible by mobile crane.
- Provide for access to all equipment for maintenance purposes. Eliminate the use of scaffold for maintenance purposes. Provide for access to pulleys and return idlers in elevated areas so that pulleys can be maintained and idlers changed without the need for the use of crane or installation of scaffold.
- Conveyor structures and platework must allow ease of access to all mechanical components (idlers, scrapers etc).
- Fit lubrication points on conveyor pulley bearings, reducer bearings, etc. which are inaccessible with extended grease lines. Terminate these grease lines at easily accessible lubrication blocks, preferably at ground level.

3.29.3 Specification of Open Grid Flooring, Stairways and Hand Railing

- Cat ladder type cross overs shall be provided every 300 m over all conveyor systems. A minimum walkway width of 600 mm shall be provided at cross over points.
- Flooring shall be of open grid type and shall be of welded or dimpled construction and capable of carrying a minimum of 5 kPa of distributed load with a maximum deflection of 1 in 200 of the span or 10 mm whichever is less. The maximum distance between supports of the open grid flooring shall be 2 m.
- Flooring panels shall be positively located on supporting steelwork by means of suitable clamps and self-fixing studs or shall be tack welded to supporting steelwork.
- Angles and kick flats of 5 mm minimum thickness and 75 mm height shall be provided around all openings in open grid flooring and at edges of galleries/walkways except at entrances to staircases.
- Stairways shall be designed for a minimum load of 5 kPa and shall be not less than 750 mm wide. They shall be placed at an angle not greater than 42° to the horizontal. Treads shall be open grid flooring without risers and shall be fitted with galvanised friction nosings.
- Ladders may only be installed with the approval of the Project Manager.
- Hand railing shall be provided to the peripheries of permanent openings and to the edges of floors. Stairways shall have hand railing on both sides.
- Handrails shall be secured to stanchions to prevent drawing out. Stanchions shall be fabricated of forged steel. Joints in railings shall be made using a minimum 150 mm ferrule smoothly pinned through both parts.
- Handrails shall have radius curves or bends at each change of direction.
- Internal hand railing shall be painted and external hand railing shall be galvanized.

CONTROLLED DISCLOSURE

3.29.4 Bearings and Bearing Housings

- Use ball and roller bearings of the self-aligning type unless otherwise specifically approved by the Project Manager.
- Use plummer block housings of the split type as supplied by the bearing manufacturer. Fit all housings with TS Taconite seals to effectively seal in lubricant and to prevent entry of dust or water. Use SSN 500 series 2 bolt or SD3100 series 4 bolt housings. Remove redundant grease nipples and plug holes.
- Sealed bearings may be used if space restriction prevents the use of labyrinth type seals. Unless otherwise approved by the Project Manager, fit sealed bearings with a proper lubrication system and do not use seals on the inside face of the bearing. Where sealed bearings are proposed to be used, each particular arrangement is subject to approval by the Project Manager
- Fit bearings for conveyor pulleys to the shaft by means of tapered adaptor sleeves and located in the plummer blocks by locating rings for one housing of each pulley. Fit locating rings on the left hand side when viewed in the direction of belt travel.
- Use oil injection type taper adaptor sleeves for all shafts 150 mm diameter and larger.
- Ensure that floating bearing assemblies are installed with the bearing in the centre of the internal clearance range.
- Machine the underside of the base of each bearing plummer block or flange type mounting and mounted only on a machined surface. Manufacture machined bearing pads from 3CR12 material or grade 316 stainless. Ensure that the alignment of this surface is such as to ensure the bearing can be aligned to within the bearing manufacturer's specified tolerance. In particular, ensure that the alignment maintain positive clearance between the inner and outer parts of the labyrinth seal and correct positioning of rubbing seals with respect to the shaft.
- Ensure that where shims or machined plates are necessary to achieve correct bearing alignment, it has the same bearing area as the base of the bearing. Use shims of brass or suitable stainless steel. Use not more than 3 shims should be used under any bearing, and if the total thickness required is more than 3 mm the use grade 316L stainless steel machined plate for the shim.
- Positively locate plummer blocks and housings after final adjustment by stainless steel adjusting screws installed at each end of the bearing. Squared off and chamfer the adjusting screws. Also machine where the bearing housing ends are in contact with the squared off adjusting screws.
- Adequately size the adjusting screws to move the relevant items including the forces acting on the item. Ensure that the threaded portions of the block through which the adjusting screws are fitted are no shorter than 1.5 times the screw diameter. Provide 2 adjusting screws at each end of plummer blocks for shafts larger than 120 mm diameter. Fit snug blocks to bearing housings after commissioning.
- Standardize all plummer blocks from one manufacturer and standardise sizes as far as possible.
- Arrange plummer blocks and their supports to avoid uplift on the cap and base bolts. Do not subject housings to upward loads.
- Provide bearing housings, shafts and any other relevant items with grease or oil ways and suitable fittings to ensure that all bearings can be lubricated in accordance with the bearing manufacturer's recommendations.
- Arrange grease nipples on housings to ensure the grease path during greasing is outwards through the bearing to the seals to enable flushing of contaminated grease.
- Ensure that plain journal bearings (other than maintenance free type) have oil or grease grooves to distribute the lubricant over the bearing surface and are fitted with labyrinth or Neoprene line contact seals.
- Ensure that grease lubricated bearings have pressure relief holes to avoid seal damage and over pressurisation.

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3.30 LUBRICATION

3.30.1 General

- Correctly pack ball and roller bearings with grease during the initial assembly with the quantity and quality of grease recommended by the bearing supplier.
- Before any equipment is operated prepare and submit to the Project Manager in triplicate, a lubrication chart indicating all lubrication points, the type and grade of lubricant required and the recommended frequency of lubrication. Ensure that all lubricant types match those currently being used on the site.
- Following the successful completion of Load Commissioning and prior to handover after Capability Acceptance Testing, drain the oil from all gearboxes and refill the gearboxes with new oil of the required type and grade. Take oil test samples at this time and the results submit to the Project Manager.
- The Contractor is responsible for lubrication of the complete Plant covered by the works up to the time of Completion.

3.30.2 Manual Lubrication

- Provision of grease nipples for manual lubrication of minor grease points may be used providing such points require servicing less frequently than once per 60 days. All grease nipples in manual systems are stainless steel.
- Grease nipples on rotating parts are to be avoided, but recess where this is not possible the parts to accommodate the nipples and provide a suitably covered hole in the safety guard. Extend nipples on stationary parts of guarded equipment outside any guards and ensure it is accessible from normal access ways.
- Where a number of manual greasing points are in close proximity, provide extended grease nipples and group the grease nipples together on a stainless steel bracketed plate. Firmly mount extended grease pipes without joints between the nipples and equipment.

3.30.3 Materials of Construction

- Only new materials and equipment are supplied under this Contract. Ensure that materials and equipment are suitable for the service required and comply with the latest regulations and requirements of all relevant statutory authorities (issued prior to the closing date for tenders) of the listed standards. Where no South African Standard exists, the British Standards Institution or other Standards Association approved by the Project Manager is used. Where the above recommendations and specifications conflict with this Works Information, this Works Information prevail unless otherwise agreed by the Project Manager.
- Ensure that workmanship is of the highest class throughout and all manufacture is to such tolerances as to ensure that similar parts of the plant are interchangeable.
- No welding, filling or plugging of defective parts is permitted without the approval in writing of the Project Manager. Such approval by the Project Manager reserves the right, for the purpose of examination, to require the Contractor to make, at his own expense, any non-destructive tests, such as x-ray, gamma ray or magnaflux, required to determine the full extent of the defects and the acceptability of repairs.
- Acceptance of materials or waiving of such tests does not relieve the Contractor of the obligation to supply materials, which meet the requirements of the Works Information.

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- Ensure that drilling of bolt-holes is accurate and any slight misalignment in the matching of holes is corrected by reaming. Ensure that where excessive misalignment occurs, the holes are filled by electric welding and re-drilled to the satisfaction of the Project Manager.
- Remove all burrs and sharp edges and drilling to enlarge or align unfair holes is not permitted.
- Obtain test certificates for all such test work and make available to the Project Manager on request.
- Any defects found in items ultrasonically tested are sufficient cause for rejection of the item. Carry out ultrasonic testing by a recognised registered laboratory or equivalent as approved by the Project Manager. In all cases forward two copies of the testing authorities report to the Project Manager.

3.30.4 Substitution of Materials and Equipment

- Substitution of alternative makes or types of Plant and Materials to those included in the Works Information or for the substitution of alternative Materials of construction to those submitted for the approved is only be permitted on receipt of written authorisation for the use of the alternative from the Project Manager.
- Submit a written application containing full technical details of the proposed substitution together with a reason for the change to the Project Manager before any such substitution is considered.

3.31 LABELLING OF PLANT

Provide all plant equipment with an approved nameplate permanently secured by riveting to a bracket welded to the equipment in a readily visible area. Use stainless steel engraved plates with lettering at least 8 mm high.

Include information to be shown on nameplates as follows:

- Manufacturer's name and date of manufacture
- Equipment No. - As referred to in the operating and maintenance manuals and complying with the Employer's equipment numbering standard provided in this Works Information
- Rated power and speed rating (where applicable)
- Rated operating pressure (where applicable)
- Lifting points location (diagrams preferred)
- Weight
- Type of lubricant required
- Type of internal lining or surface coating (where applicable)
- Safety notices as appropriate

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

3.32 BELT PROTECTION AND SAFETY SENSORS

- Provide belt damage detectors adjacent all conveyor loading points. Provide additional conveyor safety devices as follows:
- Pull cord lanyard wires and switches on both sides of the conveyors where normal access is provided and operable from the conveyor walkway, for the full length of the conveyor.
- Ensure that the installation of these trip wires and switches comply with the requirements of the relevant Conveyor Safety Code - and with the requirements of any other relevant Codes or Authorities. The Project Manager approves the location of switches and pull wires.
- The pull wires are PVC sheathed flexible stainless steel wire rope. Install pull wires within easy reach of an operator standing on the walkway on either side of the conveyors. Ensure that the pull wire required to operate the switch is in accordance with the requirements of the relevant Conveyor Safety Code. Ensure that the breaking or removal of a pull wire automatically open the switch
- Thread the pull wires through stainless steel circular eyes with polyurethane inserts (acting as guides) fastened to handrail supports or stringer supports as applicable at intervals of nominally 3 metres. Anchor the ends of each wire remote from the switch via a stainless steel turnbuckle with lock nuts. Tighten the pull wires sufficiently to prevent sagging. Erect signs at intervals along the conveyors in accordance the relevant Conveyor Safety Code.
- Local control standalone panel adjacent to the drive unit, mounted on the In-loading Facility structure at an easily accessible height, containing a pad lockable control isolator.
- Belt drift switches at the head and tail ends of the conveyor to monitor lateral deviation of the conveyor belts on both carry and return side. Provide a manual override button for each sensor and provide a master bypass switch for each complete conveyor to operate only when the conveyor is in local mode. Ensure that the installation of the switches comply with the requirements of the relevant Conveyor Safety Code. Submit the location of these switches to the Project Manager for approval.
- Contact speed sensors incorporated into the idler structure at both the head and tail ends for belt over / under-speed protection, as a result of belt slippage, coupling failure or overloading.
- Provide belt rip and tear detectors at all conveyor loading points within 1 metre of the exit end of loading skirts.
- Block chute detectors mounted inside the transfer chutes to monitor the build-up of ash.
- Guards as specified elsewhere in this specification.
- Ensure that the conveyor start-up warning siren is audible over the entire length of the conveyor. It is desirable that every conveyor belt have a unique start-up warning siren and a strobe or flashing light at the head and tail end to indicate starting of conveyor.
- Take up travel limit switches to trip the belt in case of belt failure.
- Conveyor moving head proxy and limit switches to prevent any travels beyond the designated positions.

3.33 SAFETY INFORMATION SIGNAGE

Supply and install safety and information signage throughout the System. Ensure that all signs are in accordance with South African OHS Act for the occupational environment. This does not relieve the Contractor of the responsibility for the supply and placement of equipment and device identification plates and tags detailed elsewhere in this Works Information.

3.34 COMMISSIONING AND TESTING

3.34.1 General

- Carry out Commissioning tests in stages as follows:
- Pre-commissioning tests including carrying out inspections and dimensional checks to ensure the conveyor system installation is complete and in accordance with the works
- No load tests
- Load tests
- Unless otherwise stated in these Employer's Requirements, the works shall be tested in accordance with the requirements and procedures approved by the Project Manager. Fully document all requirements and procedures for tests and submit to the Project Manager, at least 4 weeks prior to testing, the proposed test program, test procedures and forms for recording of test data.
- Complete static and no load tests during the specified time periods. Complete no load tests and be ready to commence preliminary load tests by the date nominated in the Schedule. The Employer shall endeavour to make product available for commencement of load commissioning at this time.

3.34.2 Witness Testing

Cooperate fully with the Employer where witness tests are required. Witness testing is carried out at the Contractor's expense. Any costs for the Project Manager to attend witness tests are borne by the Employer.

3.34.3 Pre-commissioning Tests

- During the pre-commissioning test period, ensure that the conveyor system installation is complete and all equipment made ready to run. At least carry out the following checks:
- All drive components correctly aligned using laser alignment equipment
- All gearboxes, fluid couplings and hydraulic systems filled to correct levels
- All motors wired for correct direction of rotation
- All brakes correctly set (of applicable)
- All conveyor idlers and pulleys correctly aligned using PROK "conveyliner" device or other survey technique
- All conveyor belt take-up systems correctly set
- All belt scrapers and ploughs correctly positioned and tensioned
- All belt hold down rollers suitably positioned
- All bearings correctly lubricated

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- All limit switches, pressure switches, lanyard switches, blocked chute sensors, under-speed sensors, and other field devices correctly set and operational
- All control and safety interlocks functioning correctly
- All equipment suitably guarded, or where guards have been removed for testing, suitable barriers and warning signs erected
- All equipment and walkways clear of debris

3.34.4 No-Load Tests

- When all pre-commissioning checks have been completed to the satisfaction of the Project Manager, commence with no load testing. This involves the running of all equipment and operating the Machine over the entire working range without product.
- Determine the exact test procedures to ensure full verification of correct machine function. However, the tests at least include the following:
- Eight hours continuous operation of the conveyor system. During this running period, the following is carried out
- Drive motor currents recorded for starting and steady running conditions
- Drive units checked for overloading, excessive vibration or noise, oil leaks, overheating, etc.
- Conveyor belts to be trained to track centrally with less than $\pm 50\text{mm}$ deviation
- All idlers and pulley bearings to be checked for excessive noise or overheating
- All scrapers checked for correct contact with the belt
- All belt washing systems checked for correct spray application and water shedding
- Operation of lanyard switches and interlocking conveyors to be checked

3.34.5 Load Tests

- When the no load tests have been completed and recorded to the satisfaction of the Project Manager, the Contractor commence load testing of the conveyor system.
- This stage of testing must be completed before Completion can be obtained. The function of this stage is to prove that the conveyor system can perform as per design specifications under the actual operating conditions.
- Determine the exact test procedures to ensure full verification of correct Mechanical function; however, the tests at least include the following:
- During this running period, carry out the following:
- Drive motor currents recorded for starting and steady running conditions
- Drive units checked for overloading, excessive vibration or noise, oil leaks, overheating, etc
- Gearbox and fluid coupling temperatures monitored for overloading
- Conveyor belts to be trained to track centrally with less than $\pm 50\text{mm}$ deviation
- All idlers and pulley bearings to be checked for excessive noise or overheating
- All scrapers checked for correct contact with the belt
- All belt washing systems checked for correct spray application and water shedding (if applicable)
- Calibrated all dust suppression systems to suitable achieve the required level of suppression as per the works (if applicable)
- Emergency stops and controlled stops are carried out to ensure safety, and functionality in terms of the works without spillage
- Conveyor start up can be achieved with a fully loaded belt
- Chutes operate smoothly without blockage or spillage

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- Run the conveyors system at its full design capacity with key operating data being recorded in verification of its suitability for continued unrestricted service with the Principal.
- Carry out controlled stops and emergency stops on each conveyor individually as well as the entire conveyor system simultaneously. Monitor the overall safety of the system, and record stopping times.
- Carry out in addition to this, fully loaded aborted starts out on all conveyors, to ensure the correct dynamic operations of the conveyor in terms of the works.
- Test average conveyor rates at the performance testing stage; undertake tests after the Load Tests have been completed.

3.35 PERFORMANCE TESTS

- Commence performance testing when all load and no load tests have been completed to the satisfaction of the Employer.
- Test the conveyor system to prove compliance with capacity, control and reliability requirements. Test all operating modes and scenarios including:
 - Normal start-up
 - Stopping (emergency and controlled)
 - Aborted starts (Fully loaded belts)
 - Belt loaded at Peak

3.35.1 Performance tests to allow for the following provisions during testing:

- Provide for a week's worth of testing - and coupling optimisation time.
- Provide another week's worth of equipment monitoring on set-up installation with a single report write-up to be provided by Contractor to Project Manager for approval.
- Fluid coupling supplier must supply nozzles and blanks of various sizes, to be utilised during performance testing. Representative from fluid coupling supplier to be on standby during performance testing to conduct simulation runs of the coupling setup.
- Parameters to be monitored are:
 - Individual drive power demands during stopping and starting of the conveyor system,
 - Belt speeds during normal running, acceleration and deceleration at drive stations and out bay of take-up station.

3.35.2 Reliability and Availability

Design and select all major equipment to ensure that the Contractor is able to provide a guarantee that System reliability over the 24 months following Completion is not less than 97% (Performance Period).

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3.35.3 Contractor's Attendance during the Performance Period

- Provide a person familiar with the maintenance requirements of each machine and system during the Performance Period. This person attends to defect rectification on behalf of the Contractor during the Performance Period and also verifies that the maintenance carried out on all equipment by the Employer is in accordance with the maintenance plan provided by the Contractor.
- Have a senior representative familiar with the mechanical equipment to conduct at least three Site inspections during the Performance Period at nominally 6 monthly intervals. Co-ordinate these visits with the Employer's operations staff so that the inspection includes operation, maintenance and legislative aspects of each machine.

3.35.4 Methodology Used to Calculate Plant Reliability

- The data for calculating the plant reliability is taken from the delay logging system. Any discrepancies in this information is interpreted and clarified by the Employer.
- Only delays caused by the breakdown of each conveyor are used in calculating the plant reliability of each conveyor. All delays caused by the associated conveyor operational delays are excluded from the calculation. Machine breakdown delays include all mechanical, electrical, and control faults on each conveyor that stop the conveyors system during a scheduled operating period or render the conveyor unusable outside normal planned maintenance periods.

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4. CIVIL AND STRUCTURAL

4.1.1 In-loading Facility Civil Structures

The *Contractor* shall provide the detail design of the Civil and Structural *works* for the new In-loading Facility on the upgraded E-Dump facility at Transfer House 'E'.

4.1.2 Introduction

This Section describes the following:

- a) The civil and structural *works* activities which are within the scope of the *Contractor*.
- b) Civil *works*, designs and all necessary interface requirements that are provided by the *Contractor*.

The *Contractor* ensures that all structures, drainage, cable trenches and service routes which are incorporated in this contract are functionally and efficiently located and that each structure/component is sized for optimum space usage.

The *Contractor* submits the design calculations/drawings of the civil items which are within this scope of work for review, acceptance and comments by the *Project Manager*.

No construction is started prior to acceptance by the *Project Manager*.

4.2 SCOPE OF WORKS

4.2.1 General

This specification describes the following:

- a) The detail civil design to be done by the *Contractor* for the followings:
 - All structures, steelwork, plinths and foundations on which the conveyor system is constructed.
 - Hopper loading ramps with side safety barriers and maximum inclination angle of 10°.
 - Tail section temporary barrier
 - V-drain channel underneath In-loading Facility for the diversion of wash water runoff.
 - Drive unit associated supporting structures.
 - All foundations on which MCC Panel is erected.
 - Cable tunnels / Servitudes where cabling is to pass under roads.
 - Cable trenches for the electrical and control & instrumentation systems.
 - Earth grid/mesh of the earthing network for the motor, MCC panel and all mechanical plants that require common grounding potential.
 - Analysis and verification of any existing structures required for re-use including the design and construction of any modifications to existing structures.
- b) The supply of detailed design, construction drawings, design report and construction specification for the construction of all the items which are listed on point a) above.
- c) Corrosion protection and design of the finishes of the plants and equipment in accordance with 240-106365693 - Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings and the current architectural design and paint colour specification of Kendal Power Station.
- d) All necessary interface requirements and liaison which are provided by the *Contractor*.

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Details and drawings of any buildings and civil works which are not expressly included in this Contract but which, in the opinion of the *Contractor*, will be necessary for the completion and proper execution of the project are included by the *Contractor* and submitted to the *Project Manager* for acceptance. The *Contractor* indicates clearly his proposed scope regarding these additional items.

4.2.2 Surveying

The *Contractor* is responsible for completing any surveying and setting out required for the works including establishment of any benchmarks, within Kendal Power Station, which is required to complete the works.

If survey information on existing benchmarks within Kendal Power Station is unavailable, the *Contractor* is required to consult the Surveyor-General's office to obtain information on available registered beacons near Kendal Power Station which can be used to establish any required benchmarks close to the works.

The *Contractor* is responsible for the locating of any underground services which may be impacted by the works prior to construction taking place. Any services damaged during construction are reinstated to the original design by the *Contractor*.

4.2.3 Geotechnical Investigations

The Contractor performs his own geotechnical site investigations he considers necessary to assist in the design of his works. The Contractor identifies and specifies all work and tests to be done. The Contractor accepts full responsibility for all ground conditions and provides adequate foundation and plinth designs.

Geotechnical investigations and foundations are in accordance with the following standards:

- 240-57127955 - Geotechnical and Foundation Engineering Standard
- 240-57127951 - Standard for the Execution of Site Investigations
- 240-91244751 - Specification for Geotechnical Investigations Standard

4.2.4 Design Phase

The Contractor conducts all Civil & Structural Designs in accordance with the following standards as well as standards and specifications referenced in the Works Information:

- 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
- 240-56364535 - Architectural Design and Green Building Compliance Manual

Services provided by the Contractor in the design phase include:

- a. Complete design in accordance with the requirements of this specification.
- b. Design of foundations and supporting structures of the conveyors system and associated infrastructure. This includes conveyor system associated supporting structures, motors and associated supporting structures, MCC Panel, cable trenches, earth grid/mesh and cables tunnel/servitudes where necessary.
- c. Design of all earthworks required for the implementation of this project.
- d. Sizing and optimizing of the different components.

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The *Contractor* provides a Detailed Civil & Structural design report signed by a professional Engineer which includes all calculations relating to the civil work and all drawings are prepared and submitted to the *Project Manager*.

The detailed design report is to be in accordance with the requirements in 240-56364545 - Structural Design and Engineering Standard.

Drawings prepared by the *Contractor* are in accordance with 240-86973501 - Engineering Drawing Standard – Common Requirements and include complete construction details including:

- a. General arrangement layouts.
- b. Layouts and sections of the different components.
- c. Reinforcement's drawings and schedules.
- d. Construction joint schedules.
- e. Details of embedded parts.
- f. Details of the conveyor enclosure and fixing.
- g. Structural steel detailing and corrosion protection.
- h. Details of all plinths, openings, box-outs, holding down arrangements, grouting, connections etc. required for plant and equipment.
- i. Earth grid/mesh arrangement drawings including the sizes of the materials used, and the copper earthing rods.
- j. As built drawings.

The *Contractor* submits his design calculations, specifications and drawings of the civil items which are within his scope of work for comments to the *Project Manager*.

All calculations are submitted in electronic format including all design files in the native format.

The *Contractor* supplies details of the computer programs used and any certification of approval by independent authorities are given for the programs used.

Drawings are submitted in PDF, Microstation (.dgn) and native format.

4.2.5 Prior to Fabrication and Construction

Electronic copies of all design calculations and electronic copies of all drawings are submitted for acceptance to the *Project Manager*, before the relevant fabrication or construction work is carried out. In addition one set of hardcopies of all drawings and calculations are provided. The *Contractor's* programme allows two weeks for the *Project Manager's* acceptance and at least one revision following the *Project Manager's* initial comments.

Approval Acceptance of the *Contractor's* drawings or calculations by the *Project Manager* does not relieve the *Contractor* of any of his obligations to meet all the requirements of the Contract or relieve the *Contractor* of his responsibility for the adequacy of design, calculations and drawings.

A detailed Construction Work Programme, broken down to specific tasks and time allocated for completion of each task are submitted.

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4.2.6 Fabrication and Construction

The *works* to be provided by the *Contractor* include:

- Provision of all embedded anchor bolts, sleeves, anchors and other miscellaneous embedded parts required for the installation of all plant and structural steel work, including if necessary setting templates required for the placement of anchor bolts/embedment.
- Provision of all scaffolding, site craneage, lifting equipment, etc. which are required by the *Contractor*.
- Excavations and casting of all foundations and plinths for the plant.
- Construction of all earthworks required.
- Construction of the supporting structures and conveyor enclosure.
- Grouting of all structural steelwork. The *Contractor* shall provide details of materials and method of grouting including epoxy type non-shrink materials for acceptance by the *Project Manager*.
- Corrosion protection of the steel supporting structures, roofing material and embedded parts.
- Provision of expansion joints where required.

Contractor submits detailed method statements for review and acceptance for all portions of the *works*. No work commences without acceptance of the respective method statement.

4.2.7 Civil Design Requirements

The *Contractor* engages a competent qualified Professional Engineer with a minimum of 7 years' experience in the design of industrial structures and equipment foundations to be fully responsible for the design

4.2.8 Materials of Construction

Non-combustible or fire resistant components are used in the construction.

4.2.9 Project Co-Operation

The *Contractor's* attention is drawn to the work done by Others, working on the project, prior to and simultaneously. Close co-operation, exchange of information, careful scheduling and planning on a continuous basis will be required to minimise interference and to ensure co-ordination between designs and good working practices are maintained at all times.

In addition the *Contractor* will be required to work continuously with the *Project Manager* and Others in identifying, assessing, monitoring and managing interface issues. Where change is required these items are to be included in the risk register, such changes will only be implemented with the by means of notification to the *Project Manager*.

4.3 PROCEDURE FOR SUBMISSION AND ACCEPTANCE OF *CONTRACTOR'S* DESIGN

All the Designs shall be passed on to the *Project Manager* for review and approval prior to placement of any order or procurement of the designs.

4.3.1 Design Review Procedure

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

- a) Detail Design Freeze Review
- b) Integrated Design Review
- c) Construction Completion Review
- d) Acceptance Testing Review

4.3.2 Project Engineering Change Procedure

The Contractor takes note of the Employer's Project Engineering Change Procedure (240-53114026). An engineering change includes any proposed change originating from engineering, Contractors, project management or construction management.

The Project Engineering Change Procedure applies to the Employer's personnel or Contractors performing engineering or engineering related work where the quality of the engineering work performed is the direct responsibility of the Project Manager.

4.3.3 Process for Submission of Documents

The *Contractor* submits all documents according to the accepted VDSS. The process for the submission of documents is described below:

- a) The *Contractor* submits the documents/drawings to the *Project Manager*.
- b) The *Project Manager's* Document Controller registers the documents.
- c) The *Project Manager's* Document Controller will supply the documents/drawings to all relevant parties within the *Project Manager's* project team.
- d) The *Project Manager's* team reviews the documents/drawings and will submit all comments or inputs to the *Project Manager* and the *Project Manager* submits to the *Contractor* for consideration.
- e) If the *Project Manager* finds major deficiencies in the submitted documents/drawings, the *Contractor* revises the documents/drawings and resubmits to the *Project Manager*.
- f) The *Project Manager* reviews the documents/drawings and if no major deficiencies are found, the *Contractor* organises a Design Review session.
- g) The *Project Manager* and the *Contractor* conduct a Design Review.
- h) If any fundamental errors were found in the designs or further actions are required, the *Contractor* records all concerns raised and revises the designs.
- i) The *Contractor* organises a Design Review session once all designs were revised according to the concerns raised by the *Project Manager*.
- j) If no fundamental errors were found in the designs during the Design Review session, the *Contractor* compiles the Design Review minutes or report and submits it to the *Project Manager*.
- k) The *Project Manager's* Document Controller registers the report.
- l) The *Project Manager's* team reviews the *Contractor's* report/minutes. If the report/minutes are not acceptable, the *Contractor* revises the report/minutes and resubmits to the *Project Manager*.

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- m) The *Project Manager* will accept the *Contractor's* design once the report/minutes are accepted by the *Project Manager's* team.

4.3.4 Time Required for Acceptance of Designs

The *Project Manager* will return one copy of the drawing marked "Accepted"; "Accepted as Noted" or "Not Accepted", as may be appropriate. The notations "Accepted" and "Accepted as Noted" authorize the *Contractor* to proceed with the manufacture of the Plant covered by such drawings subject to the corrections, if any, indicated thereon. Where prints or drawings have been "Not Accepted" or "Accepted as Noted" the *Contractor* makes the necessary revisions on the drawings and submit further copies for acceptance in the same procedure as for the original submission of drawings. Every revision shows by number, date and subject in the revision block on the drawing. The *Employer* has a minimum 14 calendar days to review and consolidate review comments for documentation submitted by the *Contractor*. The *Contractor* also has a minimum 14 calendar days to respond and / rectify as per the comments by the *Employer*.

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4.4 OTHER REQUIREMENTS OF THE *CONTRACTOR'S* DESIGN

4.4.1 Technical Risk Assessments

4.4.1.1 HAZOP Studies

- a. The *Contractor* carries out formal HAZOP Studies on all systems in their supply. These studies are done in accordance with the requirements as laid down in the Eskom HAZOP Guideline: 240-49230111.
- b. All recommendations are included in the *Contractors* designs. This is submitted to the *Project Manager* for acceptance.

4.4.1.2 FMEA (FAILURE MODE AND EFFECT ANALYSIS)

The *Contractor* carries out formal Failure Mode and Effect Analysis (FMEA) Studies on all systems in their supply. These studies are done in accordance with the requirements as laid down in the Eskom FMEA Guideline: 240-49230046.

4.4.2 System Interface

The *Contractor* is responsible for all system interfaces which forms part of the *works*. The *Employer* will provide the relevant information defining the system interfaces. The *Contractor* caters for all the identified interfaces.

4.5 USE OF *CONTRACTOR'S* DESIGN

All *Contractor* designs shall be used once review & acceptance of the designs has occurred by *Project Manager*. The acceptance shall be submitted to the *Contractor* in writing by the *Project Manager*.

4.6 DESIGN OF EQUIPMENT

All designs of equipment by *Contractor* shall be used after review & acceptance of the designs has occurred. The review & approval shall be submitted to the *Project Manager*.

- The *Contractor* shall provide to the *Project Manager* the documentation for the warranties from manufacturers or suppliers of all equipment required in execution of the structures to be built within the E-Dump area.
- All the required documentation will be made available by the *Project Manager* to the *Contractor* regarding the codification of equipment as well as the freight, storage and delivery requirements within the *Employer* sites prior to the procurement of any equipment required for the execution of the structures to be built within the E-Dump area.
- The *Contractor* is solely responsible for providing the protection of the equipment, the protection of equipment from damage or loss due to weather, fire, theft, unexplained disappearance or similar during the execution of the *works*.
- The *Contractor* shall bore the cost of the replacement of any equipment or part thereof damaged or requiring replacement and all such costs shall be covered as per the required construction insurance taken out by *Contractor* for the construction of the *works* at the E-Dump area
- The liability of the use of such equipment in the execution of the *works* shall remain that of the *Contractor* (i.e. this includes the design and transport, storage, maintenance, use of the equipment).

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4.7 EQUIPMENT REQUIRED TO BE INCLUDED IN THE *WORKS*

No specialised equipment identified as being required, however if any is required, the designs shall be provided by the *Contractor*

4.8 AS-BUILT DRAWINGS, OPERATING MANUALS AND MAINTENANCE SCHEDULES

- a) Language: All documentation, including reports, manuals, etc. is in the English language.
- b) Manuals:

The technical, training, operating and maintenance manuals are provided for each type of a functional unit. Technical manuals include all technical data as well as the technical data and leaflets of each individual component used provided. Where generic manuals are provided, an addendum is provided indicating the applicable project specific components.

Manuals are of a good quality and cover the following as a minimum:

- a) Technical descriptions of the equipment and component parts
- b) General arrangement drawings
- c) Installation instructions with drawings or pictures
- d) Operating and maintenance instructions for all components
- e) Detailed parts lists (accompanied by exploded view type drawings clearly detailing the part and uniquely identifying it)
- f) Spare part ordering instructions

Any special instructions pertaining to storage of spare parts or their shelf life is included in the maintenance manual. All drawings requested for component location, dismantling and re-assembly for maintenance are included in the maintenance manual. All special tools required for operating and maintenance of the equipment are presented in a form of a schedule in the operating and maintenance manual, respectively. The content of the training manual is based on the content of the technical, operating and maintenance manuals.

4.8.1 Drawing Requirements

The *Contractor* supplies reproducible drawings according to the Vendor Document Submittal Schedule (VDSS). The *Contractor* develops the following minimum requirements for the drawings:

4.8.1.1 Drawing Numbering System

The *Employer* supplies the proposed *Project Manager* drawing numbering system. The *Contractor* may assign his own drawing number as required to meet his document control system requirements.

4.8.1.2 As-Built Drawings

The *Contractor's* Staff will maintain a master set of red-lined as-built drawings. The *Contractor* will provide drawing mark-ups as work is completed. The *Project Manager* and the *Contractor* will ensure that all appropriate information is transferred to the field record copy of drawings. *Project Manager* and the *Contractor* will check the as-built for completeness and accuracy.

The following types of drawings will be updated to as-built status:

- Conveyor general arrangement drawings
- P&IDs
- Conveyor drive unit arrangements drawings
- Conveyor take-up arrangements drawings
- Conveyor moveable head arrangement drawings
- Underground utilities drawings
- Electrical single-line diagrams
- Electrical schematic drawings
- Wiring diagrams (including panel layouts and loop diagrams)
- Plant arrangements
- Civil & Structural drawings
- Piping layouts
- Valve and Equipment lists

4.8.2 Operating and Maintenance Manual

The *Contractor* provides operating and maintenance manuals, as well as an Operating Technical Specification for the new Plant. The *Contractor* provides four (4) hard copies and an electronic copy.

The procedures are provided by the original equipment manufacturer detailing descriptions of operating and the maintenance work. The procedure covers the requirements for maintenance of the equipment over the design life.

4.8.3 Maintenance Schedule

The *Contractor* provides a maintenance strategy for the life expectancy of the new Plant with a summary schedule. The *Contractor* provides the life expectancy of the equipment. The *Contractor* lists maintenance spares (with detailed specifications) for the life expectancy of the equipment. Maintenance strategy updates to be in accordance with the Reliability Based Optimisation (RBO) standard for civil & mechanical, disciplines

4.8.4 Data Books

The *Contractor* shall compile Data Books progressively for all manufacturing and construction/erection inspections, operating manuals and test records and documents for every piece of plant required in producing the *works*. The *Contractor* shall submit data books to the *Supervisor* and *Project Manager* for their review for all Plant and Materials and work undertaken with the applicable requirements and specifications.

4.9 PLANT & MATERIALS PROVIDED “FREE ISSUE” BY THE *EMPLOYER*

No Plant and Materials will be supplied by the *Employer*.

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5. QUALITY CONTROL PLAN

The Contractor compiles and submits a quality control package that includes the final scope of work, quality control plans, safety files, work execution procedures, etc. to Auxiliary Engineering and mechanical Technical support for acceptance prior to the commencement of the works. Refer to Kendal Quality Management Manual *1017374.

6. COMPETENCE

The Contactor shall comply with all the scope of work requirements. The competence of the Contractor will be evaluated during the technical evaluation by the Kendal Auxiliary Engineering team.

7. EQUIPMENT REQUIREMENTS

The Contactor shall supply all Equipment required to fully, and successfully, meet the requirements stated in this document.

8. SAFETY

Refer to the SHEQ Policy statement 32-727 and the OHAS 18001.

9. ENVIRONMENT

Refer to the SHEQ Policy statement 32-727 and ISO 14001.

10. RISK MANAGEMENT

Risk assessment shall comply with the following documents:

- Kendal Quality Management Manual *1017374
- Kendal Integrated Risk Management Procedure *1017401

11. PRODUCTION PRESERVATION REQUIREMENT

Refer to the Kendal Quality Management Manual *1017374, section 7.4.4 and 7.5.5

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12. PLANT AND MATERIALS STANDARDS AND WORKMANSHIP

The *Contractor* complies with all standards, specifications and regulations as listed within this Works Information. The *works* will be carried out in accordance with the latest edition of the specified standards or other standards and codes where applicable.

Table 4: General National/International Standards

SANS and other applicable International Standards		
No	Document No	Description / Title
1	OHSA	Occupational Health and Safety Act South Africa No 85 and amendments
2	AWS-QC1	Standard for AWS Certification of Welding Inspectors
3	ISO 17635	Non-destructive Testing of Welds
4	ASME BPVC Section IX	Welding and Brazing Qualifications
5	ISO 12944	Paints and Varnishes - Corrosion Protection of Steel
6	SANS 1091	National Colour Standard
7	ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles
8	SANS 962-1	Mechanical fasteners for conveyor belts Part 1: Plate-and-bolt type fasteners
9	SANS 962-2	Mechanical fasteners for conveyor belts. Part 2: Hinged type and plate-and-rivet type fasteners
10	SANS 971	Conveyor belting – Methods of testing fire retardant properties of all conveyor belting constructions
11	AGMA 6123-B06	Design Manual for Enclosed Epicyclic Gear Drives
12	AGMA 2001–D04	Fundamental rating factors and calculation methods for involute spur and helical gear teeth
13	AGMA 2003–B97	Rating for pitting resistance and bending strength of generated straight bevel, zero bevel and spiral bevel gear teeth
14	AGMA 6010–F97	Standard for spur, helical, herringbone and bevel enclosed drives
15	BS 970	Specification for wrought steels for mechanical and allied Principaling purposes. General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels
16	BS 4235	Specification for metric keys and keyways
17	ISO 5048	Continuous mechanical handling equipment; belt conveyors with carrying idlers; calculation of operating power and tensile forces
18	ISO 281	Rolling bearings – Dynamic load ratings and rating life
19	ISO 286-1	Geometrical product specification – ISO code system for tolerances on linear sizes Part1: Basis of tolerances, deviations and fits
20	ISO 1940-1	Mechanical vibration – Balance quality requirements for rotors in a constant (rigid) state – Part1: Specification and verification of balance tolerances
21	AGMA 9112	Bores and Keyways for flexible Couplings (Metric Series)
22	ISO 15236-1	Steel Cord Conveyor Belts – Part 1: Design, Dimensions and Mechanical Requirements for Conveyor Belts for General Use
23	ISO 14890	Conveyor belts - Specification for rubber- or plastics-covered conveyor belts of textile construction for general use

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SANS and other applicable International Standards		
No	Document No	Description / Title
24	ISO 1940-1	Mechanical vibration -- Balance quality requirements for rotors in a constant (rigid) state -- Part 1: Specification and verification of balance tolerances
25	BS 5304	Code of practice for safety of machinery
26	BS 1486-2	Lubricating nipples. Heavy duty lubricating nipples
27	SANS 351	Rolling bearings – Static load ratings
28	BS 1399-1	Specification for rotary shaft lip seals. Dimensions of shafts and housings
29	ISO 113-2	Rolling bearing accessories -- Part 2: Plummer block housings
30	BS 5265	Mechanical balancing of rotating bodies. Recommendations on balance quality of rotating rigid bodies
31	SANS IEC 60034-1	Rotating Electrical Machines: Part 1 Rating and Performance

12.1 MECHANICAL (BMH) & ENGINEERING WORKS

Table 5: Mechanical National/International Standards

Applicable Mechanical Standards		
No	Document No	Description / Title
1	CEMA	Conveyor Design – ‘Belt Conveyors for Bulk Materials’ Ed. 5
2	SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
3	SANS 484-1	Conveyor belting – Step splicing for multiply textile reinforced rubber covered conveyor belting – Hot-slicing method
4	SANS 484-2	Conveyor belting – Step splicing for multiply textile reinforced rubber covered conveyor belting – Cold-slicing method
5	SANS 657-3	Steel tubes for non-pressure purposes: Steel tubes for roll for conveyor belt idlers
6	SANS 1173	Conveyor belting – General purpose textile-reinforced construction
7	SANS 1313-1	Conveyor belt idlers Part 1: Troughed belt conveyor idlers (metallic and non-metallic) for idler roller rotational speeds of up to 750 revolutions per minute
8	SANS 1313-2	Conveyor belt idlers Part 2: Link suspended idlers and fixed-form suspended idlers (metallic and non-metallic) for idler rotational speeds of up to 750 revolutions per minute
9	SANS 1313-3	Conveyor belt idlers Part 3: Performance specifications for troughed belt conveyor idlers (metallic and non-metallic) for idler roller rotational speeds of up to 750 revolutions per minute
10	SANS 1669-1	Conveyor belt pulleys Part 1: Pulley types, construction and dimensions
11	SANS 1669-2	Conveyor belt pulleys Part 2: Lagging
12	SANS 1700	Fasteners

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Table 6: Employer Mechanical Specifications

Applicable Eskom Mechanical Specifications		
No	Document No	Description / Title
1	36-1126	Specification for Corrosion Protection of Plant and Equipment with Coatings
2	36-1127	Guideline for Corrosion Protection of Plant and Equipment with Coatings
3	36-943	Engineering Drawing office and Engineering Documentation Standard
4	GGSS 1423	Design of Operating and Maintenance Manuals
5	240-120532564	Splicing and Repairs of Steelcord and Plied/Textile Reinforced Conveyor Belting
6	240-49230111	Hazard and Operability (HAZOP) Analysis Guideline
7	240-49230046	Failure Mode and Effects Analysis (FMEA) Guideline
8	240-55864434	Storage and Handling of Conveyor Belting in Eskom Guideline
9	240-55864498	Operation and Selection of Fluid and Mechanical Couplings Specification
10	240-55864503	Belt Conveyor Mechanical Components Standard
11	240-55864504	Belt Conveyor Structural Steelwork and Welding Standard
12	240-55864505	Erection of Belt Conveyor Mechanical Standard
13	N.FOZ 45-382	Design Philosophy: Belt Conveyor Systems Position Paper

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12.2 CIVIL AND STRUCTURAL & ENGINEERING *WORKS*

During the construction of the *works* there are numerous standards and specifications to which the *Contractor* must adhere to, the documents listed below is not bound in this document but are obtained by the *Contractor* at his own expense and must be adhered to during the construction of the *works*:

Table 7: Civil and Structural National/International Standards

Applicable Civil and Structural Standards		
No	Document No	Description / Title
1	SANS 044	Code of practice for welding
2	SANS 0167	Quality evaluation of fusion-welded joints
3	SANS 190	Expanded Metal
4	SANS 676	Reinforced Concrete Pressure Pipes
5	SANS 677	Concrete Non-Pressure Pipes
6	SANS 878	Ready-mixed Concrete
7	SANS 966	uPVC Pipes
8	SANS 986	Pre-cast Concrete Culverts
9	SANS 1123	uPVC Rainwater Components
10	SANS 1200 A	General
11	SANS 1200 HA	Structural steelwork (sundry items)
12	SANS 1200 M	Roads (General)
13	SANS 1294	Pre-cast Concrete Manhole Sections and Slabs
14	SANS 1315	Polypropylene Pressure Pipes
15	SANS 1700-5-1	Fasteners Part 5: General requirements and mechanical properties Section 1: Mechanical properties of fasteners made of carbon steel and alloy steel - Bolts, screws and studs
16	SANS 1921-5	Construction and management requirements for works contracts, Part 5: Earthworks activities which are to be performed by hand
17	SANS 2001-BE1	Construction works Part BE1: Earthworks (general)
18	SANS 2001-BS1	Construction works Part BS1: Site clearance
19	SANS 2001-CC1	Construction works Part CC1: Concrete works (structural)
20	SANS 2001-CM1	Construction works Part CM1: Masonry walling
21	SANS 2001-CM2	Construction works Part CM2: Strip footings, pad footings and slab-on-the-ground foundations for masonry walling
22	SANS 2001-CS1	Construction works Part CS1: Structural steelwork
23	SANS 2001-DP1	Construction works Part DP1: Earthworks for buried pipelines and prefabricated culverts
24	SANS 2001-DP2	Construction works Part DP2: Medium pressure pipelines
25	SANS 2001-DP3	Construction works Part DP3: Cable ducts
26	SANS 10021:2012	The water-proofing of buildings (including damp proofing and vapour barrier installation)
27	SANS 10085	The Design Erection, Use and Inspection of Access Scaffolding

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Applicable Civil and Structural Standards		
No	Document No	Description / Title
28	SANS 10100-1:2000	The structural use of concrete Part 1: Design
29	SANS 10100-2:1992	The structural use of concrete Part 2: Materials and the execution of work
30	SANS 10144:1995	Detailing of reinforcement for concrete
31	SANS 10160:2011	Basis of structural design and actions for buildings and industrial structures Parts 1-8
32	SANS 10161:1980	The design of foundations for buildings
33	SANS 10162-1:2011	The structural use of steel Part 1: Limit state design of hot-rolled steelwork
34	SANS 10162-2:2011	The structural use of steel Part 2: Limit state design of cold-formed steelwork
35	SANS 10162-4:1997	The structural use of steel Part 4: The design of cold formed stainless steel structural members
36	SANS 10164-1:1980	The structural use of masonry Part 1: Unreinforced masonry walling
37	SANS 10164-2:2008	The structural use of masonry Part 2: Structural design and requirements for reinforced and pre-stressed masonry
38	SANS 10400	The Application of the National Building Regulations

Table 8: Employer Civil and Structural Specifications

Applicable Eskom Civil and Structural Specifications		
No	Document No	Description / Title
1	240-56364535	Architectural Design and Green Building Compliance Manual
2	240-56364545	Structural Design and Engineering Standard
3	240-57127951	Standard for the Execution of Site Investigations
4	240-57127955	Geotechnical and Foundation Engineering Standard
5	240-85549846	Standard for Design of Drainage and Sewerage Infrastructure
6	240-91244751	Specification for Geotechnical Investigations Standard

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12.3 PROCESS CONTROL

Table 9: Employer Process Standards

Applicable Eskom Process Standards		
No	Document No	Description / Title
1	ISO 9001	Quality Management Systems
2	240-53113685	Design review procedure
3	240-44974011	Routine work management
4	240-53114193	Occurrence and Incident Management Procedure
5	240-43327398	Engineering policy
6	32-1155	Project Life Cycle Model

12.4 OTHER

Table 10: Employer Project Management and Project Controls Specifications

Applicable Eskom Specifications		
No	Document No	Description / Title
1	*1024012	Kendal Waste Management Procedure
2	32-95	Environmental, Occupational Health & Safety Incident Management Procedure
3	32-365	Completion of Power Plant Projects, Commissioning, Take-over from Contractors and Hand-over to the Generation Business
4	32-846	Operating Regulations for High-Voltage Systems
5	36-681	Generation Plant Safety Regulations
6	36-943	Engineering Drawing Office and Engineering Documentation Standard
7	240-105658000	Eskom Quality Specifications Requirement
8	240-109607332	Eskom Plant Labelling Abbreviation Standard
9	240-109607450	Plant Identification Work Instruction
10	240-109607736	Eskom KKS Key Part Eskom Standards
11	240-133087117	Procedure for effective Management of Environmental related incidents
12	240-44175132	Eskom PPE Specification
13	240-53113685	Design Review Procedure
14	240-53114026	Eskom Project Engineering Change Procedure
15	240-54179170	Technical Documentation Classification and Designation Standard
16	240-65459834	Project Documentation Deliverable Requirement Specification
17	240-66920003	Project Handover Documentation Management Procedure
18	240-71432150	KKS Plant Labelling and Equipment Descriptions Standard

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Applicable Eskom Specifications		
No	Document No	Description / Title
19	240-76992014	Project / Plant Specific Technical Documents and Records Management Work Instruction
20	240-83561037	Reporting Data Requirements for Contractors
21	240-86973501	Engineering Drawing Standard – Common Requirements
22	240-93576498	KKS Coding Standard
23	RA/ENV/06	Eskom Waste Management Procedure

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13. LIST OF DRAWINGS

13.1 DRAWINGS ISSUED BY THE *EMPLOYER*

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both Works Information and Site Information.

Table 11: Mechanical Drawings

Mechanical Drawings	
Eskom No	Description/Title
In-loading Facility	
0.64/BMH-A-001	Emergency Ash Dump In-loading Facility Layout
0.64/BMH-A-002.2	Moveable Head Feeder Belt General Arrangement

Table 12: Civil and Structural Drawings

Civil and Structural Drawings	
Document No	Description/Title
Transfer House 'E' Modifications	
0.64/42680-01	Site Location Plan
0.64/42680-03	Site Development Plan
0.64/42680-04	General Arrangement
0.64/42680-05	Phased Construction Approach
0.64/42680-09	Bund Wall Setting Out Details
0.64/42680-10	Bund Wall Profiles – Sheet 1 Of 4
0.64/42680-20	Demolition Drawing
0.64/42680-22	BMH & LPS Layout
TD-S-P-1001-V1	F-Shape Temporary Barriers 800mm High Portable – Precast Concrete Details

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13.2 EXISTING DRAWINGS FOR REFERENCE

Table 13: Existing Mechanical Drawings

Mechanical Drawings	
Eskom No	Description/Title
Process Flow Diagrams	
0.64/14507	KKS Coding System For Conveyors And Machines
Overland Conveyors 8A & B (ETK 12 & 22)	
0.64/11518	Civil Arrangement
0.64/13957	Head Module & Tail Arrangements (1500 Wide Belts)
0.64/13960	Mechanical Arrangements (1500 Wide Belts)

Note: All drawings are supplied under controlled disclosure and may not be used, or issued to any other party, for any purpose other than this tender.

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14. Acceptance

This document has been seen and accepted by:

Name and Surname	Designation
Thandeka Mantshintshi	Project Supervisor
Thabile Ngcaku	Project Manager

15. Revisions

Date	Rev.	Compiler	Remarks
July 2023	0	S Malgas	First draft.

16. Acknowledgments

Jabulani Hlabangana

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