	Works Information	Kriel Power Station/Engineering
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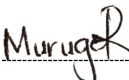


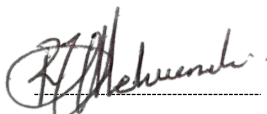
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1. Introduction

Kriel Power station uses Electrostatic Precipitators (ESP) and SO₃ Conditioning Plant to control particulate emissions within the limits set by the Departmental of Environmental Affairs. Kriel Power Station burns coal with an ash content in the region of 23-25% ash for underground coal (unit 1-3) and open cast coal for the south units (unit 4-6) ash content in a region of 31-36%. Due to the high resistivity of ash in coal, it requires conditioning to enable efficient precipitation. The higher the ash resistivity, the more difficult it becomes to precipitate the ash. The boiler flue gases are conditioned using the gas compound Sulphur Trioxide (SO₃). The SO₃ is injected into the flue gas stream via lances situated downstream of the secondary air heater outlet ducting.

The current Atmospheric Emission License (AEL 17/AEL/MP312/11/9) issued on the 25 March 2019 for Kriel Power Station requires that the station should comply with a limit of 125mg/Nm³ on continuous basis for particulate matter. It is required then for licence holder to ensure that these conditions are always adhered to through a continuous focus on the operating, optimization, and maintenance of the plant.

2. Supporting Clauses

2.1 Scope

The scope of work involves inspecting of the SO₃ plant, providing an inspection report, and repairing and/or replacing components within the SO₃ plant as necessary for outages and maintenance at Kriel power station for a period of five (5) years.

2.1.1 Purpose

The purpose of this document is to detail the scope of work for routine maintenance and general overhaul of the Sulphur Trioxide (SO₃) plant.

2.1.2 Applicability

This document shall apply to Kriel power station Sulphur Trioxide (SO₃) plant.

2.1.3 Effective date

This document is effective from September 2023, any previous version will be superseded by this version.

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2.2 Normative/Informative References

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

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems
- [2] National Environmental Air Quality Act (NEMAQA), 2004 (Act no 39 of 2004).
- [3] Atmospheric Emission Licence (AEL): 17/4/AEL/MP312/11/09
- [4] 240-56242363: Standard for Emissions Monitoring and Reporting
- [5] Flue Gas Cleaning Plant Maintenance Strategy: EBP087

2.2.2 Informative

- [6] Eskom Training: SO₃ Plant Operating and Maintenance manuals
- [7] 240-30008949: Safety, Health, and Environmental Specifications for *Contractors*

2.3 Definitions

Corrective Maintenance	The process of restoring plant and equipment which have failed or deteriorated to a state which renders it unable to meet the acceptance criteria required for its particular application.
Condition Based Maintenance	Predictive maintenance carried out because of findings from analysis of parameters measured under a condition-monitoring regime, or from recommendations from reliability analysis.
Condition Monitoring	Non-intrusive monitoring carried out to determine the physical condition of plant and equipment.
Electrostatic Precipitator (ESP)	An Electrostatic Precipitator (ESP) is a type of air pollution control device used to remove particulate matter from industrial and power generation flue gases before they are released into the atmosphere to reduce emissions of fine particulate matter, which can be harmful to human health and the environment.

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	It uses an electrostatic charge to separate particles from the gas stream, which are then collected on charged plates or electrodes.
Dust Handling Plant	Particulate Matter that had been collected by the ESP is conveyed via the DHP to the Ash Dam or Ash Dump
Sulphur Trioxide (SO ₃) plant	<p>A sulphur trioxide plant, also known as a SO₃ plant, is an industrial facility that produces sulphur trioxide (SO₃) through the reaction of sulphur dioxide (SO₂) and oxygen (O₂).</p> <p>Sulphur dioxide is generated by burning molten liquid sulphur in the presence of oxygen (O₂). The sulphur dioxide is then oxidized to sulphur trioxide by reacting it with oxygen in the presence of a catalyst, Vanadium pentoxide (V₂O₅).</p>

2.4 Abbreviations

Abbreviation	Explanation
AEL	Atmospheric Emissions Licence
ESP	Electrostatic Precipitators
ISO	International Organisation for Standardization
DHP	Dust Handling Plant
GO	General Overhaul
MGO	Mini General Overhaul
SHE	Safety, Health and Environmental
SO ₃	Sulphur Trioxide
SOW	Scope of Work
QCP	Quality Control Plan

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2.5 Roles and Responsibilities

2.5.1 Operating Section

- Operate SO₃ plant from start-up until shutdown within the technical specifications to achieve optimal performance and meet the PM emissions.
- Perform first-line maintenance such as (inspections, working fluid top-ups, housekeeping, etc.)
- Reviews Out-of-Service, permit to Work, or tag-out (including tagging of defective /isolated/out of normal) boundaries. The recording and reporting of plant deviations, isolation of plant for work and issuing of work permits.

2.5.2 Maintenance Section

- Certify that, all unplanned plant failures (defects) are corrected and tracked on SAP. Planned Maintenance activities (PMs) are executed as per works management procedure.

2.5.3 Engineering Section

- Affirm plant reliability by providing operating and maintenance sections with a comprehensive technical plant specification on opportunity and planned outages.
- Performs appropriate failure analysis on consequential equipment failures to determine the causes.
- Monitors plant component failure trends and establishes corrective actions to address the causes

2.6 Process for Monitoring

The QCPs on work to be performed during outages i.e., short term outages, MGO and GO by the contractor, will have to be approved before work can commence. QCPs must approved by the system engineer/ technical end user, maintenance supervisor, quality controller and hold/witness points should be marked to ensure the quality of the work is according to standard.

2.7 Related/Supporting Documents

- **QM 58:** Supplier Contract Quality Requirements
- **240-49230111:** Hazard and Operability Analysis (HAZOP) Guideline

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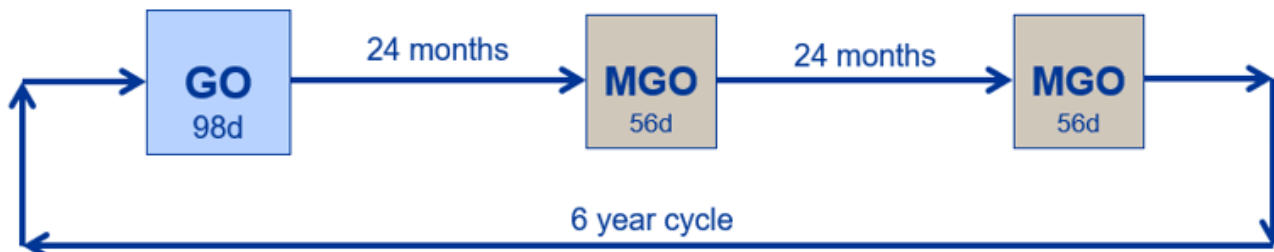
3. Description of the scopes

The scope of work entails inspections of the SO₃ plant, providing inspection reports, repair and/or replacement of the components within the SO₃ plant and commissioning during maintenance and outages (Planned and unplanned outages) at Kriel power station for a period of five (5) years. The maintenance scope of work also includes carrying out of scheduled- based maintenance (PM's) with the explicit objective of preventing functional plant and/or component failures. The contract duration will be for five (5) years covering units 1-6. The components scope of work is listed below.

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3.1.1 Outage Philosophy

The outage philosophy for Kriel Power Station is as follows:



3.1.2 Technical Criteria for the plant

The following are requirements to ensure safe operation and reliability of the plant.

- Convertor efficiency (Temp diff > 20 °C)
- Prevent molten sulphur leaks on the pump house- Fire Risk
- Zero steam, molten sulphur and SO₂ leaks on SO₃ plant
- Improve general housekeeping on the plant
- Ensure 100% availability and reliability of dosing pump
- Ensure 100% availability and reliability of the Flow Sensor
- Ensure 100% availability of the offloading pump when needed
- Ensure proper and adequate insulation and condensate drainage on the Molten Sulphur lines in order to prevent cold spots.

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3.1.3 BATTERY LIMITS

Plant	START	END	EXCLUSIONS	INCLUSIONS	P&ID DRAWINGS
SO ₃ PLANT	Common Pump House, 0mL	Unitised SO ₃ plant skid,31mL, BLR rear	Flue gas ducting	SO ₃ Injection lances Burner vessel Convertor vessel Process Air Blower Process Air filters Process Air Outlet Pressure Gauge All associated hand isolating valves Sulphur Storage tank Desuperheater /steam station,31ml, Unit 2 & 5, Boiler Front LHS Main steam supply lines & valves Hangers and supports Pump house Dosing pumps and piping	D64895000L00001

3.1.4 Scope of work

SUBSYSTEM		SO3 PLANT MECHANICA STANDARD SCOPE OF WORK					
COMPONENT ACTIVITIES						GOVERNING DOCUMENTS	
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)	
1		SO ₃ plant skid					
		Process Air Blower	Inspect and replace	<ul style="list-style-type: none">Vibration report will be made available before OPPORTUNITY to maintenance for planning.Inspect and clean the blower motor, motor fan and do balancing on the blower.Inspect the motor hold down bolts.Inspect the blower casing, casing hold down bolts and runner casing.Inspect the coupling tyre and coupling halves, replace if damaged. Ensure alignment of the coupling to motor.		W	
		Process Air filters	Inspect and replace	<ul style="list-style-type: none">Inspect the process air filters and replace if damaged, otherwise clean.		W	
		Process Air Fan (DE& NDE)	Inspect and replace	<ul style="list-style-type: none">Inspect for wear, remove old grease, and repack with new greaseReplace bearing gaskets/packingInspect the coupling for wear and tear, replace if damagedOpen the impeller casing, inspect for defect, clean and box up.Inspect the automatic grease lubricators MUST be at 4 not 12 dials if low replace.		W	

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SUBSYSTEM		SO3 PLANT MECHANICA STANDARD SCOPE OF WORK				
COMPONENT ACTIVITIES					GOVERNING DOCUMENTS	
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
				<ul style="list-style-type: none">Replace the rubber below on the blower discharge if leaking badlyNB: Install pressure gauge (15kPa)		
		Process Air Control Valve	Inspect and replace	<ul style="list-style-type: none">Remove and inspect process air control valve and replace if damaged.Replace the process air control valves with new gaskets and torque bolts.Stroke check the valve and ensure the valve is operated on auto, C&I maintenance to be present.		
		SO ₂ Cooling valve	Inspect and replace	<ul style="list-style-type: none">Inspect the SO₂ cooling valve and replace if damaged.Replace the valve with new gaskets and torque bolts.Ensure that the valve is operated on auto after the repairs or during commissioning, C&I maintenance to be present.		W
2		Steam and Sulphur supply				W
		Sulphur jacketed strainers	Inspect and replace	<ul style="list-style-type: none">Remove lagging and clean Sulphur on the floor, fire hazard.Inspect for Sulphur and steam leaks and carry out necessary repairsInspect the strainer filters, the seals on the strainer box and steam jampers and carry out necessary repairs.Replace all the Viton O -ring seals		W
		Sulphur jacketed pipework	NDE	<ul style="list-style-type: none">Once lagging is removed, perform NDE on the jacketed pipework (dye pen and thickness tests).Make a report available to Engineering with all the details. RBI requirement.		W
		Sulphur dosing pump	Inspect and replace	<ul style="list-style-type: none">Inspect the pump and replace if damagedCheck oil level and oil leaks.Drain oil on pump and flush the drive section with new oil (EP220) and top up to correct level.Drain and flush the pump section with new generic oil (Generic 46) and top up to correct levelInspect and clean the pump casing and motor fan. <p><u>Plan to refurbish the dosing pump, contractor to do hot commissioning on site.</u></p>		W
		Sulphur block valve	Inspect and replace	<ul style="list-style-type: none">Inspect the sulphur block valve and replace if damagedEnsure that the sulphur hand isolating block valve position is closed, and that the actuator position corresponds with the closed position.		
		Main steam supply pipework	NDE	<ul style="list-style-type: none">Remove lagging and cladding on the pipework.		W

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SUBSYSTEM		SO3 PLANT MECHANICA STANDARD SCOPE OF WORK				
COMPONENT ACTIVITIES					GOVERNING DOCUMENTS	
No	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)
		(54m- pump-house)		<ul style="list-style-type: none">Perform NDE (thickness test and surface crack tests on all the welds). Make report available to engineering for review		
		Steam Traps	Inspect and replace	Inspect and replace the steam traps		W
3		SO ₃ Injection lances				
		Injection lances	Inspection and replace	<ul style="list-style-type: none">Replace the injection lances with their own thermocouples together with own distance pieces or sleeve. (System engineer will issue an instruction after inspections)Use proper gaskets (Isoplan 1100)Plan to replace all 24 injection lances.		W
5		Convertor	Inspection and replace	<ul style="list-style-type: none">Open the convertor only if the conversion efficiency was low (Tdiff < 15-20 °C) and high-pressure drop was experienced (> 25 KPa).Carry out visual inspection and submit a report to Engineering.Inspect the ceramic and catalyst, vacuum them out if damaged and replace.Carryout Wall Thickness Test on the converter shell and submit the report to Engineering for review. Plan for ceramic balls and catalyst replacement.		W
6		Burner	Inspect and replace	<ul style="list-style-type: none">Open the burner and carry out visual inspection and submit a report to Engineering.Remove matrix bricks to inspect refractory, repair refractory, burner lid and replace with new matrix bricks if damagedReplace the steam inlet, burner lance, lid and outlet flange bolts and associated gaskets if it was leaking or damaged.Carryout Wall Thickness Test on the converter shell and submit the report to Engineering for review. PLAN FOR PARTIAL BURNER REPAIRS.		W
		Burner Sight Glass	Inspect and replace	<ul style="list-style-type: none">Open and inspect the burner sight glass, replace if damaged.Remove and inspect the butterfly valve in sight glass, replace if damaged.Replace all gaskets and torque bolts.		
		<ul style="list-style-type: none">Burner lance	Inspection, test, and repair	<ul style="list-style-type: none">Inspect the burner lance for defects and conduct NDT's		W
		<ul style="list-style-type: none">Burner lance thermocouple pocket	Inspection and replace	<ul style="list-style-type: none">Remove thermocouple, inspect the pocket, and replace if damaged		W

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SUBSYSTEM		SO3 PLANT MECHANICA STANDARD SCOPE OF WORK					
COMPONENT ACTIVITIES						GOVERNING DOCUMENTS	
№	COMPONENT FLOC (KKS CODE)	COMPONENT DESCRIPTION	ACTIVITY TYPE (INSPECTION / TEST / REFURBISH / REPLACE)	WORK SPECIFICATIONS	CHECK SHEET NO.	INTERVENTION POINTS (H/W/R)	
		<div>▪ SO₂ manifold pipe</div>	Inspection, repair and NDE	<div><div>• Inspect for leaks on the pipework and the welds</div><div>• Carry out MPI on the SO₂ manifold pipe and report to be submitted to engineering for review.</div></div>		W	
		<div>▪ SO₃ manifold pipe</div>	Inspection, repair and NDE	<div><div>• Inspect for leaks on the pipework and the welds</div><div>• Carry out MPI on the SO₂ manifold pipe and report to be submitted to engineering for review</div></div>		W	

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4. Acceptance

This document has been seen and accepted by:

Name	Designation
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Rofhiwa Nelwamondo	Engineering Manager

5. Revisions

Date	Rev.	Compiler	Remarks
September 2023	00	R Muruge	First Compilation

6. Development Team

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

- Feyane Tivane
- Spha Biyela
- Rinae Muruge

7. Acknowledgements

N/A

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